SEABED GAZETTE

2018

Anthropogenic Noise and the Sea

A History of Motion Sensors

Battling water scarcity in Manado

SEABED

Getting to the bottom of things

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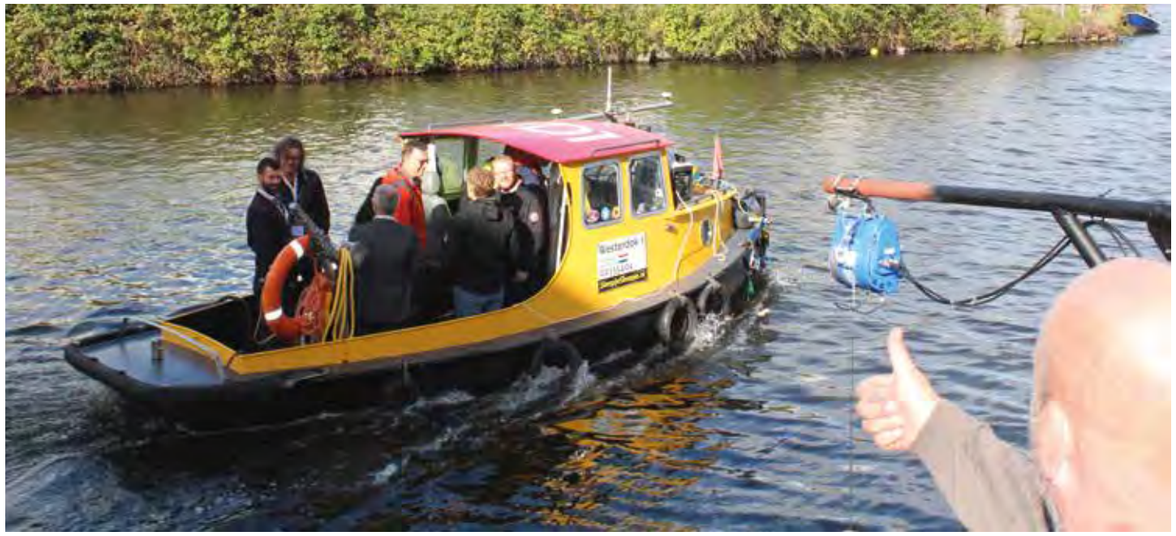
Seabed end of Summer Demo Days 2017



The 2017 demo days were a big success again! Over 80 people from different companies attended the venue to see live demonstrations of the Norbit Dual head, the Norbit STX, the mobile Lidar system, the Seabed new GNSS receiver and Inertial system. The AML X series instruments, the Ocean Sonics Hydrophone, the Admodus density probe, the Satlab SLC Handheld GNSS System and QPS Software.

Any questions after the demo's were answered by the dealer's own representative while having a drink or a snack.

Seabed is looking forward to meeting a lot of old friends and new faces at the 2018 demo days on 11 & 12 september.

Meet... Jeroen Komen

Engineer

Date of birth? And what is it you like to do on your birthday?
8th of April 1993 is the day that I was born. I try not to celebrate it but family normally shows up.

Single, in a relationship or married?
Single. It is hard enough already to care for my own, let alone someone else.

Any hobbies?
I play soccer three days a week but not on any real competitive level. Besides soccer I try to play some videogames when I've got the time. Sometimes I try to do some small projects like wood sculpting

Fast food, bistro or Michelin starred restaurant?
Fast food, I don't have high quality standards for my food.

Netflix or the cinema? And what is your favourite TV-series or movie?
I don't really like Netflix because in the Netherlands the selection isn't as big compared to other countries. For movies I don't have to go to the cinema because I made a console that lets us stream them from home.

What kind of job did you want growing up?
From what I remember I never had any job aspirations, only that I wanted it to be interesting. By the time I had any idea what I wanted my 16th birthday had already past.

What is it you like most about your current job?
The Diversity and the possibility to learn a lot really makes me appreciate the job. We also get a lot of individual responsibility which suits me personally.

What do you learn from your colleagues?
A lot of job specific tasks. The branch we work in is kind of special and needs some kind of basic level for certain things to understand. To learn some of the basics I read a book about the theory where dinosaurs would have survived the comet if only they had satellite technology.

If you would win the lottery, what would your life look like?
Nothing would really change I think, investing into real estate and perhaps spend some more on some cars and other toys.

Client tales #1

HELICOP, s.r.o., established five years ago, is a dynamic company based in Slovakia offering comprehensive solutions for the acquisition and processing of geodetic data using innovative technologies.

We came across Seabed BV in 2016 when we had the opportunity to visit their office in Amsterdam at The Seabed End of Summer Demo days. They presented to us (together with their partners) the technological capabilities they use for bathymetry and laser scanning, and demonstrated their expertise in this field. After the demo days we became convinced that the "Seabed portable multibeam set", together with LIDAR, would improve the quality of our results and, with help from Seaded BV, we started using it for our surveys.

One of our assignments, for a prestigious client in Slovakia, was a bathymetric and LIDAR survey of the hydroelectric Kralova Dam. The client requested a bathymetric survey for revision of the river bed (asking us to identify places with accumulated sediments, holes or any other damage in the river bed) near the dam, river lock and harbour. The timing was very important in this survey. When the dam gates were open, the air in the water affected the sonar and it could not penetrate the bubbles. This resulted in too much noise in the data. Therefore, we had to plan the bathymetric survey with sonar when the damgates were closed. While the dam gates were closed the water level dropped by almost 2m at what was the ideal time to start scanning with the LIDAR (to get an overlap with bathymetric data). To verify that our survey had the requested accuracy, we used classical geodetic methods for selected points and compared them with the bathymetric and LIDAR data.

The result of our survey was a digital model of the river bed as shown in the pictures. The model is currently being used by our client for their analysis. With equipment and support from Seabed BV we were able to deliver the data with a quality that exceeded any previous surveys received by our client.

Andrej Koprivnansky, CEO
HELICOP, s.r.o.

Inspiring Innovation

The Punch Powertrain Solar Team is a team of 21 Belgian engineering students. Together they build a solar car every two years to take part in the World Solar Challenge, a more than 3000km race on public roads through the heart of Australia.

Under the slogan "Inspiring Innovation" the team tries every edition to innovate the mobility of the future. For the 2017 edition, the team developed a "crab-steering" system. This system allows the car to be placed in the wind at an angle while driving, which greatly reduces aerodynamic resistance.

How Seabed played an important role in the validation of the crab-steering system can be read here.

The resistance of a solar car consists of more than 70% aero-dynamic resistance. The remaining 30% is rolling resistance and an extra factor when the car is traveling on a slope. To reduce the aerodynamic resistance, the Belgian Solar Team developed their crab-steering system. This system allows them to turn the rear wheels of the car at a slight angle, so that the car can drive on the road like a crab. Simulations show that this would reduce the air resistance, but is this really the case? To be sure, the simulations must be validated. This is where Seabed came to the rescue.

By subjecting the solar car to realistic test scenarios and continuously logging consumption, one can deduce how much less the car consumes once the crab-steering system is in operation. However, test tracks are never completely flat and a car never runs 100% straight ahead. It is important to have an accurate elevation profile of the test track, so that the influence of any gradients, pits or bumps can be eliminated from the results of the measurement. The Solar Team urgently needed a suitable solution to accurately map test tracks.

After consultation Seabed recommended using a Seabed Inertial Set as a solution to our problem. This is a high-tech position log system consisting of a GPS module and a motion sensor.
The combination of these two technologies enabled the Solar Team to accurately log the position of the car to two centimeters! Furthermore, the Seabed Inertial Set measures the speed of the car with very high accuracy, which is also an important fact.
The set fitted neatly in the solar car. This enabled the Solar Team to map the route of the car directly. After some simple calculations, one could draw all the necessary conclusions, a very efficient solution! Seabed was a big help in the development of our crab-steering system. We are very grateful to them for their support for our project.

NORBIT STX Multibeam sonar solution for 3D & 4D bathymetry operation

1. Introduction to NORBIT STX 3D & 4D multibeam sonar system

Since 2012 NORBIT has pioneered and developed a new perception of imaging systems in underwater acoustic market. The novel approach aimed for small, compact and easy to use multibeam systems providing customers with efficient tool to be used for underwater imaging. The new product has been called WBMS – Wide-Band Multibeam Sonar.

Since then NORBIT has built up the entire portfolio of multibeam products for bathymetry and forward looking applications with the integration of GNSS/INS systems directly into the sonar and intuitive software, simplifying further the operation.

The sonar platform has been used by hundreds of customers all over the world and proven that NORBIT's curved-array sonar offers great advantages to users with a task at hand to be solved quickly and efficiently.

The need for efficiency and ease of use has called for yet another break-through technology offered by NORBIT. The new STX 3D&4D imaging sonar is shown in Fig. 1. is based on a proven WBMS platform but with the transmitting antenna having new capability of electronically changing the direction of the emitted sound wave. That process is called beam steering or similarly to the receiving beamforming we call it transmit beamforming operation. The transmit and receive beamforming processes are outlined in Fig. 2.

Fig. 1. NORBIT STX - 3D&4D multibeam (left) and integrated GNSS/INS & Lidar version (right)

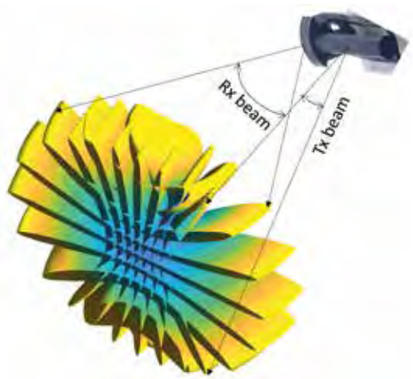


Fig. 2, Transmit and receive beamforming in STX

The scanning sonar can be mounted on any type of installation as the weight and size and low power consumption follow NORBIT's novel approach to multibeam integration and operation and the 3D system is just a hair taller than the standard 0.9 x 0.9 deg. WBMS product. The system comes in two versions with 400kHz and 200kHz long range (larger) projector. Integration efforts are minimal as the system comes with integrated high grade GNSS navigation system in the same way as other NORBIT's sonars. It also comes in a dual head configuration and with Lidar system covering virtually any application one may think of.

2. ~Explore More~ 3D bathymetry solution

Perhaps the most challenging problem for underwater acoustic bathymetric systems is inability for acoustic wave to penetrate hard structures and consequent shadows causing gaps in bathymetry coverage. While for some application it is desired to see shadows (e.g. mine-hunting and side-scan operation), for bathymetry mission the goal is to cover as much of the sea bottom as possible and eliminate the unwanted holidays in coverage. In some cases it is possible to go around the structures with the vessel and fill up the gaps, but in some cases it may deem impossible due to presence of structures or lack of access or time. In such cases the mission operators do not need to live with no data from these areas and can utilize the NORBIT STX.

The STX with its unique capabilities to steer the transmit beam can also "look" behind the structures in a way that standard multibeam cannot. This paper explains how it is accomplished.

In June 2016 NORBIT and SeaBed performed joint mission in the harbor of Amsterdam testing new capabilities of STX. The survey was set up on a motorized vessel with a task to map the area around the port efficiently and with no holidays.

Fig. 3, Survey area in Amsterdam harbor

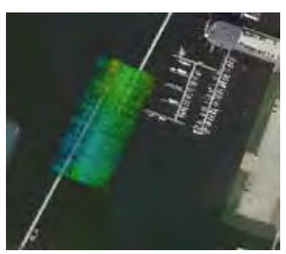


Fig. 4, Zoom at the test area

The vessel has passed the same line (Fig. 4) two times, first time with no STX capabilities as standard multibeam and second time with STX sweeping capabilities.

The first line, when no transmit sweeping is used, the pilings generated common shadows as the acoustic wave reflected from the hard pillars and left gaps in the coverage. This is identical to a standard bathymetry survey performed with standard multibeam system.

