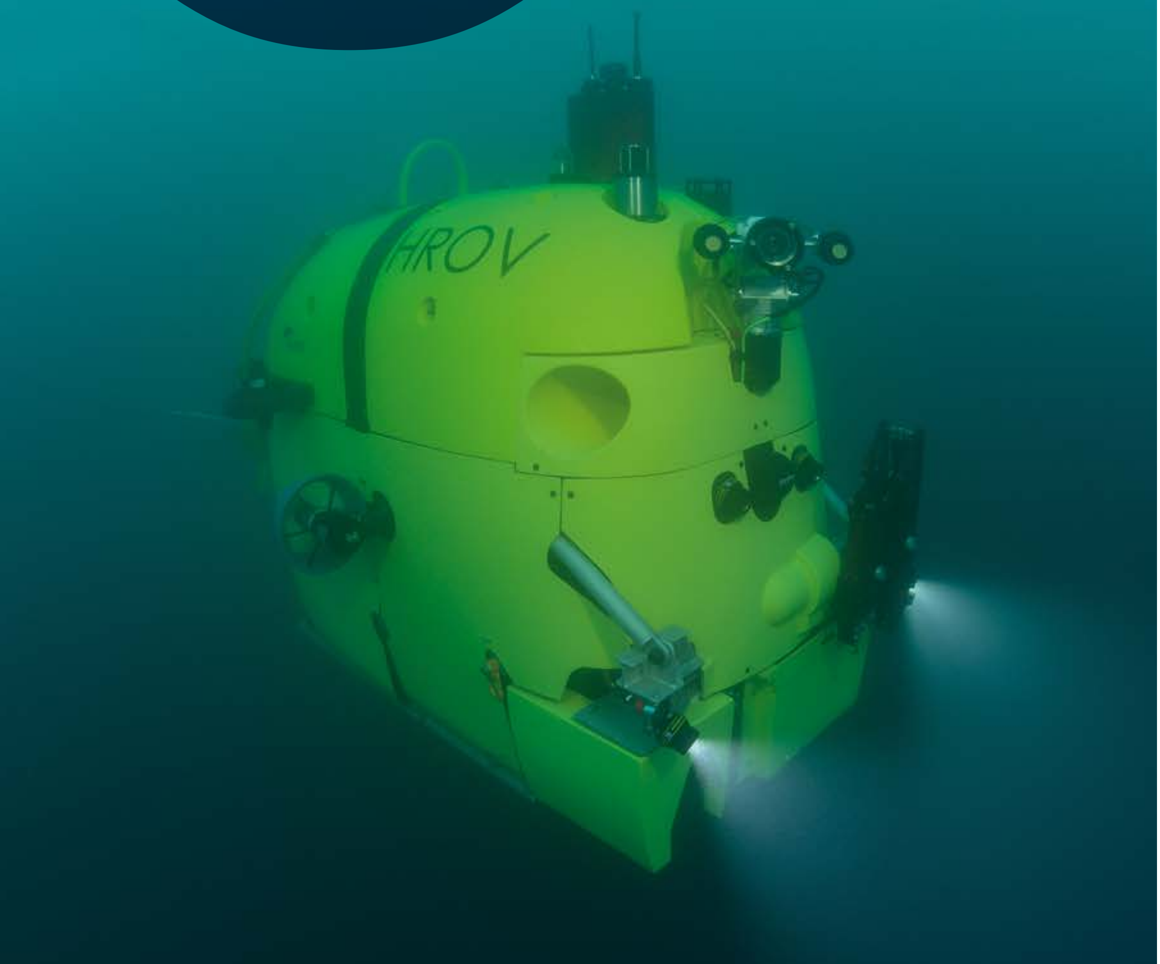
ROV PLANET



8

ISSUE

Q3 / 2016

The magazine of choice for Subsea Construction and ROV Professionals

ABOUT

With 8000 email distributions and 2000 printed copies delivered to the offices of ROV & subsea construction related companies, oil majors and also distributed at trade shows – ROV Planet aims to become the leading publication, online news portal, and forum of the ROV & subsea construction industries.

ISSUE NO.9: **OCTOBER 2016**
ISSUE NO.10: **JANUARY 2017**

NEWS

If you have any company news you would like us to share on our website and news portal please send it to: **NEWS@ROVPlanet.com**

DESIGN WORK

If you would like any kind of design work done (full corporate branding, magazines, flyers, posters and advertisements, flash/html5 banners, bus banners, etc.) please send enquiries to our talented design team: **DESIGN@ROVPlanet.com**

TABLE OF CONTENTS

EDITOR-IN-CHIEF
Richie Enzmann

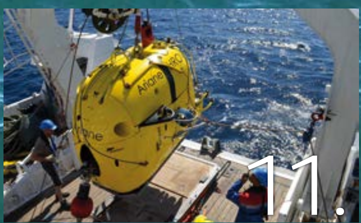
COPY EDITOR
Will Grant

CONTRIBUTORS
Richie Enzmann, Will Grant, Celia Hayes, Paul Unterweiser, Jill Zande, Hans W. Van Sumeren

DESIGN & LAYOUT
Milan Farkas

SPECIAL THANKS TO
Claire André, Bill Mallin, Victoria Moran, Meliha Boucher, Lorenzo Brignone, Ewen Raugel, Matt Withworth, Stephen Gibb, David Brown, James Stafford, Mike Scott

Douglas Westwood
Oceaneering
ECA
Ifremer
Tecnadyne
Seanic Ocean Systems
Balmoral Offshore
Imagenex
Marine Simulation
Sonardyne
MATE Center
AeroLift eXpress
iXblue
Northwestern Michigan College



Front Page Cover Photo: Courtesy of O. Dugornay | Poster Photo: Courtesy of Seanic Ocean Systems

WELCOME TO ROV PLANET

My name is Richie Enzmann, and allow me to welcome you all to the latest issue of ROV Planet!

Dear Reader,

In this quarter we will look at the offshore wind market, which could be the next big thing for ROV companies and marine contractors investigating new opportunities. The offshore wind industry is forecasted to be worth 200 Billion Euros within the next decade with installations going further offshore and eventually into deeper depths.

Then we will take a look at the HROV Ariane, a hybrid vehicle designed in collaboration between ECA and Ifremer. This truly unique vehicle has both tethered and autonomous configurations and was introduced to the public earlier this year at Oceanology International exhibition in London.

Recently, Paul Unterweiser has received an Imagenex gyro-stabilised scanning sonar and after rigorous testing he was kind enough to share his thoughts and experience with us. You can read his findings and evaluation in our product review section.

The MATE International ROV competition took place at NASA's Neutral Buoyancy Lab in Houston at the end of June. Congratulations for all teams and organisers that participated in this truly educational and exciting event!

Finally, James Stafford, an ex-ROV Project Manager with a brilliant idea has founded AeroLift eXpress. He firmly believes that the future for offshore cargo transportation is by the use of aerial drones to keep costs down and reduce the times of critical parts delivery. He does have a point! If drones can deliver books, why shouldn't they also deliver equipment offshore? Who knows, one day we might even see people transported offshore via James' fixed winged drones...

Sit back and enjoy our eighth issue!

Best regards,
Richie Enzmann

UPCOMING EVENTS

19-23 September, 2016 – MTS/IEEE OCEANS'16 – Monterey, CA, USA
World class technical event focusing on marine science and ocean technology.

27-30 September, 2016 – WindEnergy Hamburg – Hamburg, Germany
The World's biggest technical event focusing on offshore wind technologies.

24-26 October, 2016 – ATC Arctic Technology Conference – St John's, NL, Canada
OTC's event focusing on the development of offshore resources in the arctic.

08-10 November, 2016 – HYDRO 2016 – Rostock, Germany
Annual hydrography event of the International Federation of Hydrographic Societies.

29 Nov – 2 Dec, 2016 – OSEA2016 – Singapore
Major biannual exhibition focusing on Asia's oil and gas industry.

07-08 December, 2016 – Deepwater Asia Pacific – Jakarta, Indonesia
Exhibition focusing on Asia's oil and gas industry.

Please check out our website on:
www.ROVPlanet.com

THE OFFSHORE WIND CONSTRUCTION MARKET

By Celia Hayes
(celia.hayes@douglaswestwood.com)

THE STORY SO FAR:

The early history of the offshore wind industry was far from smooth, with high costs and operational challenges arresting growth in the early 2000s. Now, wind has become a fully-fledged offshore industry, with rapid expansion taking place over the last few years. 2015 was a record year for offshore wind, capacity additions doubling those seen in 2014.

Figure 1: Annual Installed Offshore Wind Capacity to Date. Source: Douglas-Westwood

Europe is the force behind current growth (see fig. 1), driven by EU renewables targets and key legislation such as the Climate Change Act (2008) in the UK. Additionally, increased supply security of energy has been a major driver of large scale renewables projects in Europe. Government incentives and long-term supply agreements have prompted developers to continually bring new projects into the pipeline, expand existing projects and unite in order to push mega-projects through to construction.

Consequently, new markets have emerged – China is making its mark on the industry with a significant pipeline of projects and rapid development timescales. Nevertheless, Europe and in particular the North Sea region will lead the market to 2025, accounting for >70% of global capex estimated for this period (upwards of €200bn).