However, when sweeping feature is turned on and allow the transmit beam to be send in predefined directions, the acoustic pulse is sent sometimes in front of the boat and sometimes behind the boat. That makes the sound to penetrate areas which are not visible in a normal scenario and maps the bottom with coverage impossible for standard sonar. That is how "Looking" behind works for STX.
The actual real data (processed with Qimera) is presented below.

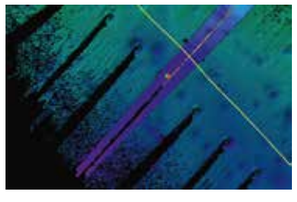


Fig. 5, Gaps behind pillars with standard survey with no sweeping capabilities

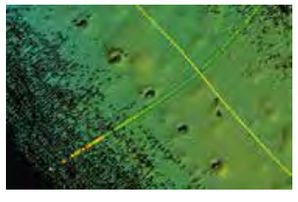


Fig. 6, No gaps with STX ~explore more~ feature

In Fig. 5 one can see several pings worth of data processed in Qimera (QPS). The usual shadows are obvious problem which require the operator to conduct additional survey on the other side of the pillars to cover the holidays.

However, when STX sweeping functionality is used (Fig. 6), the transmit beam is being sent in front and behind the boat avoiding the shadows. That is why it is called ~explore more~ feature. The figure highlights the swath which is steered forward and similar phenomenon happens when steering the other direction. The steering angle is exported with the data to processing software and allows to accurately georeferenced the detection points.

The sweeping action of STX does not only provide the "seeing" behind the structures, but also it allows for more accurate representation of the underwater structures as it increases the number of observable angles at which the object is seen. It is intuitively very simple, when one passed an object and always can look only in one direction, it will be seen from one side only. If, however, one can look forward and backwards at the same object, the number of observables is much increased and captures much more details of the underwater 3D structures.
The above has been demonstrated by surveying close to the jack-up barge KRAKEN in Amsterdam.

Fig. 7, Google Earth historic photo and overlaid data from survey

Fig. 8, Kraken's steel legs - hard reflectors and difficult target for acoustics

As one can imagine surveying this type of environment results in many gaps behind the steel legs of the underwater structure. It may take many attempts to position the boat at different angles to try to hit the target with different angles and with the positioning errors and GPS multipath sometimes it is impossible mission.

But when the STX sweeping capabilities are used, a single line covers all shooting angles and allows to quickly and efficiently cover the area without gaps and avoid position errors.

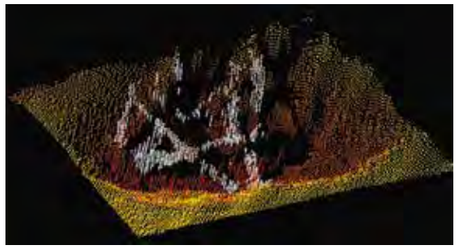


Fig. 9, Gaps behind steel structure with standard survey with no sweeping capabilities

Fig. 10, No gaps with STX and better 3D structure description with ~explore more~ functionality.

On the left hand side in Fig. 9 the STX sweeping capabilities has been turned off and it acted as a standard multibeam sonar. The gaps due to shadows are clearly seen and the structure is visible with limited details due to single angle look.
Whereas with STX sweeping capability (Fig. 10) the structure is insonified from different angles resulting in good detailing and the gaps behind the steel structure are filled up.

3. Summary

The new 3D &4D sonar from NORBIT is based on a proven platform for WBMS family of multibeam integrated systems. The new transmitting antenna allows to insonify the 3D sector by slicing it with the narrow electronically controlled transmit beam and receive the signal with the state of the art cylindrical NORBIT receiver. All processing is confined to the sonar head and no additional top side processors are necessary to use the sonar.

NORBIT's new offering vastly optimizes the operation time for many application with few discussed above, and delivers high resolution 3D & 4D bathymetry that meets and exceeds IHO Special Order, CHS Exclusive Order & USACE New Work and is suitable for any platform due to small size and easy integration.

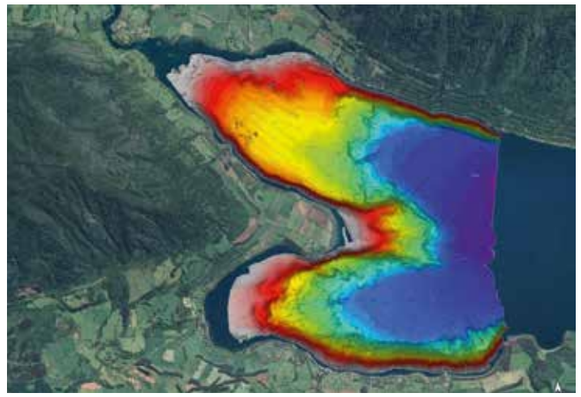
NORBIT

Flanders Marine Institute

An international research project of the University of Innsbruck (Austria), the Renard Centre of Marine Geology of Ghent University (Belgium) and the Flanders Marine Institute (VLIZ, Belgium) aims at a better estimation of the probability of giant earthquakes in Chile. Therefore, past earthquakes are reconstructed by investigating the bottom morphology and sedimentary infill of lakes Riñihue and Calafquén in great detail.

In December 2017, we deployed the Seabed Portable Lightweight Multibeam Set (acquired by VLIZ in 2017 from Seabed BV) on a small vessel in South Chile and were positively surprised by its performance and on-the-fly versatility, especially in dealing with complex lake bottom structures down to 180m water depth. The expedition was highly efficient and cost-effective, thanks to the compact size and light weight of the system, allowing quick transportation and easy installation over the side of the vessel. The excellent quality of the multibeam data strongly minimizes the time needed for post-processing of the data.

The wealth of new data revealed impressive structures of earthquake-triggered sublacustrine landslides, erosive canyons, localized gas escape and landforms sculpted by glaciers during the last glaciation. These structures would have remained undetectable without the use of the very high-resolution Seabed Portable Lightweight Multibeam Set.



New multibeam bathymetric data of Lake Riñihue (unprocessed field data: 0-130m water depth)

Research vessel on Lake Calafquén

Seabed's Quality Management Process

In 2017 Seabed started to work on streamlining work processes and improving the overall internal organisation, to work more efficiently and deliver even better customer value. Being a small organisation and a busy schedule, we decided to ask Maurice Buijsman of Buijsman Advies (Buijsman Consultancy) to help us with this process. In this interview he explains what has been done and what is next.

Seabed: How did you come into contact with Seabed?
Maurice: I have known Hans for quite some time and have, since then, been interested in the Seabed business, although I have no experience in the maritime sector whatsoever. At one point, Hans told me about his plans to describe and analyse their work flows and asked me if I could assist. I immediately became enthusiastic about this, but took some time to think it over. I did not see my lack of knowledge of Seabed's technology as a barrier, but my consultancy practice was only just beginning to shape up. However, I sensed that I could add value to Seabed's business, just based on my overall knowledge and experience. So, we started working together.

Seabed: Could you tell us a little bit about yourself?
Maurice: I have studied Economics and, after that, worked in the financial sector for close to 20 years. I specifically worked for the Dutch Stock & Options Exchange (the AEX and later Euronext) and after that, for different international companies, involved in managing and settling financial exchange transactions. I have had a variety of positions; in financial accounting, customer relations and I have also been the manager of the Dutch local branch of the company. I later realised that what these positions had in common was that they all focused heavily on work processes. Without being consciously aware, I have learned to describe, analyse and communicate on primary processes of organisations. So, when Hans asked me to advise Seabed on, what is basically, process management, it did make more sense than I would have thought earlier. After all, as a customer relations manager I explained our processes to clients all the time. Nevertheless, I did read up on some literature on process management, just to give myself some theoretical backing.

Seabed: How did you start at Seabed?
Maurice: I started out with reading the product documentation and the Seabed website, to give myself some better sense of the company, the products and the clients. After that I interviewed all employees. We talked about their work, their responsibilities, internal communication and what they thought could be done better, more efficiently. People were very forthcoming and open, which was a good sign. It meant that there was no hesitation to be critical and, at the same time, it showed they were loyal to the company and eager to do better.

Seabed: What were your conclusions and what do you think about Seabed?
Maurice: To be honest, I was positively surprised and became very excited! All employees are different in background, education and talent, leading to a wonderful mix of people in one small organisation. I believe diversity in any company is a major asset, but it sometimes looks like the bigger the company, the more people look and act the same. Seabed is still a small organisation with loyal employees that are very diverse and have the opportunity to use their talents in specific situations. Leading to a major competitive edge: flexibility. The capability to act on specific client demands quickly.

However, flexibility comes at a price. Unrestrained flexibility can lead to inefficiencies in work flows, communication and planning. There weren't any major problems at Seabed, but there was room for improvement, as is probably the case for any organisation. So, we started out with describing work processes and visualising them in flow charts. That method in itself was a very good experience for all. The Seabed team took plenty of time to discuss what they were doing and how they were doing it and immediately suggested changes for improvement. And then acted on it the very next day. So, it is not just a process of describing work flows for documentation, but it is also very much about raising consciousness and changing behaviour.

Seabed: So, what are the results, what has been practically done?
Maurice: We have now finalised describing the work processes and shaping the flow charts. They are used daily, both as a reference, a check list, but also for further analysis; can we always stick to the described processes or are there exceptional circumstances where we need to skip certain steps and for what (valid!) reasons? So, it is an ongoing process. The flow charts should be followed step by step to guarantee efficiency and quality. But without losing Seabed's flexibility. So, exceptions are possible, but only when there are sound reasons, which need to be described, argued for and reviewed. In addition, we have produced a shortlist of practical changes to internal communication and planning methods, which will be detailed further and implemented during 2018.

Seabed: How further?
Maurice: In the end, this whole process is aimed at working more efficiently and provide even more customer value. A second goal is to become ISO certified, after having documented all processes, procedures and quality standards. We feel that this is important to streamline the whole Seabed organisation, especially when it is about to expand its business further.

For myself, this has been a very good experience so far. I have already learned a lot from the process and the Seabed team. And it confirmed the idea that an outsider, asking simple, basic, questions and providing different views and experience, can add value to a business. I find Seabed's technology fascinating, even though I still understand just a tiny fraction of what Seabed does. I was rightly laughed at for a full day, after I suggested when you throw a GPS device under water, you may be able to measure depth… But hey, that is why Seabed sells sonars and I am not.

Monitoring the Canadian Arctic: Easier with AML's UV Biofouling Control

Ocean Networks Canada recently tested several technologies and deployment techniques designed to reduce the cost and complexity of establishing subsea monitoring sites. This story features the development of an end-to-end power and communication system for real-time data transmission, and a successful "extreme-environment" demonstration of an AML Oceanographic multiparameter sonde with UV anti-fouling.

Ryan Flagg, Observatory Support Engineer
Ocean Networks Canada

The Arctic is one of the most rapidly changing areas on the planet, and is also one of the most difficult places to effectively monitor. Challenging logistics and fierce environmental conditions prevent most technologies and monitoring programs from ever setting foot there. In the face of global climate change, there is an immediate need for robust technological solutions and innovative deployment methods that can respond to this growing demand.

As part of a larger study focused on monitoring solutions for the Canadian Arctic, Defence Research and Development Canada (DRDC) awarded a contract to Ocean Networks Canada to conduct a test deployment that would integrate and test several technologies and deployment techniques in an attempt to drastically reduce the cost and complexity of establishing subsea monitoring sites with real-time data transmission. Aside from surface temperatures that reach well below -40oC and subsea temperatures of almost -2oC, the annual formation and break-up of 2m thick sea-ice (coupled with a tidal swing of 2.5m) make the deployment of any technology difficult, and it is particularly hard on subsea cables crossing the intertidal zone.

The result of the recent contract has been a subsea instrument platform, which is connected to a shore-based data storage and transmission device via a short (120m) subsea cable, that was installed in Gascoyne Inlet on Devon Island (Lat:74o39.5966' Long:-91 o18.6317'). Devon is the largest un-inhabited island on the planet. The DRDC camp at Gascoyne Inlet is shared with a research program run by the Department of Fisheries and Oceans' Bedford Institute of Oceanography (BIO). The BIO program has successfully operated a comprehensive suite of instruments since 2009, with data transmission relying on a subsea cable that crosses the intertidal zone through a steel pipe that had considerable expense. The primary purpose of the Ocean Networks Canada project was to test a low cost cable-protection deployment technique as well as the chosen armor's ability to withstand extreme arctic conditions. The entire manifest of hardware, equipment, and tools for this deployment had to be compact enough to fit on a small aircraft to make it possible to use the solution almost anywhere in the arctic (or around the world), and on relatively short notice.

Figure 1 - Shore stranded sea-ice chunks and local residents in Gascoyne Inlet (Image courtesy of Ocean Networks Canada)

Figure 2 - A relatively small (1.5m high) sea-ice chunk in Gascoyne Inlet can easily damage intertidal cables during tidal swings. (Image courtesy of Ocean Networks Canada)

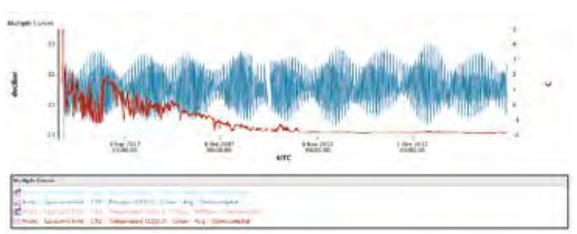
Figure 3 - Articulated pipe being installed for an Arctic test to protect subsea ethernet cable. A diver-free installation method was used and has so far protected the cable from potentially damaging ice conditions. (Image courtesy of Ocean Networks Canada)

Another element that needed to withstand the harsh environment and long deployment duration was the instrumentation: enter AML Oceanographic. Since the results of this test would dictate future monitoring and deployment techniques, the value of the data to be collected was high. With biofouling conditions unknown, preventative measures had to be taken. Given a strong desire to not deploy toxic anti-fouling substances in the Arctic's fragile ecosystem, AML's UV biofouling control technology was the ideal choice. An AML Metrec•X sonde equipped with CTD, Turbidity, and Chlorophyll A sensors, protected by UV•Xchange biofouling control, was selected for the deployment. Additionally, AML's modular design of all of their components allowed for their UV timer system – the Duty Cycle Controller – to be re-purposed for controlling power to the entire system, thereby allowing for an anticipated 1 year to 18 month deployment life using a standard subsea battery. The raw data are stored on the instrument and backed up on the "shore-buoy" before being transmitted back to Ocean Networks Canada at regular intervals. From there the data are made instantly available to the research community and to the general public for both viewing and download at **www.Oceannetworks.ca**.

Not only is this test a successful "extreme-environment" demonstration of AML instrumentation and their UV anti-fouling systems, but also of an end-to-end power and communication system that AML helped to develop alongside Ocean Networks Canada and Oceanetic Measurement Ltd.

Ryan Flagg is the Observatory Support Engineer for Ocean Networks Canada (ONC). He implemented ONC's first cabled "Community Observatory" in 2011 and led the installation of ONC's first arctic observatory (Cambridge Bay, Nunavut) in 2012. He has helped lead almost every subsequent maintenance operation and continues to assist with community engagement and to take part in research and instrument testing in Cambridge Bay. Ryan is actively helping to propose, plan for, and implement new monitoring initiatives throughout the north and along Canada's other coast-lines. Outside ONC, Ryan has served as a Marine Engineering Systems Operator with the Canadian Armed Forces Navy Reserves for over fifteen years.

Figure 4 - Metrec•X multiparameter sonde with UV biofouling control ready for 12-18 month deployment (Image courtesy of Ocean Networks Canada)



Client tales #2

Contract, Rental, Support, The works.

Van Tunen, a third-generation family-owned business engaged in coastal development, earthmoving, rockworks, dredging and mining activities. We provide contract, rental and support services for the dredging, earthmoving and mining industry as well as the maritime/shipping sector.

The internationally operating Van Tunen company is driven to provide both top class equipment and high-quality service with international approved HSEQ standards. Integrity, mutual respect and a strong commitment to perform are the cornerstones of our partnerships. What's more, we are as happy now as we were sixty years ago to deploy our knowledge, skills and experience for the benefit of our clients worldwide. We believe that this, together with our demonstrable ability to innovate, is exactly what gives us the edge today.

"The Total Package"

In the last decade our clients had to use their own GPS/Positioning system when working with our equipment. The times are changing. More and more, our clients demand a 'full service package' and we want to accommodate them. So, at one of our projects in Bulgaria, we called upon Seabed again to assist us with the GPS/Positioning Seabed Navigation system. The project involved an extension of the existing harbor in Burgas for the Port Facilities with a lot of work both on and under the water surface. To ensure excellent 'visibility' under water we asked Seabed to build this system onto our special long reach triple boom excavator. There was a catch: it had to be done at our yard in the Netherlands before the machines were sent off to Bulgaria. Seabed delivered. Upon arrival of the machine in Burgas we asked them to check and confirm that the system was still in perfect working order after its journey. They were only too happy to oblige and provided operating instructions on the spot to our client's operator as well. By taking part in this joint effort, Seabed helped to create the synergy that proved beneficial to all parties involved.

Van Tunen Contractor and rental BV

Anthropogenic Noise and the Sea...

When you stand on a beach or the edge of a cliff looking over the wide expanse of the ocean, it seems vast and endless. We know there are animals and plants that live in the ocean but since we don't see them it seems like they are not there.

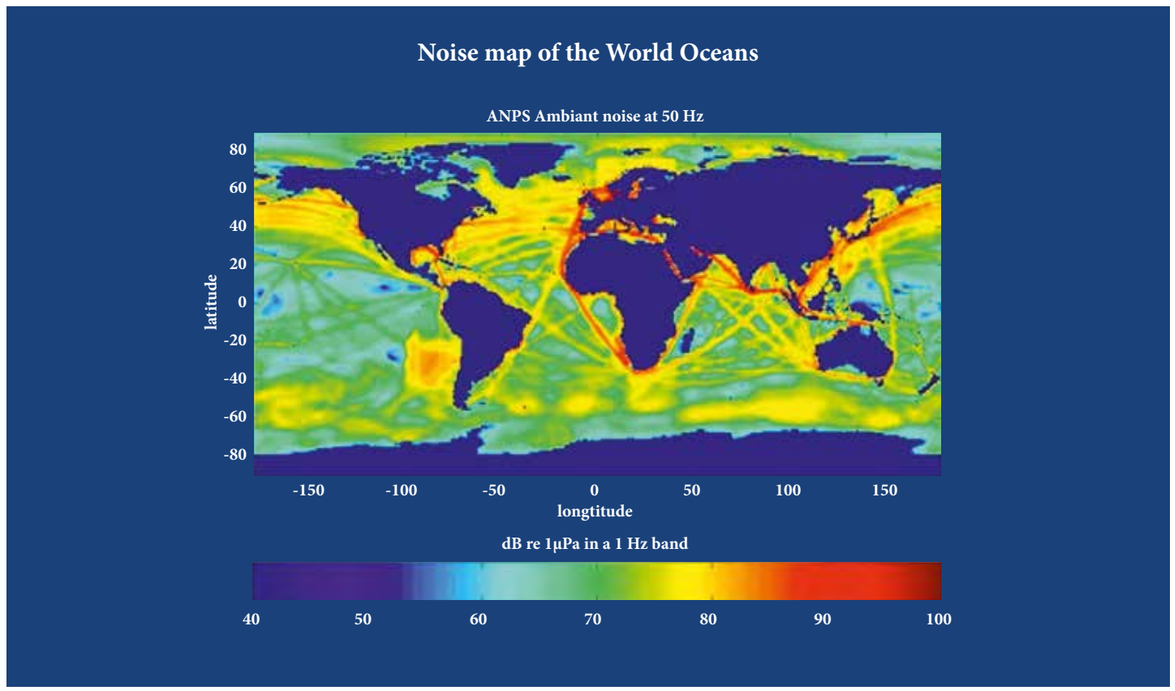
A casual piece of garbage falls into the sea. We may try to pick it up but the waves take it away before we reach it. Pollution has entered the ocean system. There are many ways we pollute our oceans. Plastic bags that we use for groceries often end up in the sea, miniscule plastic beads from cosmetics ends up in the stomachs of sea animals, nets for fishing entangle whales and drowns them. These are all things we can see and there are tangible ways of reducing this kind of pollution. What we cannot see is the noise pollution that is generated by ships, by seismic surveys, by pile driving and construction noise. We call these man-made sounds anthropogenic noise.

We know the ocean is rich with natural sounds from waves, wind, rain, thunder, tsunamis, earthquakes, fish, mammals, invertebrates, combining to create a soundscape that the marine life has adapted to over millennia. What happens to the sea animals if the noise increases due to human activity?

Due to the absence of light in the ocean depths, many marine animals use sound to communicate, forage, to socialize, to mate and and avoid predation. Corals are noisy places, and we are

still learning how they use sound to thrive and survive.

Sound is a powerful tool for measuring the health of the ocean. Measuring soundscapes near human activity can help reduce the risks to life, particular to animals unable to escape the sound sources.



What is being done about noise pollution?

The 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.

The 11 Descriptors for which Good Environmental Status (GES) must be achieved by 2020 are:

1. Biodiversity
2. Non-indigenous species
3. Commercial fish and shellfish
4. Food webs
5. Eutrophication
6. Sea-floor integrity
7. Hydrographic conditions
8. Contaminants
9. Contaminants in seafood
10. Marine Litter
11. Energy including Underwater Noise

The 11th Descriptor is Energy including Underwater Noise. Energy refers to light, electricity, heat, noise, electromagnetic radiation, radio waves or vibrations. The dominant source of energy is man-made sound, including:

- Shipping for trade or tourism, like ferries or cruise ships, recreation boats and fishing boats, which all produce noise;
- The use of sonar systems by all kinds of vessels;
- Construction (especially through piling) of offshore oil and gas platforms and wind parks;
- Dredging for shipping lanes, sand mining and for laying pipes and cables;
- Operation of platforms and their lights;
- Cable connections between offshore activities, the main land and between power stations, causing electromagnetic radiation;
- Cooling water systems for industry, which raise water temperature;
- Military activities, which produce noise.

Good Environmental Status

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 l160 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.

A number of consultants is available to perform these measurements, and reports. Some construction companies may wish to perform compliance measurements directly, if they wish, to manage the cost of compliance.

Ocean Sonics provides Smart Hydrophones that simplify the compliance measurement process. It is important that calibrated instruments be used during this type of work to ensure compliance while avoiding unnecessary effort.

Noise Mitigation methods

There are proven methods of noise mitigation such as using bubble curtains, cofferdams, reducing pile driving intensity (reduce mass or height), introduce resting periods. It is recommended that contractors consultant experts in this field before work begins.

About hydrophones

Underwater microphones, or hydrophones are sensors the measure underwater sound. Calibrated hydrophones are required for the type of measurements made in this article. Ocean Sonics designs and produces the icListen Smart Hydrohone which is a digital processing hydrophone.

Combining the digital electronics with the sensor ensures a calibrated digital recording. Built-in processing simplifies the deployment and measurement process, allowing users to focus on what they do best, and trusting the instrument to provide accurate, reliable results.

Meet...

Stefan van Delft
Engineer

Date of birth? And what is it you like to do on your birthday?
31-05-1993. Celebrate with family and friends. Throw a party maybe?

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

Any hobbies?
Playing guitar, gaming, watching movies, going out, and going to festivals.

Fast food, bistro or Michelin starred restaurant?
All of them of course!

Netflix or the cinema? And what is your favourite TV-series or movie?
I prefer cinema, though Netflix is nice. My favorite movies are Star Wars, Blade Runner, and Fight Club. My favorite series are Game of Thrones, Stranger Things and Twin Peaks.

What kind of job did you want growing up?
When I was very young I wanted to be archaeologist. Yeah, I don't know why.