LOOKING FORWARDS – REGIONAL FOCUS

UK & EUROPE

Major European markets are committed to renewable electricity generation and have looked offshore where onshore potential is limited or unfavourable. In the past 12 months, the UK and Germany have added over 3GW to the market, equivalent to a quarter of current global capacity installed. These two markets will continue to dominate the European (and Global) offshore wind sector through to 2025 – the UK will install a further 17GW of capacity over this period, retaining its title as market leader.

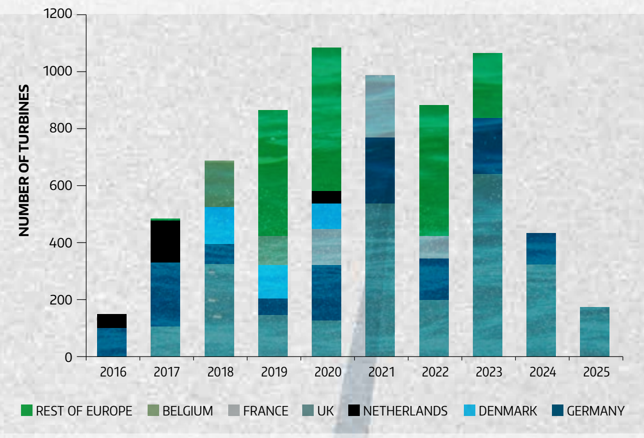


Figure 2: Wind turbines installed by European Country, 2016-2025. Source: Douglas-Westwood.

The North Sea, despite being synonymous with the oil and gas industry, will be the hub of the offshore wind industry to 2025 (and likely beyond). Denmark, the Netherlands and Belgium all contributing alongside the heavyweights UK and Germany to install 29GW of capacity into the region. Additionally, France and Poland are both expected to establish themselves as players in the European market – installing up to 4.7GW of fresh capacity. This equates to significant installation and maintenance activity in Europe - over 6,800 turbines and foundations, 111 substation platforms and over 18,000 km worth of offshore cables are to be installed in the region to 2025.

The next few years will be key as the European market enters a new stage of maturity. Construction will begin at UK Round Three megaprojects and we will see the installation of the first commercial-scale floating windfarm (Hywind) offshore Scotland. DW also expects further decommissioning activity following the removal of Yttre-Stengrund in Sweden in January this year.

USA & EMERGING MARKETS

Towards the end of 2016, the first commercial wind project will be commissioned in the US (Block Island, Rhode Island). The development of this project has re-invigorated interest in US offshore wind, previously dampened by attempts to progress the Cape Wind project. Block Island will likely be closely watched as existing players assess the potential of the US market.

For many, the case for US offshore wind is already compelling – DONG have secured development rights for large zones offshore Massachusetts and New Jersey –areas with conditions similar to those in NW Europe. For others, the ghost of Cape Wind haunts the market – political variation between states and a lack of an established supply chain have been cited as key issues for US development. There is a significant pipeline of over 17.5GW of additions planned for US waters, yet the highly speculative nature of many of the proposed projects suggests only a small portion will likely be online by 2025.

The US is one of six countries visibly striving to enter the global offshore wind market – France, Poland and Italy will bolster European activity and we also anticipate the entry of Brazil and Taiwan. Cumulatively, these countries will contribute to 14% of forecast capacity to 2025, of which the US, France and Poland will form a significant majority (87%).

KEY TREND - PROJECT SCALE

DRIVERS

Increasing project scale has been a major underlying trend in the industry. As the knowledge base grows within Europe, the capability to install and manage much larger projects improves, allowing megaprojects such as Dogger Bank (UK) to progress beyond a conceptual phase. These large projects are advantageous due to cost-efficiencies gained through increased turbine size and increased volume – hence a drive towards the gigawatt scale projects seen predominantly offshore UK. Cost reduction is the key motivation, as developers try to remove a strong dependence on subsidy and make offshore wind cost-competitive. Larger projects also bring increased efficiency in contracting strategies, standardisation and focus on technology development.

IMPLICATIONS FOR INSTALLATION & MAINTENANCE

Upscaling brings its own challenges for construction and installation – as projects grow in scale, they also move farther offshore and into deeper water (see Fig.3). Shallow water sites are being built out and by the latter end of the forecast period (2021-2025) we will be see average water depth approaching 40m. This will drive changes in foundation design and selection, the increased use of jackets for example, and also the introduction of floating models.

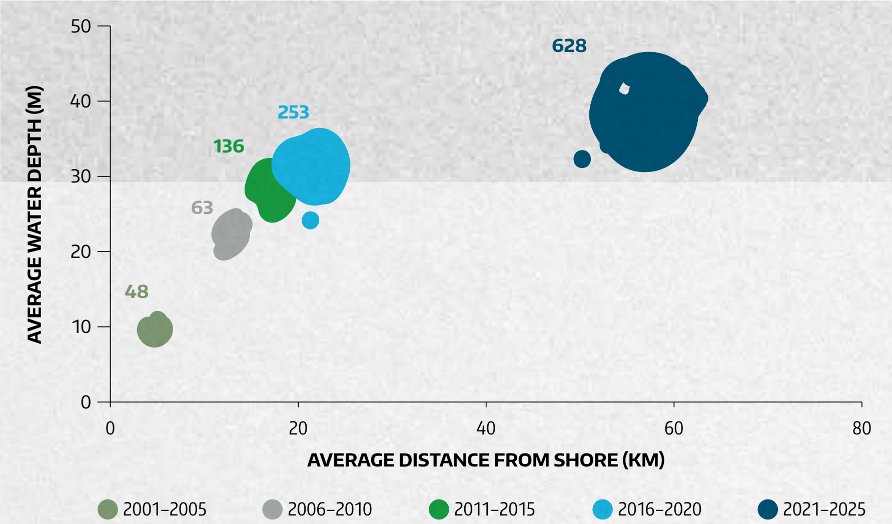


Figure 3: Average Project Capacity, Distance from Shore and Water Depth. Source: Douglas-Westwood.

As figure 3 demonstrates, the average distance offshore is markedly different towards 2025 – projects are moving beyond the 100 km milestone, a key shift in mentality for wind. Development of these projects will require a move to an offshore-based maintenance model – using the likes of Service Operation Vessels (SOVs) or offshore accommodation units (as seen in oil and gas) as opposed to transferring crew daily from shore.

Additionally, the distance increase will also heavily affect installation campaigns – projects farther offshore are likely to need specialised vessels firstly for the transport and installation of large unit volumes in less sheltered conditions, and secondly to manage installation of turbines with a swept area larger than the London Eye and a total height approaching 190m. The sheer size of these turbines will require a similar up-scaling of foundations, with further implications for installation – both on vessel & equipment size and for the method of driving large monopiles into the seabed which has raised environmental concerns.

SUMMARY

The offshore wind market has seen recent rapid growth, yet global activity to 2025 is forecast to reach new highs – capacity additions will peak at 9.3GW in 2023 and over €200 billion in Capex will be spent over the next decade. Despite the entry of the US and other countries to the global market, the North Sea will remain a hub as high activity levels in the UK and German continue – fed by the development of gigawatt-scale projects.

The scale of these projects is key to ensuring the sustainability of the offshore wind pipeline via a low-cost pathway. Upscaling in project size and a shift of projects farther offshore will require the market to find solutions for the challenge of installing large turbines in large volumes at a greater distance from supply bases. This will likely take the form of specialised vessels with improved capabilities.

Factors beyond installation challenges also threaten the strong global pipeline, including: supply chain bottlenecks, HSE, cost-overruns and policy changes. Energy is always highly political and this is no different for offshore wind. Cooperative policy is not only key in ensuring a pipeline in established markets, but also the growth of offshore wind in emerging markets such as the US, France and Poland. Only with amenable political conditions (taking the above factors into consideration) will countries such as the US be able to develop on a scale equivalent to that seen in the North Sea.

The offshore wind industry faces many challenges, both local and global. However, its historical growth is a sign of expansion to come – through advancements in technology, ambitious renewables targets and ongoing cost-reduction, the industry will undoubtedly see significant growth over the next decade.

BIO

Celia is a consultant in Douglas-Westwood's London office. Since joining DW, Celia has conducted high-level research on a variety of markets, with a focus on upstream oil and gas and renewables – aided by prior experience in extractive industries research for PwC.

Celia is lead-author of DW's recent Offshore Wind Market Forecast, covering market expectations and trends from 2016 to 2025. Most recently, Celia's focus has been on renewable energy in the UK & Germany – her latest consulting work looked at route-to-market for a new offshore renewables technology as well as advising on a potential investment into the German offshore logistics market. Prior to joining DW, Celia graduated from the Royal School of Mines, Imperial College London, with a Master's degree in Geology.

As the trusted subsea connection specialist, we focus intently on the many challenges that global offshore operators face—from routine to extreme. Our Flowline Remediation System solves beyond the status quo by remediating hydrate and non-hydrate blockages, and the system is suited for flowline deinventory and decommissioning of subsea facilities. The result of this cost-effective, innovative solution is minimized cost and downtime that enables our clients to maintain their production safely and successfully.

- Connect with what's next at **Oceaneering.com/WhatsNext**

THE BEST OF BOTH WORLDS:

IFREMER AND ECA'S HROV ARIANE BRIDGES THE GAP BETWEEN AUTONOMOUS AND TETHERED CONTROL

It's a design conundrum that ROV engineers have wrestled with for some time: use a reliable tethered configuration and lose range and versatility, or go further with an autonomous design that compromises control and mission targets? Now, French manufacturer ECA Group and the Ifremer institute have launched their exciting new ROV/AUV hybrid the HROV *Ariane*. ROV Planet takes a closer look to see whether vehicle operators will finally be able to have their cake and eat it.

HYBRID DESIGN

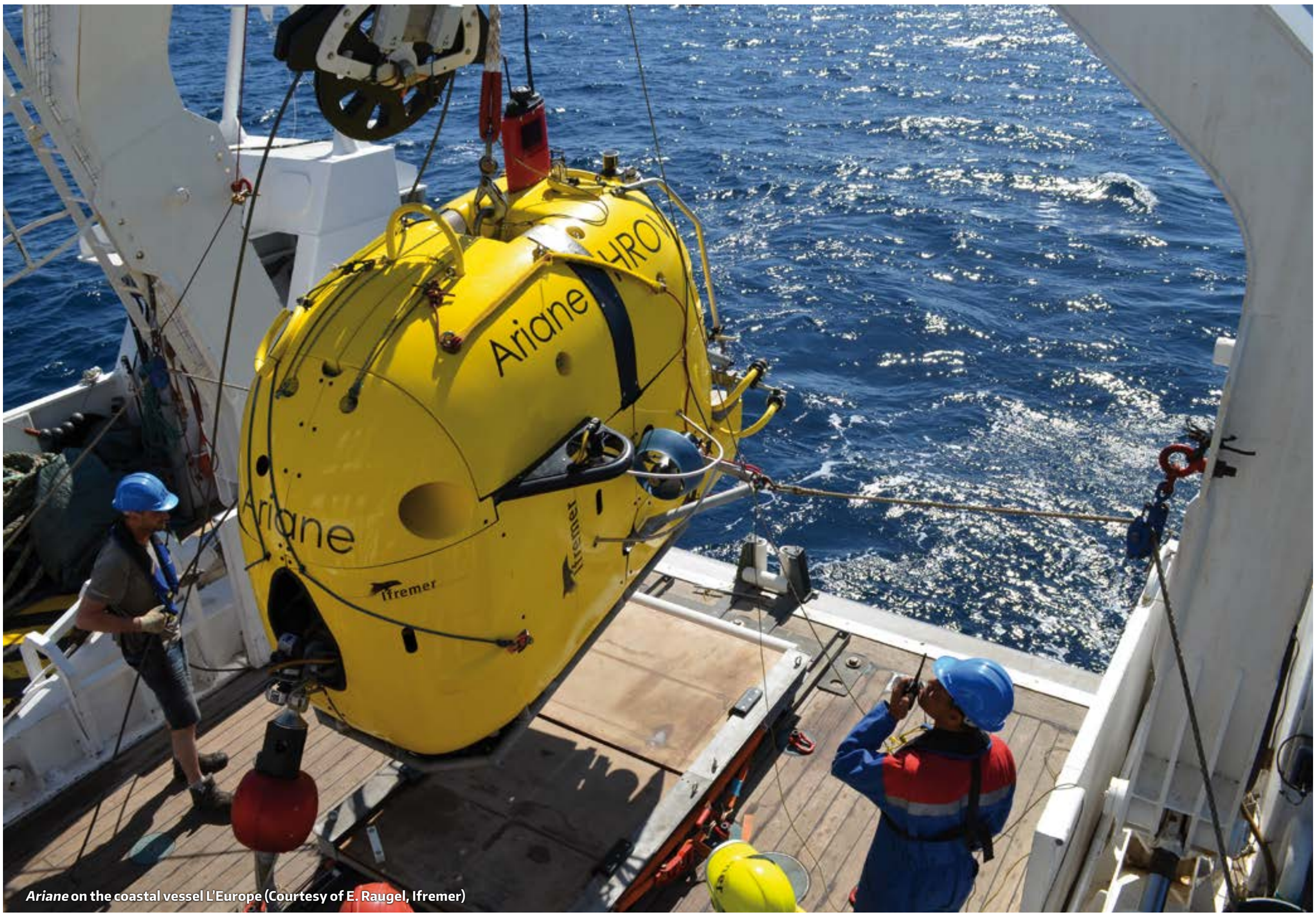
At the recent Oceanology International 2016 Exhibition held in London in March of this year, a new HROV was unveiled, one which features a range of exciting applications for undersea operations. The *Ariane* (named after the Greek goddess *Ariane* for its distinctive thin fibre-optic umbilical) was developed by Ifremer, in collaboration with the commercially licensed ECA Group. A range of different developers were involved in the design of this vehicle, and in the case of the ECA Group, they contributed to the integrative architecture and the electric remote manipulation system.

As a matter of fact, Ifremer and the ECA Group have had a long-lasting partnership, and the *Ariane* is not the first vehicle with AUV capabilities that they have developed together. In 1979 they collaborated on the development of the Epaulard, the world's first AUV for deep-sea observations. It had an impressive range, and was able to operate at depths of up to 6,000 m.


Ariane on the coastal vessel L'Europe (Courtesy of E. Buffier, Ifremer)

This hybrid vehicle had been designed with versatility at the heart of its design. It can be operated in tethered mode as an ROV, or autonomously as an AUV at depths of up to 2,500 m. In tethered mode, the vehicle can be controlled in real-time with a fibre optic, which is managed by a specific, patented system. This is very useful for close inspection and intervention work. However, it can also be operated autonomously, either as part of a dedicated mission or as a fall back strategy in the event of rupture.

This hybrid vehicle features an array of other exciting features. For scientific applications it's equipped with two dexterous electric arms, a motorised tool bay, a water and faunal specimen sampler, and a reversible water ballast system. And it's versatile design has specific applications for the oil and gas industry, where its ability to switch between autonomous and remote modes means that it can continue to operate without repeating execution steps or breaks in sequences.



Ariane on the coastal vessel L'Europe (Courtesy of E. Raugel, Ifremer)

INCEPTION AND INAUGURATION

The *Ariane* entered its initial design phase back in November 2010. It was developed in order to meet the needs of changing European legislation including the Marine Strategy Framework Directive (MSFD), Marine Protected Areas (MPAs) and the Water Framework Directive (WFD). It was also conceived to meet changing environmental factors such as the implementation of subsea observatories, coastal research projects, deep-sea biodiversity exploration near submarine cliffs, and more. The issue of deep-sea biodiversity in particular was an important consideration. The *Ariane* has been designed to meet a range of practical environmental morphology needs, including cold water coral reefs, underwater canyons, seamounts, ridges, rift valley walls, and continental margins. These crucial yet extremely fragile ecosystems are exposed to ever growing threats caused by human activity. As such, a number of international directives have been issued in order to enforce the requirement to map and monitor their evolution.

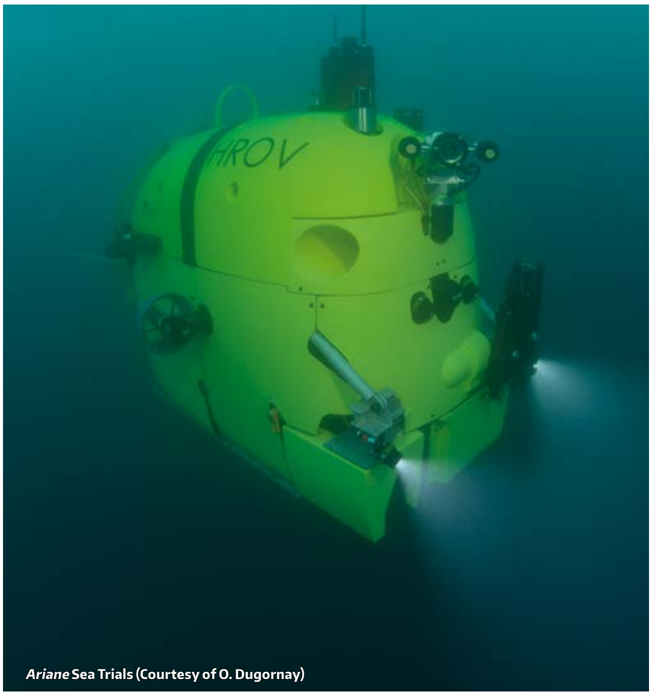
With all of these factors in mind, it was integral that *Ariane* be designed in such a way that she be able to launch from a variety of vessel types. *Ariane's* hybrid design means that she can be launched from both large oceanographic vessels and coastal vessels, without dynamic positioning capabilities. The design team wanted to create a more cost-effective vehicle through measures such as avoiding having to hire large vessels for relatively small-scale operations.

The *Ariane* was inaugurated on 23rd April last year at the Ifremer's Mediterranean Centre in La Seyne-sur-mer, France in the presence of many of the project's funders. These included the European Union (ERDF funds), the Provence-Alpes-C6te d'Azur Regional Council, the Var Departmental Council, the Toulon Provence Méditerranee Agglomeration Community, and lfremer themselves.