What is it you like most about your current job?
Programming! Turning coffee into code!

What do you learn from your colleagues?
I learn to work professionally, as this is my first job after my study. I only had the experience from my internships.

If you would win the lottery, what would your life look like?
I don't know. Maybe go on a road trip?

a History of Motion Sensors

When you look at the history of motion sensors it goes way back to the first gimbal systems.

The gimbal was first described by the Greek inventor Philo of Byzantium (280–220 BCE). Philo described an eight-sided ink pot with an opening on each side, which can be turned so that while any face is on top, a pen can be dipped and inked — yet the ink never runs out through the holes of the other sides. This was done by the suspension of the inkwell at the centre, which was mounted on a series of concentric metal rings so that it remained stationary no matter which way the pot is turned.

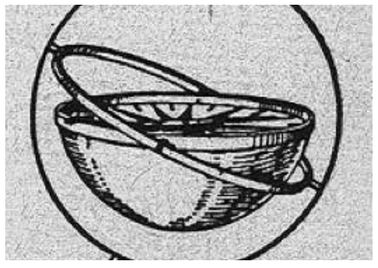
Cardan suspension in Villard de Honnecourt's sketchbook (ca. 1230)

In Ancient China, the Han Dynasty (202 BCE – 220 CE) inventor and mechanical engineer Ding Huan created a gimbal incense burner around 180 CE. There is a hint in the writing of the earlier Sima Xiangru (179–117 BCE) that the gimbal existed in China since the 2nd century BCE. There is mention during the Liang Dynasty (502–557) that gimbals were used for hinges of doors and windows, while an artisan once presented a portable warming stove to Empress Wu Zetian (r. 690–705) which employed gimbals. Extant specimens of Chinese gimbals used for incense burners date to the early Tang Dynasty (618–907), and were part of the silver-smiting tradition in China.

The authenticity of Philo's description of a cardan suspension has been doubted by some authors because the part of Philo's Pneumatica which describes the use of the gimbal survived only in an Arabic translation of the early 9th century. Thus, the sinologist Joseph Needham suspected Arab interpolation as late as 1965. However, Carra de Vaux, author of the French translation which still provides the basis for modern scholars, regards the Pneumatics as essentially genuine. The historian of technology George Sarton (1959) also asserts that it is safe to assume the Arabic version is a faithful copying of Philo's original, and credits Philon explicitly with the invention. So does his colleague Michael Lewis (2001). In fact, research by the latter scholar (1997) demonstrates

Gyroscope invented by Léon Foucault in 1852. Replica built by Dumoulin-Froment for the Exposition universelle in 1867. National Conservatory of Arts and Crafts museum, Paris.

that the Arab copy contains sequences of Greek letters which fell out of use after the 1st century, thereby strengthening the case that it is a faithful copy of the Hellenistic original, a view recently also shared by the classicist Andrew Wilson (2002).



Early modern dry compass suspended by gimbals (1570)

The ancient Roman author Athenaeus Mechanicus, writing during the reign of Augustus (30 BC–14 AD), described the military use of a gimbal-like mechanism, calling it "little ape" (pithêkion). When preparing to attack coastal towns from the sea-side, military engineers used to yoke merchant-ships together to take the siege machines up to the walls. But to prevent the shipborne machinery from rolling around the deck in heavy seas, Athenaeus advises that "you must fix the pithêkion on the platform attached to the merchant-ships in the middle, so that the machine stays upright in any angle".

After antiquity, gimbals remained widely known in the Near East. In the Latin West, reference to the device appeared again in the 9th century recipe book called the Little Key of Painting Mappae clavicula. The French inventor Villard de Honnecourt depicts a set of gimbals in his famous sketchbook. In the early modern period, dry compasses were suspended in gimbals. Essentially, a gyroscope is a top combined with a pair of gimbals. The first known apparatus like a gyroscope (the "Whirling Speculum" or "Serson's Speculum") was invented by John Serson in 1743. This was an early form of artificial horizon designed for marine navigation, consisting of a mirror, attached to a spinning top, that attempted to remain in a horizontal plane despite the movement of the ship. This device be a precursor to the gyroscope used in modern inertial navigation, although it was not itself a gyroscope. It was used as a level, to locate the horizon in foggy or misty conditions.

The first instrument used more like an actual gyroscope was made by Johann Bohnenberger of Germany, who first wrote about it in 1817. At first, he called it the "Machine". Bohnenberger's machine was based on a rotating massive sphere. In 1832, American Walter R. Johnson developed a similar device that was based on a rotating disc. The French mathematician Pierre-Simon Laplace, working at the École Polytechnique in Paris, recommended the machine for use as a teaching aid, and thus it came to the attention of Léon Foucault. In 1852, Foucault used it in an experiment involving the rotation of the Earth. It was Foucault who gave the device its modern name, in an experiment to see (Greek skopeein, to see) the Earth's rotation (Greek gyros, circle or rotation), which was visible in the 8 to 10 minutes before friction slowed the spinning rotor.
In the 1860s, the advent of electric motors

made it possible for a gyroscope to spin indefinitely; this led to the first prototype heading indicators, and a rather more complicated device, the gyrocompass.

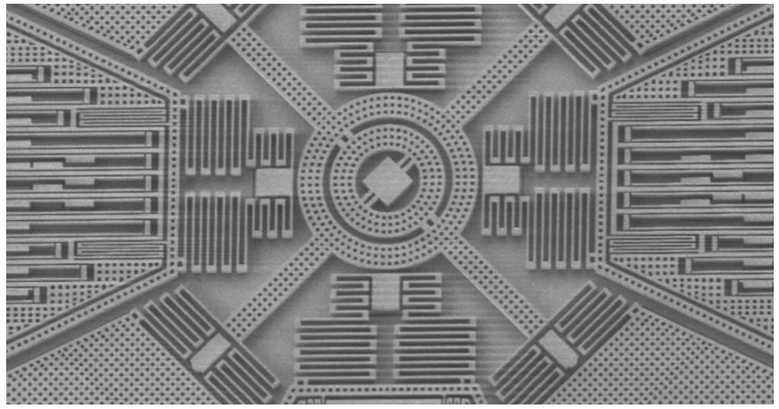
The first functional gyrocompass was patented in 1904 by German inventor Hermann Anschütz-Kaempfe. American Elmer Sperry followed with his own design later that year, and other nations soon realized the military importance of the invention—in an age in which naval prowess was the most significant measure of military power—and created their own gyroscope industries. The Sperry Gyroscope Company quickly expanded to provide aircraft and naval stabilizers as well, and other gyroscope developers followed suit.

In the first several decades of the 20th century, other inventors attempted (unsuccessfully) to use gyroscopes as the basis for early black box navigational systems by creating a stable platform from which accurate acceleration measurements could be performed (to bypass the need for star sightings to calculate position). Similar principles were later employed in the development of inertial navigation systems for ballistic missiles.

During World War II, the gyroscope became the prime component for aircraft and anti-aircraft gun sights. After the war, the race to miniaturize gyroscopes for guided missiles and weapons navigation systems resulted in the development and manufacturing of so-called midget gyroscopes that weighed less than 85 grams and had a diameter of approximately 2.5 cm. Some of these miniaturized gyroscopes could reach a speed of 24,000 revolutions per minute in less than 10 seconds.

Gyroscopes continue to be an engineering challenge. For example, the axle bearings must be extremely accurate. A small amount of friction is deliberately introduced to the bearings, since otherwise an accuracy of better than of an inch would be required.

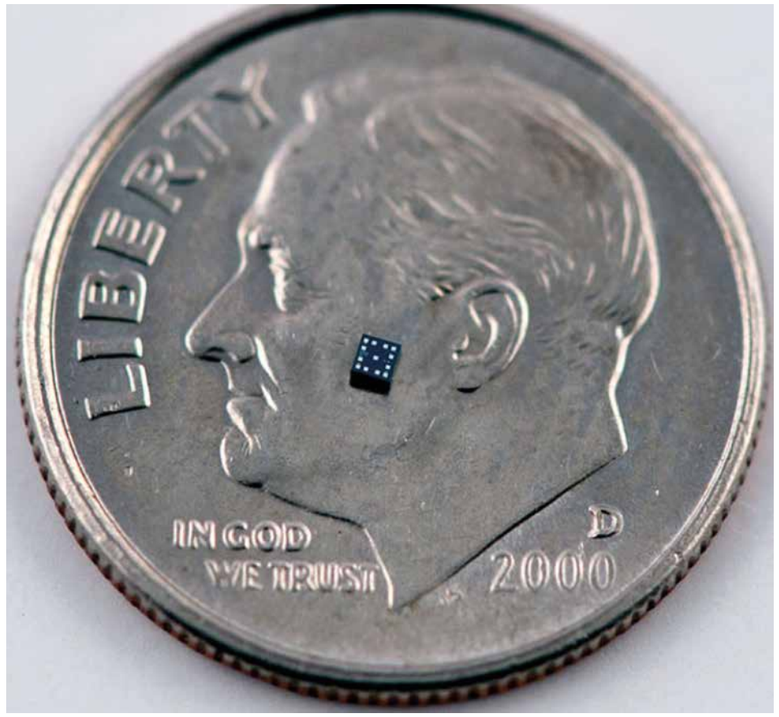
Three-axis MEMS-based gyroscopes are also being used in portable electronic devices such as tablets, smartphones, and smartwatches. This adds to the 3-axis acceleration sensing ability available on previous generations of devices. Together these sensors provide 6 component



Mems Based IMU

motion sensing; acceleration for X, Y, and Z movement, and gyroscopes for measuring the extent and rate of rotation in space (roll, pitch and yaw). Some devices (e.g. the iPhone) additionally incorporate a magnetometer to provide absolute angular measurements relative to the Earth's magnetic field. Newer MEMS-based inertial measurement units incorporate up to all nine axes of sensing in a single integrated circuit package, providing inexpensive and widely available motion sensing.