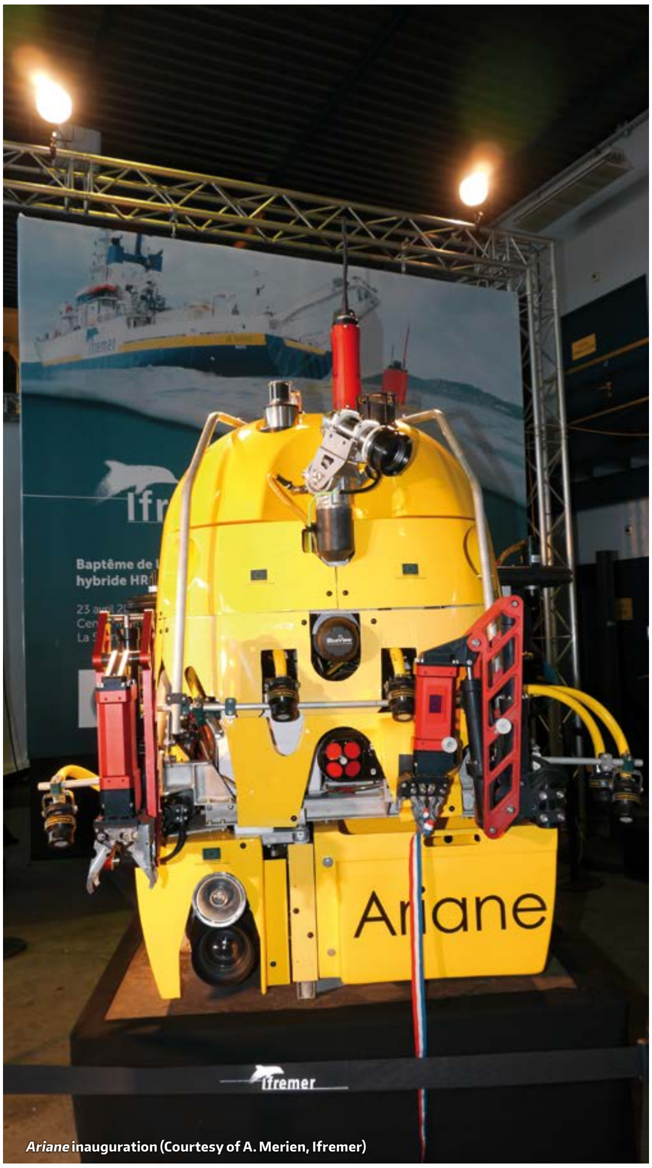
HOW IT WORKS

As previously mentioned an array of innovative features and technologies are being implemented in order to bring the *Ariane* vision to life. The need to work independently of both an umbilical and a support vessel meant the inclusion of a compact, long-lasting power source. In this case that power source is a 20 kWh lithium ion battery, similar to those used in electric cars but conditioned for atmospheric pressurised vehicles. This ensures both operational independence and reduced implementation costs.

In free-swimming mode there is no physical link to the operational craft. All commands and data are transmitted and received acoustically. This means that missions can be changed on the fly. Also, the inclusion of smart control software based on OpenSource technology – used in space applications at NASA – allows permanent or temporary interaction with human pilots, or total decisional autonomy if communication is lost with the surface.



Ariane Sea Trials (Courtesy of O. Dugornay)



Ariane inauguration (Courtesy of A. Merien, Ifremer)

And navigation itself is controlled via an optical fibre INS coupled with twin DVLs (Doppler Velocity Log) positioned to provide a velocity solution through varying degrees of sloping terrains. External absolute position sensors include a GPS and low frequency USBL, for surface and underwater operations respectively.

All of these features allow for an enormous amount of freedom when operated as an AUV. However, the hybrid is still versatile when deployed in tethered mode. This is because of its unique umbilical design featuring innovative and patented fibre optic management system. This is mounted on the vessel and controlled via a mini-winch inside *Ariane*, which automatically adjusts the length of paid out cable. This enables the *Ariane* to be deployed and operated from smaller coastal vessels which are not fitted with a dynamic positioning system.

Furthermore, the entire vessel has been designed to navigate in some of the most complex of underwater environments. In this case, it has so far been used to navigate and research the underwater canyons of the Mediterranean. This has been made possible through an adapted propulsion design. This design features omnidirectional thrusters and navigation sensors that work on flat bottoms as well as vertical walls. The two main tilting thrusters and four fixed auxiliary thrusters – all manufactured by Tecnadyne – allow for full control through 4 degrees of freedom and a range of actuation schemes. This enables the *Ariane* to adapt to the terrain profile and the task at hand.

DEPLOYMENT

But how does the *Ariane* actually perform when underwater? Well, when the operational depth is reached, the vehicle undocks from the plug. It's now completely free floating in AUV configuration. Although operators have yet to encounter the actual limit for its operational range, the theoretical range is thought to be in excess of 2,000 m. In tethered mode the range is obviously shorter: the vessel needs to be positioned within 300 m of the depressor's vertical.

DIMENSIONS

| Dimensions (mm): 2800 L × 1850 W × 2300 H

| Weight in air: 1550 to 1780kg according to payload

| Material: Stainless steel structure + GRP

TECHNICAL SPECIFICATIONS

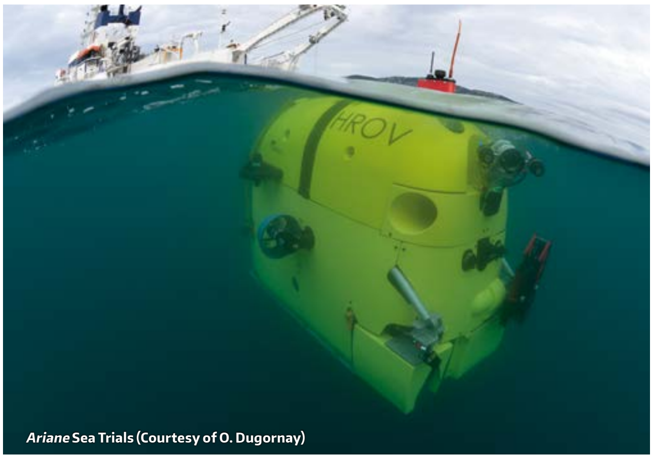
| Propulsion:
2 vectored thrusters, 2 lateral thrusters, 2 vertical thrusters

| Forward speed:
Up to 2 knots relative to current, Up to 1.7 knots vertical

| Endurance: Up to 10 h

| Payload: Up to 210 kg (on air), Up to 120 kg (in water)

| Operational depth: 0 to 2500 m



Ariane Sea Trials (Courtesy of O. Dugornay)

The vehicle's on-board TMS regulates the length and tension of the light tether in order to prevent entanglement, propeller ingestion, or exceeding the rupture load.

In order to help evaluate and anticipate course corrections and following manoeuvres to maintain the designed configuration during operation, the ship is steered using specifically developed software based on Ifremer's own management software, MIMOSA. During autonomous deployment and up to the undocking phase, the vehicle's embedded controllers are linked to the surface control station. This allows the operator to carry out pre-run validation checks, to verify and adjust sensor payload settings, and to ascertain the correctness of the positioning by ground truthing. As the vehicle undocks, it performs the given autonomous survey mission that is handled by the on-board Autonomous Discrete Mission Controller (ADMICO)

VALIDATION AT SEA

Initial wet testing of the *Ariane* began back in September 2014, and an early sea trial was conducted on board the oceanographic vessel Suroit before the end of the year. The vehicle operators were able to test most of the system's core elements during initial deployment. However the weather conditions and other minor technical setbacks limited the extent of validation.

In March 2015 a second, two week campaign was run from the same vessel. On this occasion a full system validation was successfully achieved. This represented a green light for the eventual transfer of the system from Ifremer to its subsidiary operational branch. It is this team who will exploit the vehicle on behalf of the Institute on scientific missions for years to come and gather further operational data for exactly what the *Ariane* is capable of. And for our part we are very keen to see what else this astonishing hybrid can do, and what other technological crossovers it might inspire in the future.

TETHERED VS. AUTONOMOUS CONFIGURATIONS

The Ariane is capable of a wide array of operations in both ROV and AUV mode, but how do the two configurations compare?

TETHERED MODE: Tethered operation allows full feedback from the vehicle's on-board systems to the control room. This monitoring system includes two HD video cameras, a further four SD video cameras, and a digital SLR still camera. A gigabit Ethernet link provides ample margin of interaction with the vehicle embedded controller, forward looking multibeam sonar data, navigation, and payload sensors.

Tethered is the nominal configuration for close inspection and intervention tasks where the operator can control directly the vehicle actuators. These include:

- the propulsion system consisting of 6 thrusters and a main thruster tilting actuator;
- two electrical manipulators incl. a 5 function grabber arm and a 7 function dexterous arm;
- motorised sampling tools bay, and a sediment and faunal specimen sampler;
- pan/tilt support for the main video camera tilt and the digital still camera tilt actuator;
- an electrical reversible water ballast system with 20 dm^3 seawater capacity;
- the vehicle mounted TMS to handle the light fibre optic cable.

AUTONOMOUS MODE: In autonomous mode communication relies on the acoustic link between vehicle and depressor, which is also deployed in nominal AUV mode. The acoustic link is implemented via a pair of Evologics S2C 18-34 kHz modems. The nominal AUV payload includes a multibeam echo sounder for bathymetric surveys as well as a tilting digital still camera optical imaging system for optical mosaicking and 3D reconstruction.

In autonomous mode the control of the vehicle is managed by a purposely developed mission controller that interprets a novel domain specific language introduced by Ifremer. Mission execution does not rely on strictly sequential chaining of control primitives; it also allows parallel, conditional, and pre-emptive execution of tasks. The notion of static and dynamic variables is also introduced and integrated to mission scripting in order to increase operational flexibility. The use of variables allows the modification of key parameters over the acoustic link and adaptation to the user's needs in runtime.

Furthermore, this vehicle's capability whilst in AUV mode creates a great opportunity for the Oil and Gas industry. The autonomous system will perform safer and faster operations in case of unexpected environmental conditions which would typically cause a break in sequences or execution steps. Pre-sequenced operations tasks and hands-free ROV navigation can be automated offering greater efficiency in construction sequences. Also, extended development of hybrid technology with the possibility for resident solutions which are semi-permanently installed in subsea operations will soon be considered as a new way to reduce operational expenditures in both the Life of Field and Inspection Repair Maintenance (IRM) markets.

Courtesy of Seanic Ocean Systems

TESTING THE WATERS:

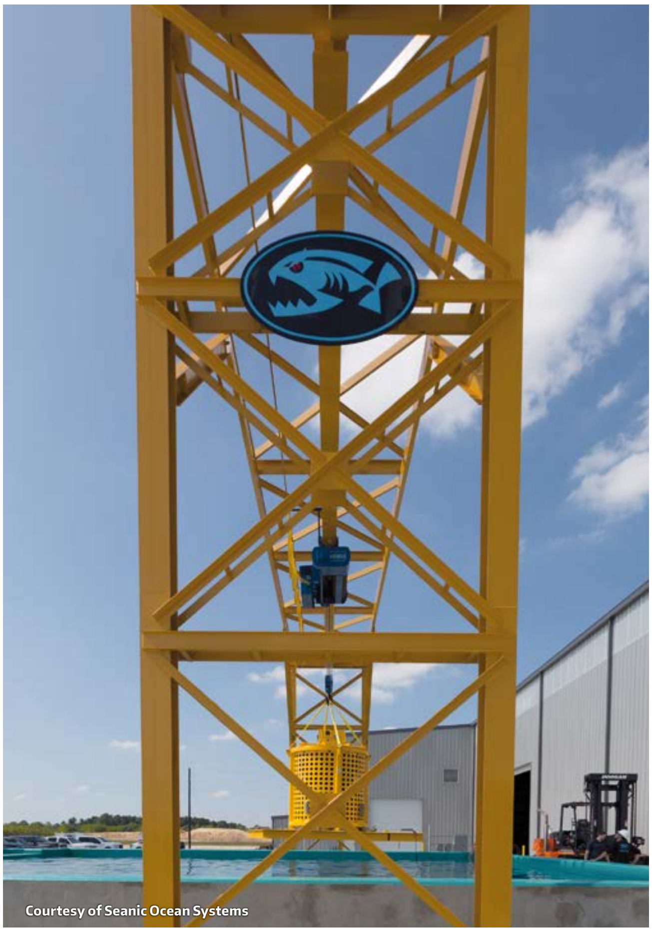
SEANIC LAUNCHES NEW TESTING FACILITY IN KATY, TEXAS

seanic ocean systems

We're currently living in an era of lower oil prices and depressed market conditions. In spite of this, many companies are seeking ways to continue to operate profitably and emerge from this current downturn stronger, ready for the inevitable market growth that will follow. All across the industry, companies are finding ways to do things cheaper. This might mean collaborating with others, merging with others, or utilising new technology without compromising safety, quality, or performance.

Seanic Ocean Systems is one such company. Since its inception in 2007, Seanic has operated with a culture and philosophy of providing clients with products and services that enable them to be more productive with less downtime. The company – headquartered in Katy, Texas (West suburban Houston) – specialises in the sale and rental of standard ROV intervention tooling products. Seanic also prides itself on creating custom subsea products that integrate seamlessly with intervention hardware.

Tom Ayars, President of Seanic, says 'we formed the company because we felt there was a need for an ROV intervention tooling company that could provide superior customer service with fair pricing, regardless of the critical or urgent nature of the customer requirement.



Courtesy of Seanic Ocean Systems

Courtesy of Seanic Ocean Systems

Courtesy of Seanic Ocean Systems

'This formula has proven to be very successful for us as we now find ourselves in the fortunate position to be expanding into our third location in only nine years. When it comes to clients' critical offshore operations, our "Simple, Rugged and Reliable" philosophy to building tooling products has resonated with our clients.'

One of the ways clients can offset the high-costs of developing new projects or products is by conducting extensive testing prior to going offshore. System Integration Testing (SIT) of new systems is standard operating practice for many manufacturers who want to provide their clients with the peace of mind that once offshore, products will function flawlessly.

Many alternatives exist for conducting these types of tests. Some companies opt for dry-land testing where subsea equipment is pressurised, and mock-ROVs are used to verify that valves and connections are operable remotely. Other facilities offer wet-testing capabilities where anything from function testing of an ROV, up to full-scale testing of subsea structures with ROV intervention can be conducted.

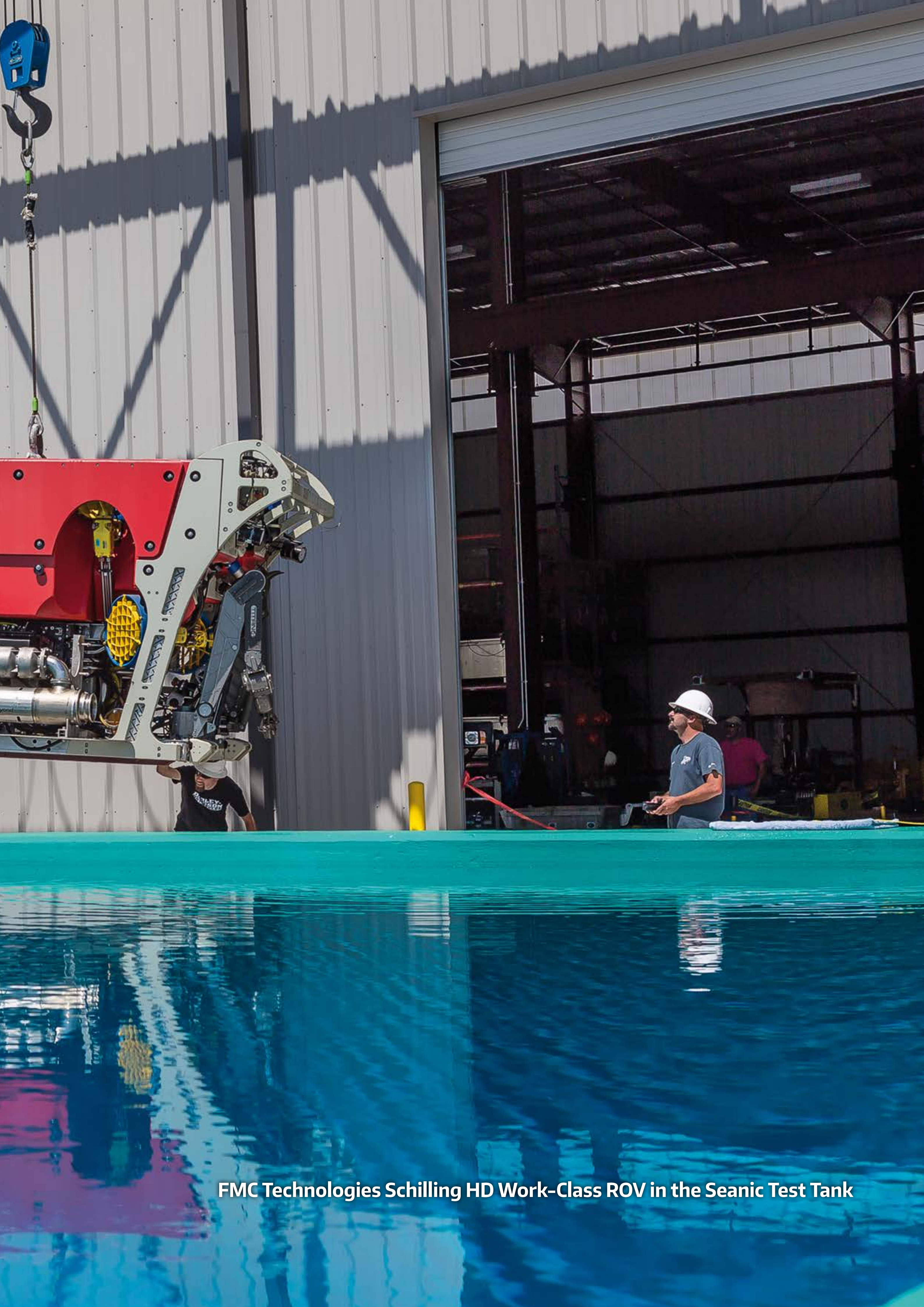
The Houston area has several options for clients wishing to do a wet-test. However, many of these options tend to be either too small, or too large with logistical issues. The smaller tanks tend to be above-ground, with limited load bearing capacity, and they also require witnesses to view testing through portholes in the tank's sides. These tanks are limited to dunking an ROV, with very little room to manoeuvre. On the other end of the spectrum, tanks like NASA's Neutral Buoyancy Lab are large enough for most SIT scenarios. However, this can be an expensive option, with limited access, due to daytime NASA usage, and problematic if there are any oil releases during testing.

With these factors in mind, Seanic seized the opportunity to meet a need in the market for a right-size, full-service test tank option in the Houston area when building its new facility. Seanic's tank is 50 ft (15m) square, 30 ft (9m) deep, and is large enough to wet-test a full size subsea tree and work class ROV, with access from all sides of the tree. The tank is reinforced with 3 ft (0.9m) thick concrete on its base which allows for heavy items of up to 2000lbs/sq ft (9765 kg/sq m) to be tested.