Inertial navigation unit of French IRBM S3



Format MEMS based IMU

Seabed at the Expo's

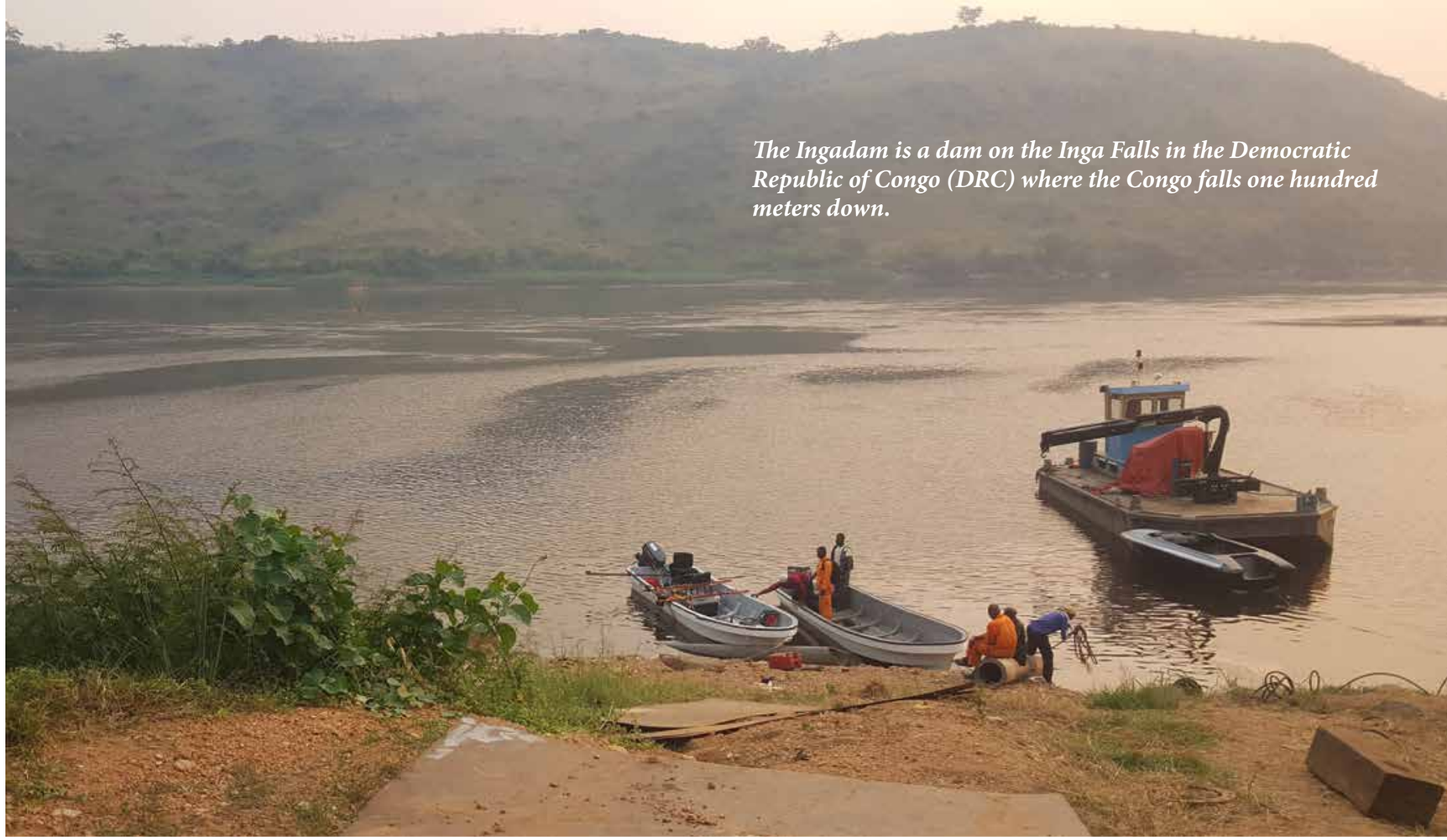
Hydro 2017

HSB Waternet
Baggernet dag
2017

Ocean Business
2017

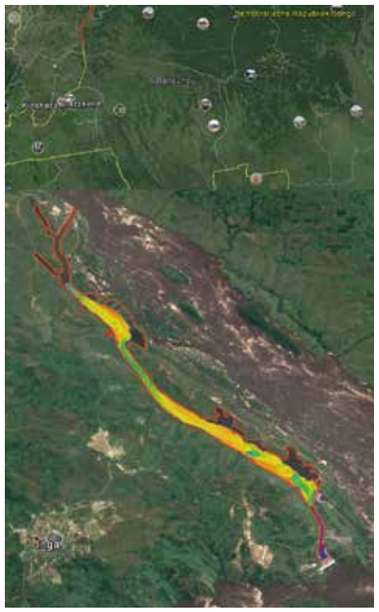
See you in 2018 at: Oceanology International London, Offshore Energy Amsterdam and Hydro Gdansk

How to build a dam in Congo



The Ingadam is a dam on the Inga Falls in the Democratic Republic of Congo (DRC) where the Congo falls one hundred meters down.

The Belgian colonial administration decided in the fifties to construct two dams in the river. About 150 kilometers southwest of the capital Kinshasa, two hydroelectric power stations were built. The Inga 1, with an installed capacity of 351 megawatts (MW), was completed in 1972. Ten years later, Inga 2 followed with a total capacity of 1424 MW. Inga 1 has six turbines of 58.5 MW and Inga 2 has eight of 178 MW each. Due to a lack of maintenance, Inga 1 and Inga 2 are largely out of order: in Inga 1 there are still two turbines and in Inga 2 two or three more.



The country has a huge potential power for generating electricity through hydro-power plants. The total is estimated at 100 GW, putting the country in third place worldwide after the People's Republic of China and Russia. At the Inga location the estimated potential is 40GW of which only a fraction is used. Since almost the entire electricity production of the DRC is dependent on Inga, the World Bank is considering investing in rehabilitation. In addition, there are plans for Inga 3 (approximately 4800 MW) and even for Grande-Inga, a gigantic hydroelectric power plant with a capacity of 39,000 MW.

The National Electricity Company (SNEL) is a public industrial and commercial establishment with legal personality. The history of SNEL dates back to the colonial era, from the discovery of the Congo River, which gave the colonial authorities the prospects to create the Inga Institute implementing the project of construction of the vast dams and hydroelectric power stations. Established in 1970 out of a total of six companies in the electric sector with the purpose:

- to collect and use the waters of the Congo River in the Inga region to produce electrical energy or for other purposes;
- to construct, equip or operate by itself or by third parties, for itself or for third parties, any works, installations and factories for the abstraction of hydraulic power or the use of energy sources;
- to produce, transport, transform, and use in any way, electrical energy in all its forms;
- to sell and use the energy produced.

Currently SNEL operates three CSD's to manage the flow of sediment into the lake and turbines. All three are operating individual from each other without a general master dredge plan or up to date info of the general state and condition of the lake regarding siltation.

HYDRODAM INDUSTRIES, a Dutch based company, offers worldwide total solutions for sediments problems related to dredging, dewatering & treatment, mining and reclamation projects was hired to conduct a survey to investigate the dredge operations and siltation towards the intake of the turbines and to demonstrate hardware to plan and maintain dredge operation. SEABED was asked to consult and advice in the integration of dredging registration systems to optimize the dredging effort in lake Inga.
A single beam survey was also part of the total assignment. A good moment to de-monstrate our SPLMS 2 to SNEL instead.

Packed with a portable dredging regis-tration set and one Rimowa suitcase containing the SPLMS 2 and additional base station we left for Kinshasa airport. Weighing no more than 27kg the suitcase was accepted as standard luggage. Shortly after arriving at Inga dam it took no more than the remaining second half of the day to set up the multibeam spread on the available vessel.

The vessel, made available by SNEL was a common fiberglass boat with a 55HP outboard engine. Two car batteries were used to supply 24VDC to the survey equipment. The batteries were powered by a generator mounted in the front of the boat. The frame to be able to place the multibeam over the side was made of scaffolding material found near the dam. The flange to mount the multibeam to the scaffolding pole was brought from Amsterdam.

For the most accurate and stable position on the vessel we installed a SGR6 RTK base station on the railing of the dam. Power was obtained from the lighting posts at 220VAC transformed to 12VDC. As an alternative to this system a TER-RASTAR-C L-BAND correctional data service is available to the project.
This signal again is available mainly for navigation purposes by the maritime industry and is operating at the same frequency as the L1 satellites. This service is installed all around the world. The geographical accuracy is better than 4cm horizontal and 8cm vertical (95%).

The multibeam demonstration lasted two days including patch test. It was the first time ever that more than 90% of the lake was surveyed in half the time of a single beam survey. Detailed information of the underwater structures and steep banking in some areas was also of value for the management of the dam.

Client tales #3

Projects at Jan De Nul Group over the last couple of years, have become more expeditious and more challenging. To serve the requirement towards fast mobilization of survey systems, Jan De Nul Group was in search of a portable multibeam set.

As Norbit dealer, Seabed introduced us in the strengths and abilities of the iWBMS.The cooperation and will to supply a tailor made product, complying with our specific work approach, has been the main success of a purchase of several systems over the past 2 years. Today we are owner of a product that can serve our versatile projects for many more years.

Seabed knows its clients, understands their needs towards innovation and strives to be a good middleman between manufacturer and client. That`s the approach we like and that`s how we hope to work together in the future.

Steven Bontekoe
Manager Survey Systems, Jan De Nul Group


Cat-Surveyor deploying an Observer mini-ROV

Introducing SeaCAT, an integrated solution for unmanned inspection of offshore wind farms

As for any other offshore infrastructure, the inspection and the maintenance of offshore wind turbines, in a safe and efficient way as expected by today's industry standards, may reveal itself as a costly and technically challenging operation due to harsh environments and budget constraints.

Working in heavy swells and high currents in the vicinity of rather light structures, as compared to traditional oil and gas platforms, brings in a new context for which traditional intervention spreads such as DP support vessels and construction ROVs can be seen as oversized and thus, presenting major risks both for the infrastructure itself and the operators on board.

Back in 2013, Subsea Tech started working on unmanned surface vessels (USV) concepts to carry out marine operations, aiming at reducing operating costs and enhancing man safety. However, using USVs alone does not make the whole job for the offshore turbines, as critical submerged parts such as moorings, foundations and subsea cables require underwater inspection capability with dedicated tools.

Next step was therefore to add an ROV deployment capability on board the unmanned vessel in order to give the system a full water depth observation and intervention capability. An additional challenge was to design a system compatible with operations in turbid waters as generally encountered on offshore wind farms sites.

This was done 3 years ago by Subsea Tech, as a world premiere, within their Cat-Surveyor project where an observation class ROV was integrated and deployed from a lightweight autonomous catamaran, Cat-Surveyor. Although not designed for open seas, this first experience allowed developing an expertise in the design of a USV/ROV combination with specific challenges such as relative behaviour of the two vehicles. In parallel, a long range/low latency wireless communication was developed to enable the ROV operation through the USV.

Capitalizing on that initial knowhow, Subsea Tech is presently completing the development of an ocean going USV with an autonomy of 72 hours, SeaCAT, capable of deploying an inspection class ROV down to 500 m.

SeaCAT is a 5.8m (16.5 feet) long and 1,200 kg catamaran type USV especially designed for open sea conditions. A special feature is the USV inflatable edge which improves the behaviour in harsh conditions (up to sea state 6). Thrusted by 2 powerful electrical engines, SeaCAT can be controlled and hold position (DP mode) accurately even in strong current conditions. The small dimensions and lighweight of SeaCAT allows operating it close to the inspection site with a highly reduced risk of damaging the infrastructures.

Thanks to its 200 kg payload capacity, SeaCAT can embark multiple sensors to carry out inspections above and under the water: multibeam echosounder (NORBIT WBMS for instance), side scan sonar, 2D imaging sonar, video cameras, inspection class ROV Tortuga but also a light UAV on the deck for aerial inspections.

The latest release from Subsea Tech's design office, Tortuga ROV, can be deployed from SeaCAT to carry out multiple missions such as: inspections with HD video cameras and imaging sonars, wall thickness measurements, corrosion protection control, etc. Tortuga is a 40 kg and 500m depth rated inspection class ROV, especially designed for operations in strong current conditions, up to 4.5 knots. Each one of its 4 horizontal thrusters develops a 20 kgf thrust, offering the highest thrust/weight ratio on the Inspection class ROV market (1,8). Its unique azimuthal thrust control allows the ROV stabilizing its position in an optimal way, regardless of the current direction. The INS and the dynamic positioning system ensure an accurate control of the ROV position while carrying out inspections and measurements.

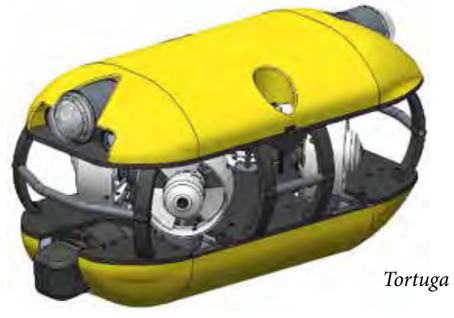
SeaCAT and Tortuga fit into a standard 20 feet container, thus allowing easy mob/demob on site.

The SeaCAT solution offers the following benefits:

- Unmanned operations controlled from shore or a remote boat, thus reducing drastically the human operator risk at sea
- Infrastructure damage risks reduction by using light and agile intervention spreads
- Significant reduction of the environmental impact by deploying low consumption vehicles (CO2 emission reduced by a factor 20 to 50 compared to conventional spreads)
- O&M costs cutting by an estimate factor 10 compared to the current procedures
- Increased operational flexibility thanks to a quick and easy deployment, involving a reduced crew.

The SeaCAT and Tortuga highly innovative solution will be commercially available by mid-2018.


SeaCAT USV


Tortuga ROV

To know more about our extensive range of underwater and marine products, please visit our website: www.subsea-tech.com and meet us at OI 2018 booth #K200.