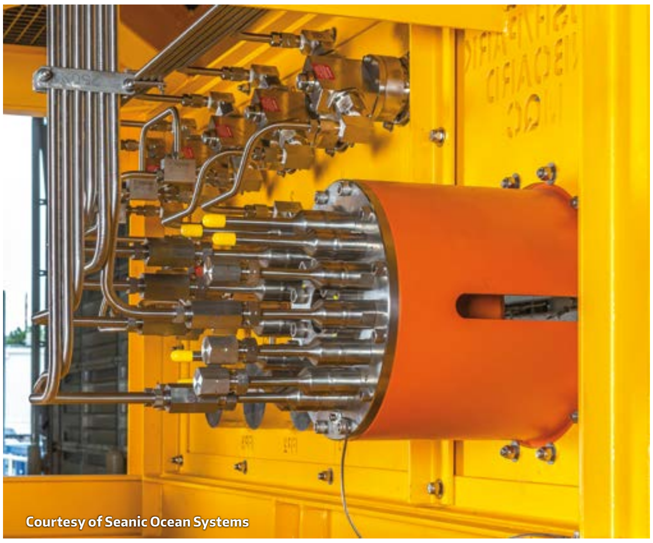
Seanic also offers the use of an on-site FMC Technologies Schilling HD work-class ROV – through collaboration with Canyon Offshore – for testing systems. A 10-ton overhead gantry crane provides lift capabilities in order to move products into the tank. During testing, clients can witness operations in multiple ways: since the pool is in-ground, it is possible to stand anywhere around the edge of the pool, or watch over the pilot's shoulder in the ROV shack.

Seanic also had the foresight to broadcast HD video to 3 x 70" screens situated in a conference room, or to 2 x 70" screens which are situated in a private client conference room with

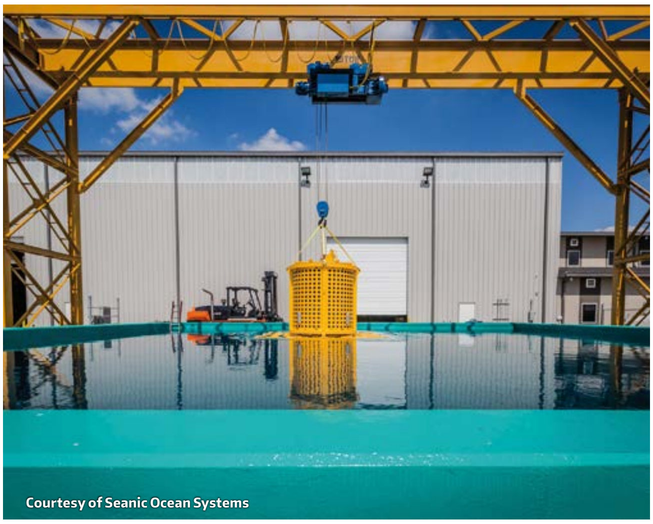

HELIX
CANYON OFFSHORE
ROV PLANET
Please check out our website on:
www.ROVPlanet.com

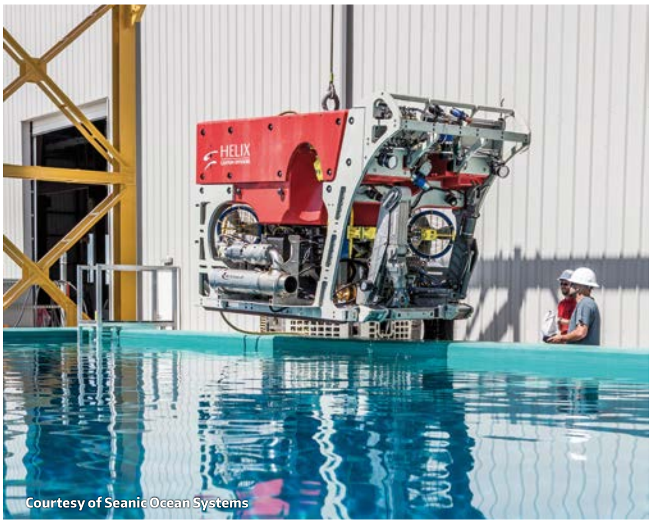


FMC Technologies Schilling HD Work-Class ROV in the Seanic Test Tank


Courtesy of Seanic Ocean Systems


Courtesy of Seanic Ocean Systems


Courtesy of Seanic Ocean Systems



Courtesy of Seanic Ocean Systems

an adjoining office. This allows monitoring of operations in air-conditioned comfort, with full communications to the operations managers who are conducting the testing outside. Seanic's support capabilities extend to providing its range of tooling, if required, to enhance testing, as well as being able to provide welding and fabrication services if maintenance or fast-turnaround manufacture is required.

The pool was also designed to be able to handle oil spills, which can possibly happen in a testing environment. The pool has an infinity edge which can be used to skim off surface oil for disposal.

Seanic's new building is conveniently located in Katy, TX. Katy is a suburb west of Houston, close to the Energy Corridor and within easy access to many of the primary housing areas in West Houston. 'This makes it very convenient for our clients to visit us', says Tom Ayars. 'Most of our clients either live or work very near to us, so it is easy for them to make a quick visit or conduct testing over several days without impacting normal work routines.'

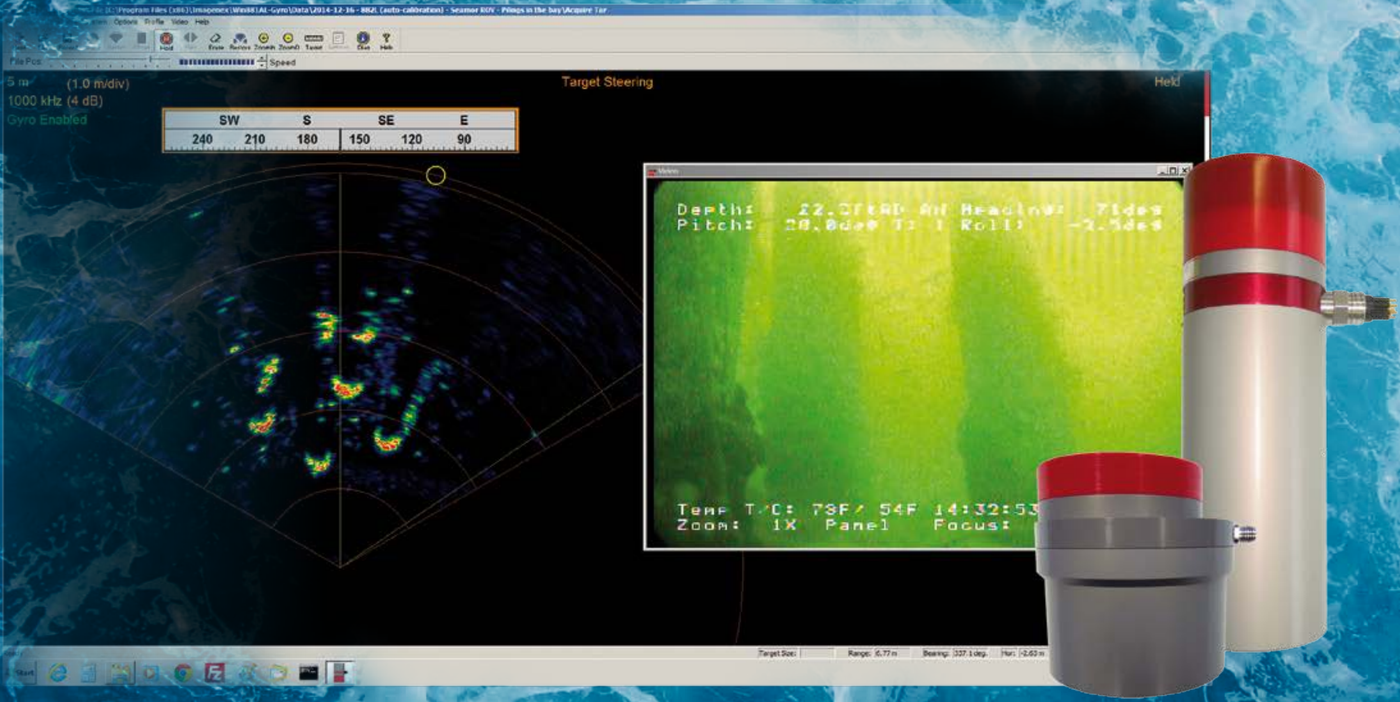
The Seanic pool is open for use by any company wishing to rent on a day-rate basis for a variety of types of testing they wish to conduct. Or, if companies wish to demo a product, they can apply to use the pool free of charge for a day and invite their clients to witness the testing in-person. In this instance, there would only be a charge if the ROV is required. This is already proving to be popular with clients. Example operations which have already been conducted – or which are being discussed – include:

- Client demonstration of a dredging unit to demonstrate that dredger can move rocks of up to 4" in diameter
- Demonstration of cavitation-blaster unit to show cleaning capabilities at low pressure, and with a smaller vehicle.
- Tree SIT testing – using full-size work-class ROV and subsea tree
- Capping stack demonstration – showing ROV access and emergency procedures
- BOP intervention – testing pumping solutions required to close shear rams to latest standards

Tom Ayars adds, 'We invite interested parties to contact us for more information or to reserve a spot in our testing calendar. We are proud of what we have achieved in a relatively short space of time, and look forward to being able to help our clients realise substantial cost savings through conducting their vital testing prior to offshore operations at our new facility.'

For further information or to reserve the tank, please contact Seanic at info@seanicusa.com , www.seanicusa.com or +1-713-934-3100.

Courtesy of Seanic Ocean Systems



IMAGENEX 881AL-GS

GYRO-STABILISED SCANNING SONAR

By Paul Unterweiser, President of Marine Simulation

INTRODUCTION

The Imagenex models 881A-GS, 881L-GS (881A/L-GS), and 882-GS are all gyro-stabilised, high resolution scanning sonar devices. Manufactured in Canada, the 881A/L-GS is available in models built to withstand depths of up to 10,000 m and can scan and display targets from 0.2 to 200 m away. This model is available with either an RS-485, RS-232, or Ethernet interface, giving the user a wide range of options for integration into an existing underwater platform.

The principal benefit of a gyro-stabilised sonar is that it can produce a clear sonar image regardless of how the host vehicle may be moving. That clear image is the key feature that allows the system's guidance software controlling the sonar to incorporate more complex functionality. In the case of the 881A/L-GS, one advanced feature that has proved it to be invaluable is target focused scanning.

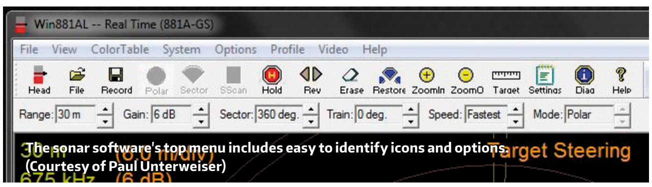
This version of the sonar was designed for mounting horizontally on smaller ROVs. (Courtesy of Paul Unterweiser)

The package I received from Imagenex included the 881AL-GS gyro-stabilised sonar, a four lead pigtail for integration into my ROV, software and documentation on CD, and an RS-485 to USB interface (available as an additional option). This model differs from the 881A-GS or 881L-GS in that it is intended to be mounted horizontally. This allows it to be used with smaller, low profile underwater vehicles such as ROVs and AUVs.

The only other component that I added was a voltage regulator to convert my ROV's nominal 14.8V to the 881AL-GS required 24V. Fortunately, the power requirements of the sonar were minimal (less than 7W) so a tiny off the shelf regulator was all I needed to complete the integration.

The 881AL-GS size and shape are a bit different from other sonars that I've used in the past. The main housing is an aluminium tube, with a red polyurethane transducer mounted at one end at a 90 degree angle. The entire unit is roughly 28 cm in length and weighs 1.6 kg (in air). Therefore, it needs to be mounted on a vehicle capable of handling a sonar of this size. Mounting the sonar is straightforward but the mounting location must be chosen carefully; it has to allow for both unobstructed sonar transmission whilst protecting the transducer from damage. The sonar may be mounted transducer "up" or "down" providing more options when choosing a mounting location.

I divided my testing of the 881AL-GS into three parts: initial setup and bench testing, static testing in the water, and fully operational testing at a dive site.



The sonar software's top menu includes easy to identify icons and options. (Courtesy of Paul Unterweiser)

BENCH TEST

Once I had all the components necessary to integrate the sonar, setting it up was straightforward. Of the pigtail's four leads, two supply power and two are for RS-485 serial communications. I installed the supplied software and drivers - initially on a 10" Windows tablet and then later on a laptop - then connected the sonar to the serial/USB interface, and supplied power to the sonar. I launched the software, selected the COM port, and a few seconds later it was working.

I have to say that setting up the sonar was considerably easier than what I was expecting. The system automatically starts an initialisation and calibration process as soon as it has power. A few seconds later, it's ready to go.

With the sonar running on the bench I took a few minutes to familiarise myself with the included software. The software interface, just like the integration, was straightforward and simple to use. At the top of the screen are icons and pull down menus. To the right are larger icons for the most frequently used functions - which also happen to be ideal for touchscreen use - and the remainder of the screen is filled by the sonar display. There is also an option in the settings menu for a separate video window, so both video and sonar can be displayed and controlled via the same software interface.

STATIC TEST

My first "in the water" test was conducted in conditions typical of the coastal estuaries of North Carolina; the bottom was a combination of silt and weeds with a depth ranging from 0 to 10 m. Visibility was less than 1 m, making navigation without a sonar virtually impossible. Potential sonar targets ranged from soft sand banks to hard oyster beds and a variety of steel and wood pilings.

One of the dive locations chosen to test the sonar. (Courtesy of Paul Unterweiser)

Although I had used a 10 inch Windows tablet for the bench test, I decided that in the field a larger screen would be easier to see, so I opted for a 15 inch laptop instead. The 881AL-GS was mounted to the under-side of our mini ROV and launched alongside a floating dock.

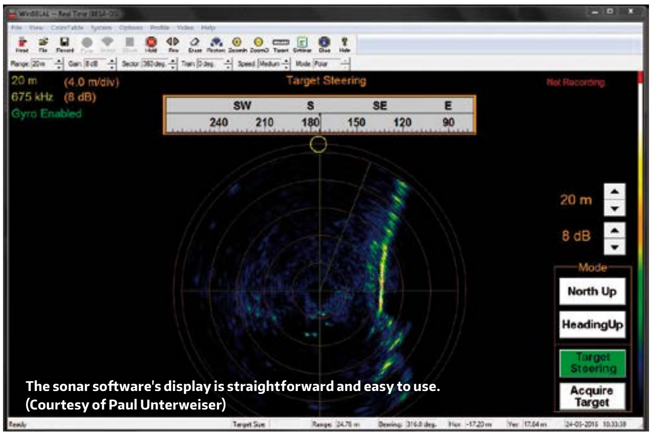
My objective was to become familiar with the 881AL-GS and software whilst keeping the ROV as stationary as possible. The ROV was kept just below the surface and held in place using thrusters and tether tension. I ran the sonar at various ranges and levels of gain to get a feel for the submerged terrain and obstacles.

After letting the sonar run for a few minutes, I decided to try out the "Acquire Target' feature. This feature allows the operator to select and direct the sonar's beam towards a contact on the display. The gyro stabilisation is then employed to track the selected target regardless of where the ROV (and transducer) may be pointing. I picked what looked like a small oyster bed 30 m from the ROV's position, selected the "Acquire Target" icon, and then highlighted the oyster bed on the screen. The display changed from a full 360 degree sweep to a 120 degree sector centred on my oyster bed. I then pivoted the ROV whilst holding this position and watched as the sonar sector on the screen matched whatever movement the ROV made.

The smaller sonar sector and quick response of the gyro resulted in quick refresh rates of the painted target. I could immediately see that this could be an enormously useful tool in any application where a scanning sonar is required for navigation.

OPERATIONAL TEST

The operational testing was conducted under similar conditions to the static tests. Visibility was less than 1 m, so I navigated entirely by compass heading, depth, and sonar. Immediately after launching the ROV, I did a full 360 degree "polar" scan of the surrounding area out to 100 m in order to help visualise the underwater terrain.



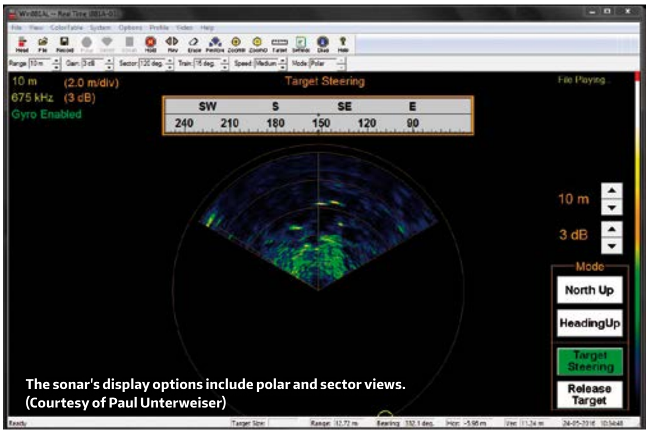
The sonar software's display is straightforward and easy to use. (Courtesy of Paul Unterweiser)

After setting the sonar display to "Heading Up" I had a clear picture of the terrain, and identified a series of wooden pilings roughly 10 m away. I changed the sonar range to 10 m and then flew the ROV to the piling. The gyro stabilisation did an excellent job of keeping the displayed image clean and understandable as I flew the short distance to the piling. The Imagenex software display includes a "yellow circle" that swings around the circumference of the polar display, indicating the current heading of the ROV. It also provides a compass heading graphic at the top of the application window. This feature made flying towards the piling much easier.

I repeated the same scenario with targets at roughly 15 and 20 m with similar results. Without gyro-stabilisation I would have needed to stop every few minutes to allow the sonar image to stabilise, and then re-orient myself to the ROV's new position, before continuing towards the contact.

The next mission took place near a highway over-pass. Conditions were similar to those seen in the earlier mission, with the addition of roughly half a knot of current caused by an out-going tide. Repeating the steps from before, I identified a concrete piling on the sonar roughly 50 m away.

With the sonar in "Target Steering" mode, I selected "Acquire Target" and then highlighted the bridge piling. The display immediately switched from a full polar sweep to a 120 degree sector centred on the piling in the distance.