SUBSEA TECH

Seabed Calibration Lab ready to go

From now onwards Seabed will be able to calibrate the following AML sensors namely: Pressure, Temperature, Sound Velocity, turbidity and PH.

By standard al the sensors need to be recalibrated annually. Before the European calibration lab Seabed send all the AML sensors over to Canada. Now we can provide all the customers with a European calibration thereby reducing inbound duties and turnaround-time.

Seabed has setup a cleanroom, with all the necessary lab equipment, like an pc controlled water reservoir and a 24/7 logging pc, so all the calibrations will be done with the same reliability, and quality wise like that of AML.

Here are some pictures of the lab while under construction.

As of OI we are ready to go and calibrate your sensors!

Research Vessel R.V. Dreissena

R.V. Stands for Research Vessel and Dreissena is genus of mussels in the Dreissenidae family. This genus includes the zebra mussel (Dreissena polymorpha) and the quagga mussel (Dreissena bugensis), both key protagonists in Markermeer's changing ecology.

The eight meter long aluminium ship was built by Stormer Marine Workboats and is fitted with specialised research equipment. Notably, the University of Amsterdam is now the first university in the Netherlands with its own research boat. The ship will be used by the Institute for Biodiversity and Ecosystem Dynamics (IBED-UvA) to carry out research on Lake Markermeer.

The construction of the R.V Dreissena is the result of a crowdfunding's effort initiated by aquatic biologist Harm van der Geest (IBED-UvA). Until now, research was done with small dinghy's that were not suitable to safely use in all weather conditions. Waves on Lake Markermeer can be as high as a meter. With the new ship both researchers and students are able to do research safely in all seasons, and during stormy conditions.

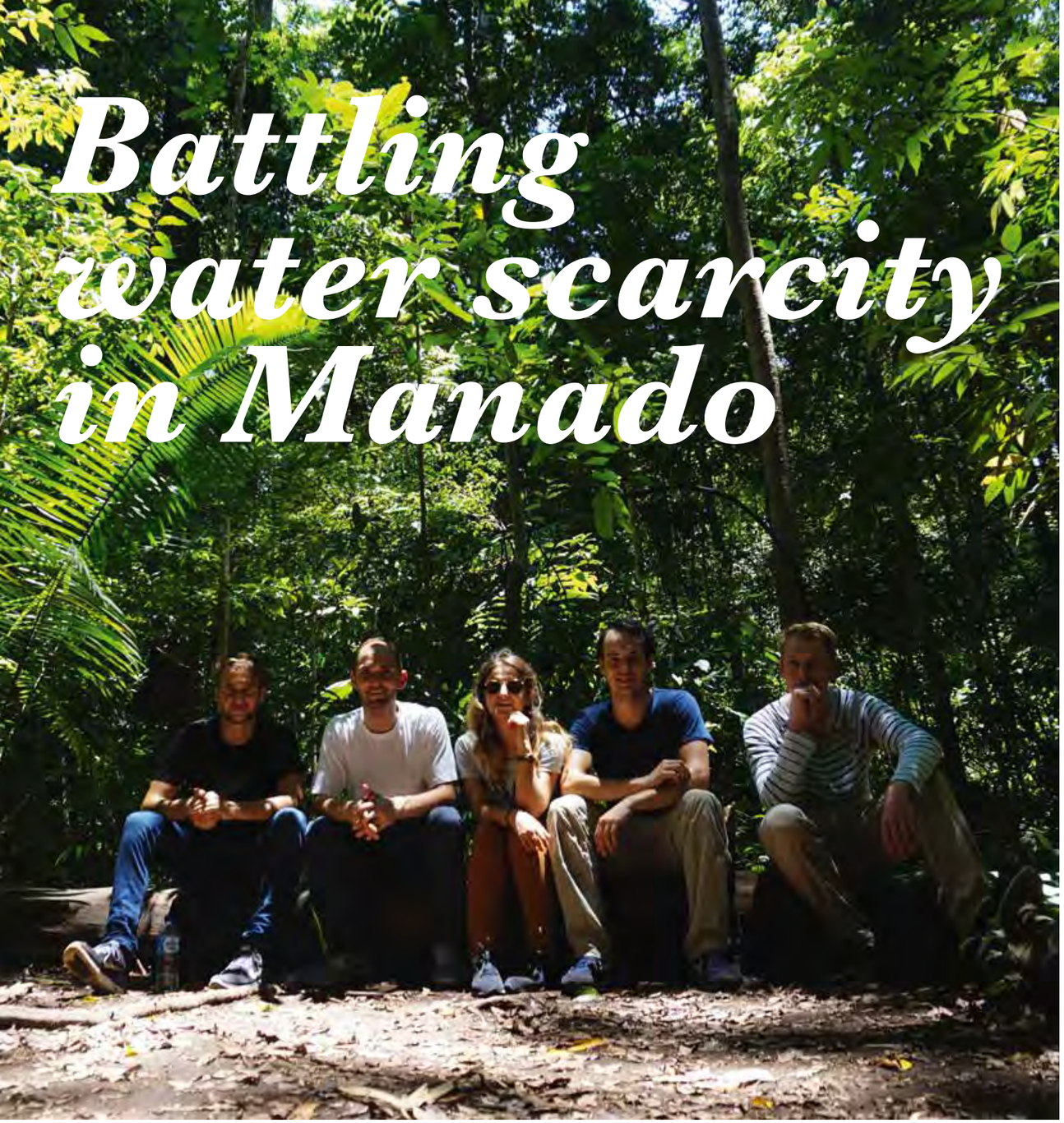
Markermeer

The arrival of the research vessel will give ecology research in Lake Markermeer a great boost. The ecology of Lake Markermeer has changed considerably due to the building of dikes and dams, but not a lot is known about the steering factors that determine the state of the lake. A better understanding of for instance the lake's food webs, will lead to a better appreciation of what is currently going wrong in the system and what we can do to improve the environmental quality in the area.

Crowdfunding

The money for the ship has been collected by various parties. The Amsterdam University Fund made the research vessel one of the spearheads in the 2016 annual fund campaign, after which many alumni and friends of the UvA contributed. Other parties that contributed were Amsterdam Water Science, the Blue Heart Foundation, Science Hub, Hoogheemraadschap Hollands Noorderkwartier, Waternet, Rijkswaterstaat, Stormer Marine Workboats, Raymarine, Bataviahaven Lelystad, Edam-Volendam Municipality, Technautic, Humminbird, Bynolyt, RDG advertising, Dekker Watersport, Seabed BV, Maritech, NewDealSals and participants in the crowdfunding campaign.

Battling water scarcity in Manado



October 2017, Manado, North Sulawesi. The sun sets, we are sitting at the quay and are looking out over a red reflective bay. In the distance the contours of the volcano Manado Tua are visible above the water and the sea changes colour at the coral reefs of the island Bunaken. In the background the silent noise of the city, that is hardly noticeable at this new land reclamation. It is a relaxing moment, away from all the problems that the growing economy of Manado causes.

Due to climate change and growing cities, water scarcity is becoming one of the futures biggest problems. On top of that, the population and prosperity of cities around the equator are growing rapidly. Meaning that the need for electricity, cooling and drinking water will grow quickly in the following decades. Student team "ROTEC" is convinced that these growing problems require a sustainable approach for the future.

A solution to these challenges can be found in the oceans temperature difference. The top layer of the ocean is heated by the sun, while the deeper layer remains cold. Around the equator, this causes a temperature difference of more than 20 degrees over the ocean's depth. This temperature difference offers a lot of opportunities. It can be used as a vast source for electricity production (OTEC), large scale drinking water production (ROTEC) and for cooling of buildings (SWAC). Indonesia is one of the best locations worldwide, due to their easy accessibility of cold deep seawater and the abundant presence of hot surface water. These solutions are not only sustainable but can be cost effective and reliable solutions.

Therefor five Msc. students from Delft University of Technology were invited to Manado to conduct a research that focuses on the use of cold deep seawater for sustainable energy production, drinking water production and cooling. First the needs of Manado and the island Bunaken, in front of the city, were mapped out. And most importantly the vertical temperature gradient needed to be checked, in order to obtain cold deep seawater. Only after these two were verified the design of deep seawater solutions could be started.

Need

With 700,000 inhabitants, Manado is one of the fastest growing cities in Indonesia. Until a few years ago, the city had daily power blackouts due to a lack of energy production. This is solved temporarily by renting a fossil fuel power vessel. This solution is short term and still does not solve the power blackouts as they still occur weekly. A part of the solution lies in decreasing the power consumption of big consumers. In tropical countries, the biggest part of the energy problem is a challenge to reduce the cooling load. The new land reclamations along the coast of Manado, is filled with hotels and malls. These already use 10% of the cities electricity for cooling only. Decreasing the impact of cooling can already mean a large gain for Manado.

Bunaken has totally different needs. They are struggling with their energy and drinking water supply. Expensive diesel and drinking water is transported to the island, since the island is not self-sustaining. Thus, Bunaken needs an electricity and drinking water supply that is easy to operate and maintain and which is independent from the mainland.

Measurements

In order to propose deep seawater solutions data was necessary. During the preparation of the project a lack of data about Manado bay was evident, therefore a measurement campaign of one week in Manado bay was conducted. It included water depth measurements with a lead line and vertical seawater temperature profiles up to a depth of 1000 m with a Minos X CTD head. During the search for in kind sponsoring of the measurement equipment the project team came in contact with Seabed B.V., which were enthusiastic about the project proposal and were willing to help. The involvement of Seabed in the project made it possible to take a Minos X CTD head to Indonesia for two months, in this way it was possible to do the measurements in the most efficient manner. Other equipment like 1500-meter dyneema wire, fishing rod and a motor to haul in wire was sponsored by Bluerise B.V. All components were taken from the Netherlands, in this way the quality of the equipment was assured and made the preparation in Indonesia more efficient.

To conduct the measurements a proper boat was necessary. Normal sport fishing boats or large fishing vessels were not available in this region, therefore is chosen for a local tourist boat with captain. The boat was large and with a few adaptations suitable to mount the equipment. The captain called; Canto, was a friendly local who lived his whole life on Bunaken Island which was part of the project area. Below an image is shown to give an idea about the research vessel.

Manado bay temperature with CTD plus index temperature.

In two days of offshore measuring several lead line measurements and nine vertical temperature profiles were made.
The measurements were combined with research on the environmental impact of a land reclamation in Manado. First, the data was processed and after that compared to measurements on other locations. Two important observations were made; 1) due to the tectonics large height difference are found over a short lateral distance and 2) The vertical seawater temperature gradient is large compared to other locations, or in other words cold deep seawater is found in relatively shallow depths (see figure).
It can be concluded that North-Sulawesi has a unique access to cold deep seawater due to the steep slope of the seabed near the coast and the availability of cold deep seawater in shallow depths.

Solutions

The measurements revealed that the access to cold deep seawater at Manado and Bunaken is good. For Manado this gives a great opportunity to reduce the electricity for cooling, by using SWAC.

To cool the buildings 7°C is pumped up and flows through a heat exchanger to cool a fresh water loop that is distributed to all the hotels and malls. These buildings already have a central cooling system and only have to make small adjustments to their current system. After implementation of this system, the buildings use 96% less energy for cooling. Considering the investment and operational costs, this can cut half of the cooling costs over a lifetime of 20 years.

At Bunaken an OTEC plant combined with desalination is proposed, by using the temperature difference between the surface water (never below 28.5°C throughout the year) and the deeper water (8.5°C). The surface water is used to make a working fluid evaporate and run through a turbine, after which the working fluid condensates again with the deep seawater. The total capacity would become 125kW of which 80kW is used as a baseload for the island. 45kW is used to supply the island with its need for drinking water, by powering a desalination plant. This SWRO plant desalinates part of the seawater that is pumped up for the energy production after which the salty waste is safely discharged back into the sea with the rest of the water. The drinking water would be 12 times cheaper than the bottled water they currently consume and 1.4 times cheaper than the not drinkable water from fresh water wells. This installation could produce 24/7 and solely by using the ocean. The energy production costs are equal to what they pay now.

Many parties showed interest, and now its part for the next step: Make it really happen! Measurements, calculations and interest from many parties showed that there is high potential for the future. Hopefully the future of the friendly people of Manado, that enjoy every evening the red reflective sunset, with in the background the contours of volcano Manado Tua. And in between, for them still unknown, an ocean of opportunities.

An overview of the history of GNSS

GNSS – Global Navigation Satellite System. GNSS make it possible to determine your position everywhere on earth. The most recognizable GNSS is the system of the United States (GPS).

In the modern-day, GNSS systems are almost unmissable. Without them your smartphone couldn't say what the shortest route is to Seabed. Or let land surveyors know where to build your new house. All these things that are now normal were 60 years ago still science fiction. In this article we will guide you through the development of GNSS systems and how it is possible that now everybody can enjoy the wonders of GNSS.

It all started when Russia successfully launched their first satellite (Prosteyshiy Sputnik-1, Meaning Elementary satellite 1) in 1957. This satellite had no sensors and could only send a simple radio signal for 21 days until it ran out of battery. However, with the help of multiple receivers it was possible to calculate the location of the Sputnik-1.

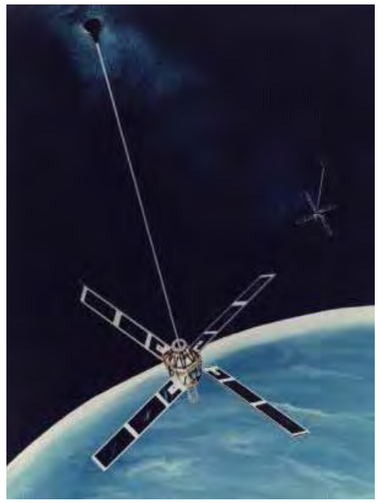
Postage stamp depicting Sputnik 1 orbiting the Earth, the Earth orbiting the Sun and the Sun orbiting the center of the Milky Way galaxy

Soon people realized that if it was possible to calculate the location of the satellite with multiple receivers it was also possible to calculate the location of the receiver with multiple satellites. In 1957 this idea was much too expensive to realize. But when cold war advances two big things made GNSS possible:

1. The cost to manufacture technology decreased;
2. The need for an intercontinental missile guiding system increased.

This last thing made GNSS not some sort of novel idea, but it became a way for the United States to win the Nuclear Arms Race. In 1967 the United states realized this idea with the first ever Satellite navigation system called Transit. This gave the United States some advantages but lost it in 1970 when the Russians deployed their own satellite positioning system called Paurus.

When time went on and the world was not yet destroyed by nuclear weapons, both Satellite systems were upgraded to the satellite systems we know today. The United States created GPS and Russia created GLONASS. However, GPS was still not yet available to the public, this changed in 1983 when a Korean airplane was shot down after flying in prohibited airspace. Ronald Reagan recognized that this would never have happened if GPS was available for the public. He ordered that it should be made freely available for civilian use.



Transit satellite

The accuracy of GPS nowadays is around ≤0.715 meter for 95 percent of the time. But if the accuracy of GPS alone is around 0.715 meter for 95 percent of the time, than how is it possible for Seabed to sell GNSS-Receivers with Sub-centimeter accuracy? To answer this question, we must first know where most of the errors come from. It turns out that most of the inaccuracies come from the fact that not all satellite signals travel at the same speed trough the atmosphere. This means that if the speed of those signals is known, much of the positioning errors could be reduced. That's why Seabed receivers are not only equipped with GNSS-antennas but also with equipment to receive correction signal to compensate for the atmospheric delays.

admodus®

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-dependently by a limiting density of approximately ρ=1.20 g/cm3.
„Determining the Nautical Bottom", Markus Jänen




Determining nautical depth in real time

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

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

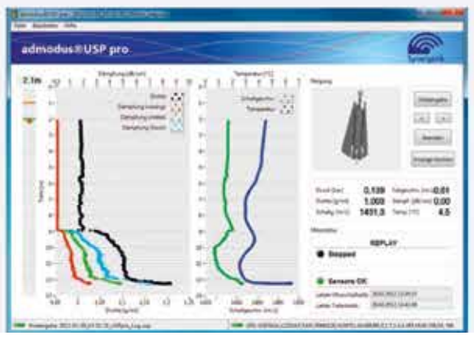
The admodus®*USP pro* is linked via high-speed Ethernet to a PC which displays all measurement data clearly laid out and in real time, stores them, and exports them as a PDF report as required. The user software features an automatic recording mode which permits serial measurements without interaction.

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

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

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

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



Onsite installation and training of a single beam system in Ghana

Somewhere in October of the year 2017 when the oceans were still crystal-blue, Seabed received an request by Blebs Geo-Consult to perform an installation of a brand new digital Single Beam system and to assist with the initial test and provide an training onside.

The location of the training and test was near the Tema harbor Ghana, the construction of the harbor was proposed by the British who ruled the Gold Coast before its independence. An old fishing village called Torman was the proposed site for the harbor's construction. The rapid industrialization that followed Ghana's independence led to the town adopting the name Tema from that of the fishing village. After independence, under the leadership of Ghana's first president Kwame Nkrumah, the construction of the harbor began in the 1950s and was commissioned in 1962. The Harbor lies along the Gulf of Guinea and is 18 miles from Accra, the capital of Ghana. The harbor has a water-enclosed area of 1.7 million square metres and covers a total land area of 3.9 million square metres. The harbor lies on a 410 acres of sea the harbor has 5 kilometers of breakwaters.
In the past Blebs worked with an paper based single beam which they wanted to replace with the newest high-tech single beam sonar, this sonar has two channels 38kHz and 200kHz. Which enables you to take measurements from 1 meter up to 2500 meter. Because of the dual channel they can better determine the amount of sludge that is present in the port.


Transit satellite

Seabed was on a three day journey in beautiful Ghana for installation and training purposes, the first day was used for mobilizing the setup on their nameless vessel which I named the "blue dragon", we installed the hardware on this blue beast and afterwards we checked if all the equipment was working on their field laptop, on which we installed the latest acquisition software QINSy 8.17.

The second day was used for data acquisition on the blue dragon on the great blue ocean. Before we started we explained them the ease of the AML Oceanographic, Base X2 with sound velocity sensor, compared to a bar check. A barcheck is done in several steps, first you have to determine the bedding of the bar. Then you have place the bare under the single beam at three different depths to determine the average sound velocity speed. Using a SVP can save time and this way you will avoid hazardous situation. You can simply take an averaged of the SVP profile and you are done. After calibration we showed them the influence of sound velocity on the measured depth.

The third day was used for data processing and we repeated the installation, so all the trainees were comfortable with the setup of the system.

Skilltrade e-learning

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

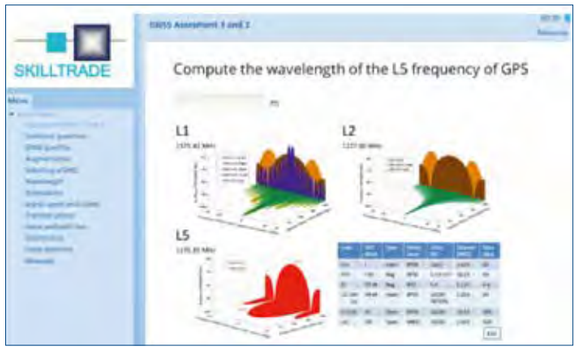
Skilltrade offers the following, hydrography and geodesy related E-learning:

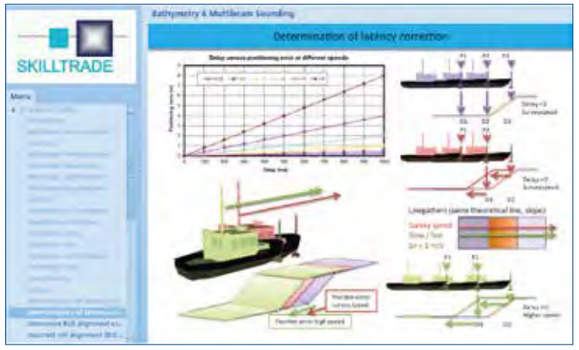
- Mathematics
- Physics
- Bathymetry
- Geodesy
- Global Navigation Satellite Systems

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

Level

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





Advantages e-learning

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

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

Furthermore e-learning is cost effective; no more travel and accommodation expenses for employees. The IHO requires that a Cat B course last at least 26 weeks. With the addition of the 13 weeks e-learning programme we have minimalized this this down to only 13 weeks in class room including a week of offshore recognized safety training. In 2008 the Skilltrade Cat B programme first received recognition by the FIG-IHO-ICA International Board on Standards of Competence for Hydrographic Surveyors. Skilltrade received continued recognition for 6 years for their updated curriculum, which includes the 13 weeks e-learning programme, in April 2016.

Interaction

A potential limitation of online learning is that it may feel like a solo act. The e-learning platform is not a one way road, Skilltrade has added interaction and made it more personal. The student can connect with the experts through e-mail.
Huibert-Jan Lekkerkerk: "Not every student likes to do self-study alone. Sometimes they have questions which they cannot solve for themselves. To prevent that a student gets stuck in a module, we offer e-mail support. On a daily basis our teachers check the e-mail box and they try to answer the question a student has".
The student can also connect with his or her fellow students from all over the world. Furthermore we offer the possibility to subscribe for tele-conferencing sessions based on a fixed schedule.
Both the student and the trainer can monitor progress through the E-learning system. As each E-learning lecture is accompanied by an interactive assessment, after answering the questions the results is immediately available from the E-learning system.

Hydrographic Survey Category B Course

The students of the 21st Skilltrade Hydrographic Survey Category B Course all successfully completed their e-learning before continuing their study in The Netherlands. The Cat B students are positive about the e-learning: it gives them more time to digest the subject matters and relieves the pressure during the theoretical, on-site part of the Cat-B course in IJmuiden.

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SKILLTRADE

Hydrodam dredging in the Canton of Vaud in Switzerland

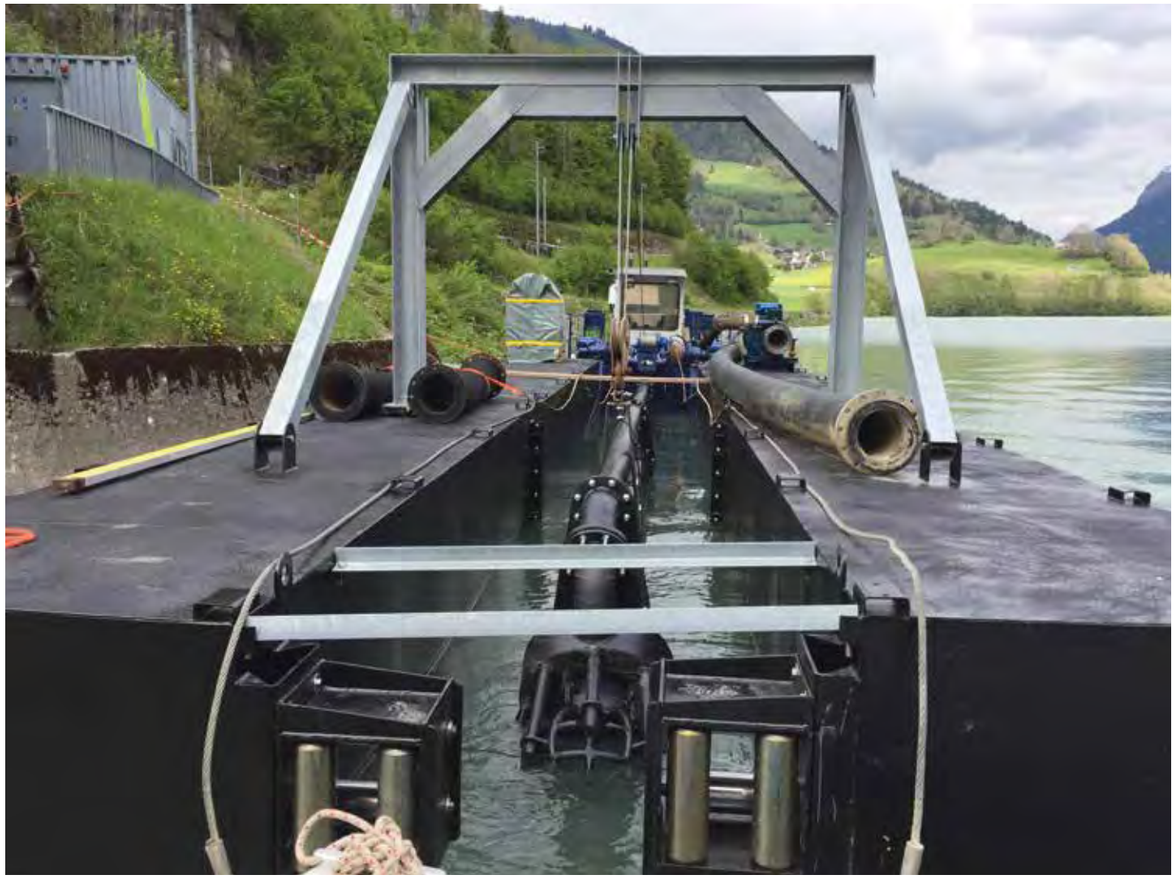
The canton of Vaud is the third largest of the Swiss cantons by population and fourth by its size. At an elevation of 895 meters above sea level between the Pointe de Cray and Planachaux mountains on the Saane/Sarine river at Rossiniere a small reservoir can be found, Lac du Vernex. Centred in the regional park Gruyere – Pays-d'Enhaut a national park of Switzerland.

Part of Lac du Vernex is Rossière dam which was built in 1972. Rossière dam is one of the many dams owned and maintained by Groupe-E, a Swiss electricity supply company. Group E produces approximately 40 % of the 3-terawatt hours distributed each year. Through some 40 district networks, the company supplies more than 140 gigawatt-hours of heat per year via a 50-kilometer network.

Due to heavy sediment inflow and restrictive laws concerning flushing of the reservoir, an important reservoir silting can be observed. Considering the actual measurements, the reservoir will be completely filled with sediments by 2032, i.e. 20 years before the end of the actual permission for the operation of the power plant. As a loss of storage capacity would lead to high economic losses for the owner of the dam.

HYDRODAM INDUSTRIES, a Dutch based company which offers worldwide total solutions for sediments problems related to dredging, dewatering & treatment, mining and reclamation projects, was hired to conduct dredge operations of the siltation towards the outlet of the Rossière dam. SEABED was asked to consult and advice in the integration of dredging registration systems to optimize the dredging effort in Lac du Vernex.

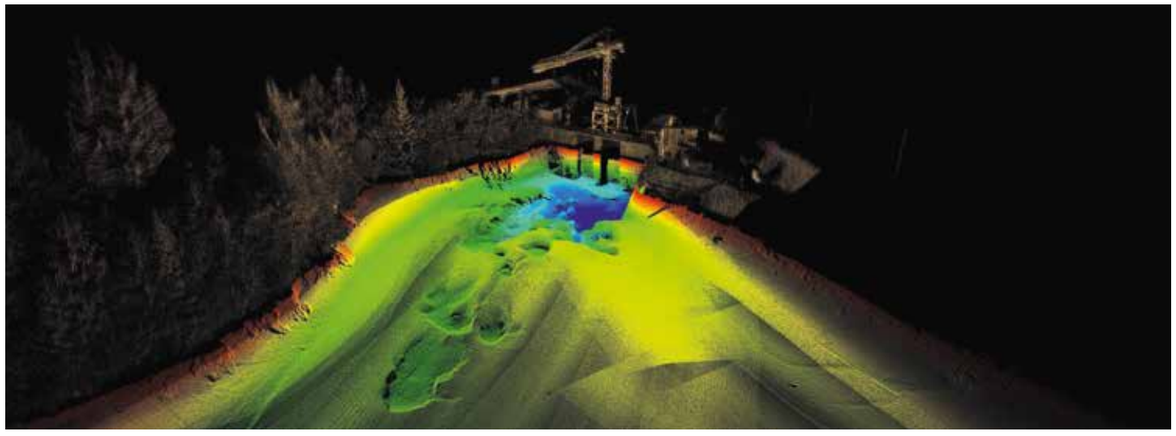
Hydrodam Purchased a dredging registration system from Seabed to do a realtime representation and visualisation of the dredge head in QINSy. This way the dredger knows where he or she has dredged and how much silt has been excavated. Afterward a quick calculation of the cubic meters dredged can be done using the raw grid recorded while dredging.
One of Seabed's company policies is that every system must be checked on location and meet the required acceptance test. In order to do this Seabed decided to bring the SPLMS S2.



For Detailed specifications of the SPLMS S2 visit our website **www.seabed.nl**.

Packed with a portable dredging registration set and one Rimowa suitcase containing the SPLMS 2 two Engineers travelled down to Switzerland. The dredge registration system was installed onboard a small pontoon on a beautiful sunny day with the sound of swiss cow bells in the background on Lac du Vernex. After installing the dredge system Seabed installed the SPLMS S2 onboard L'Observer.

And a small test survey was done near the dam where Hydrodam had to perform their dredge job. Afterwards the data was loaded into the dredge system and a test dredge was made. To check if all was well, a few new lines where recorded with the SPLMS2 and results where perfect.



Meet the Seabed Team

Eva Brans
Hydrograhic Surveyor

Evert Bootsman
Engineer

Jolanda de Cock
Financial Assistant

Elice Collewijn
Sales

Stefan van Delft
Engineer

Erik Jak
Intern

Jeroen Komen
Engineer

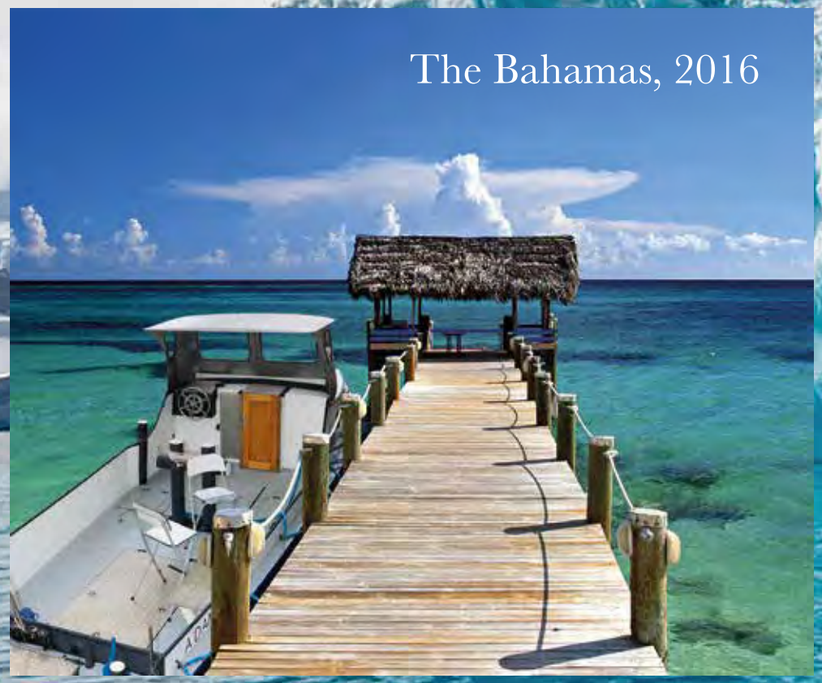
Martijn Rombouts
Intern

Hans Tuinman
Sales

Wouter Tuinstra
Hydrographic Surveyor

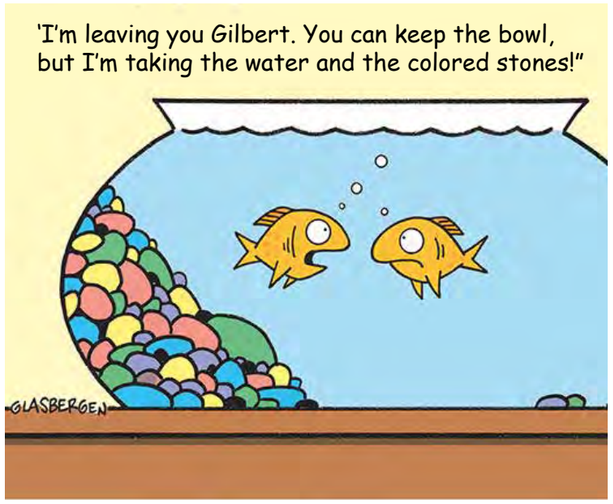
Naatje's travels

Moraine Lake, Canada 2017



The Bahamas, 2016

The South Pole, 2018



© Glasbergen

Make them laugh

© Tom van Dun

© Jerry King

© Max Garcia

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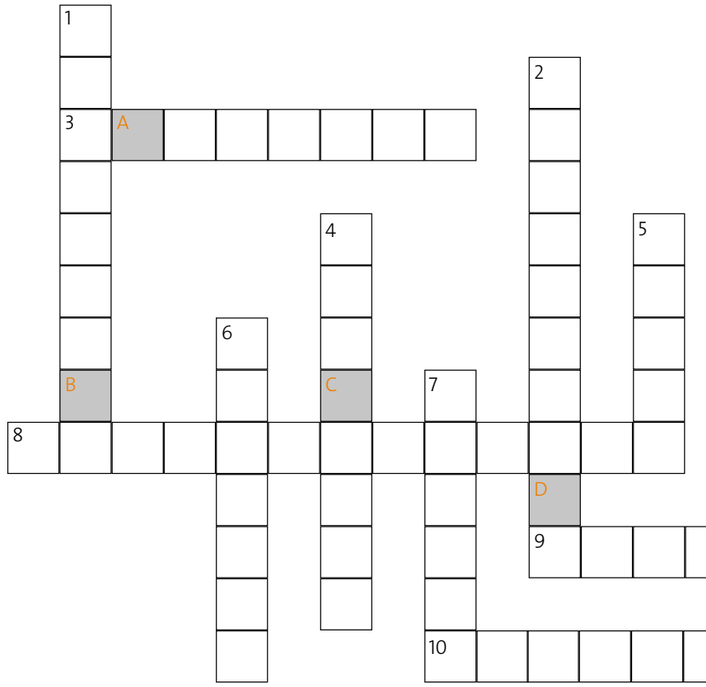
Prize Puzzle



Across:
3. Radio
8. Teaching by example
9. Bottom of the sea
10. Continent

Down:
1. Home of Santa Claus
2. Technology using fluids
4. Climate typical of the West Coast
5. Big water
6. Flightless bird
7. Dock

A	B	C	D	E

The object of the puzzle is to find words using the hints above. The letters in the grey squares will form a name. Solutions have to be submitted before November 1st 2018. The winner will receive a Virtual Reality Visor.
Please send your solution to: sales@seabed.nl

Last year's winner of the prize puzzle was: **Rowdy Tuinhout, Deep BV**

Colophon

Editor: Elice Collewijn
Design: RBREG Concept & Art Direction
Words: Eva Brans, Elice Collewijn, Ray Breg
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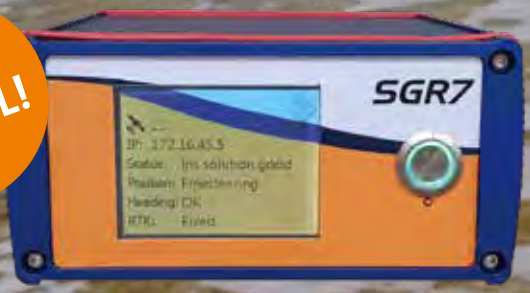

Seabed's new SGR7 GNSS Receiver

Electric Vibrocoror

SEABED

Getting to the bottom of things