The sonar's display options include polar and sector views. (Courtesy of Paul Unterweiser)

Keeping an eye only on the heading display and sonar contact whilst maintaining a depth of roughly 3 m, I flew the ROV towards the contact. Every time the ROV turned, veered, or pitched, the sonar display instantly responded with an equal, compensating movement on the display.

I did notice that, over a longer period of time, the target did seem to drift by a degree or two, but this should be expected of any gyro stabilised system. Although I didn't feel this small amount of drift required it, I could have simply selected "Calibrate Gyro" from the pull-down menu at the top of the screen in order to eliminate any amount of drift that may have accumulated. Based on my field experience with the Imagenex 881AL-GS, I felt that as long as I was able to locate a target on the sonar I could navigate to that target regardless of what the ROV might be doing.

CLOSING THOUGHTS

Overall I was very impressed with the performance of the Imagenex model 881AL-GS. The construction was excellent. Also, installation of the software and integration of the hardware into my ROV's system were both easy and straightforward.

Using the 881AL-GS was equally straightforward and the software which came packaged provided all the features and information that I needed. But what made the 881AL-GS really stand out was its gyro-stabilisation. With gyro-stabilisation, scanning sonar becomes a very effective tool with a number of key benefits, including:

- Sonar targets are more easily identified;
- The ROV doesn't need to stop to stabilize the sonar image, thus reducing transit time to a target;
- Bottom terrain and obstacles are more clearly defined, and thus more easily avoided.

These benefits make the Imagenex GS family of gyro-stabilised sonars ideal for any application where a scanning sonar is required. However, I feel they would be especially suited to Search and Recovery (SAR) and operations performed in limited visibility.

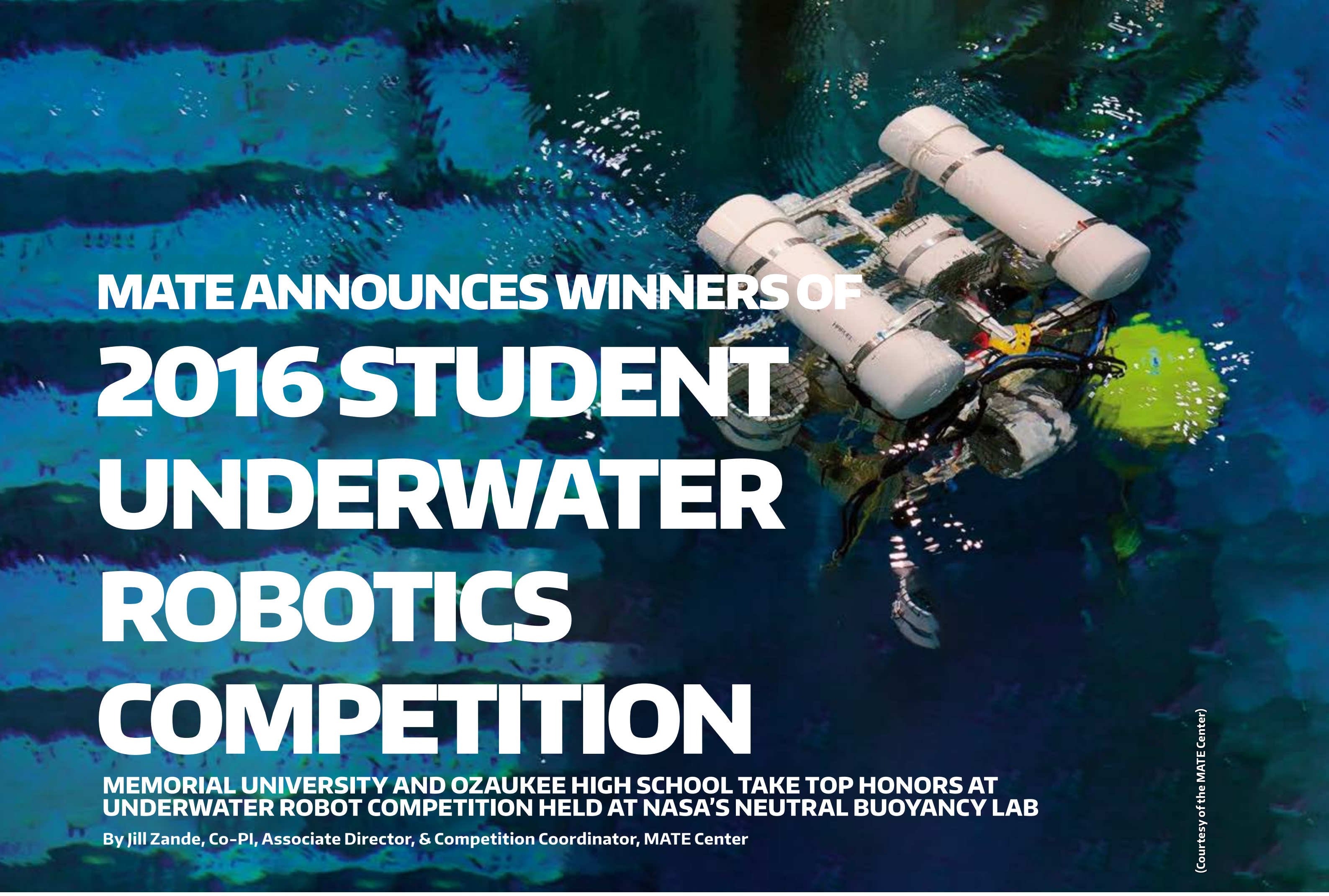
Imagenex Technology Corp. Imagenex Technology Corp. manufactures a wide variety of sonar equipment with one purpose in mind: to provide the sharpest images to your computer screen. Each system in this growing product line integrates the latest in sub-miniature electronics into industry proven, robust underwater housings for a total package that is small, rugged, and will provide years of maintenance-free usage.

Ease of use is also an integral part of the Imagenex design philosophy of sharp images. Each sonar system is designed to maximise imaging time, and minimise setup time. The custom software available to operate most Imagenex sonar systems has been refined into a package that is user friendly, yet complete with various options for sonar control, data display, and recording.

THE AUTHOR

Paul Unterweiser is a retired US Navy officer, USCG licensed master, ROV pilot, and - for the last ten years - President of Marine Simulation, a software company located in North Carolina. Marine Simulation specialise in developing training simulators for ROV pilot schools and other marine industry applications.

http://www.marinesimulation.com



(Courtesy of the MATE Center)

MATE ANNOUNCES WINNERS OF 2016 STUDENT UNDERWATER ROBOTICS COMPETITION

MEMORIAL UNIVERSITY AND OZAUKEE HIGH SCHOOL TAKE TOP HONORS AT UNDERWATER ROBOT COMPETITION HELD AT NASA'S NEUTRAL BUOYANCY LAB

By Jill Zande, Co-PI, Associate Director, & Competition Coordinator, MATE Center

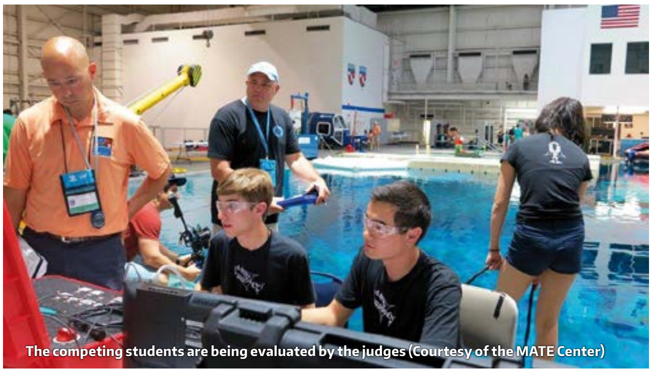
Teams participating in the Marine Advanced Technology Education (MATE) Center's student underwater robotics competition represented countries from all over the world. Top honors in the Explorer (advanced) class went to Memorial University of St. John's, Newfoundland and Labrador, Canada, while Ozaukee High School of Fredonia, Wisconsin, USA captured first place in the Ranger (intermediate) class.

Memorial University won several other honors in the Explorer class, including best product demonstration and a special award given to a team or individual that demonstrates courtesy, kindness, professionalism, and assistance to other teams. The team's Rachel Seymour was named an "MVP" for capabilities demonstrated during her team's presentation to a panel of competition judges.

Ozaukee High School also took home multiple Ranger class prizes, including best product demonstration and the "biggest bang for the buck" award for having the vehicle with the best performance for the price.

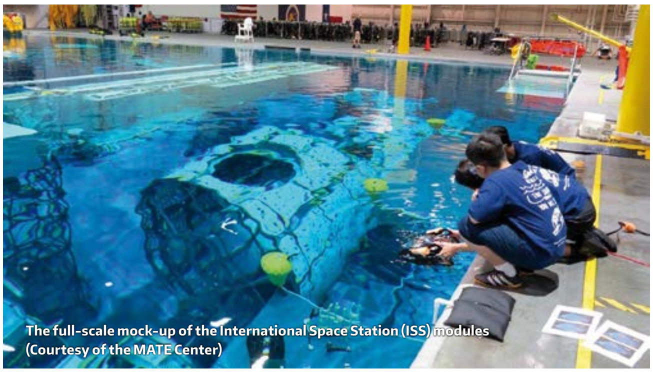
In the Explorer class, Jesuit High School of Carmichael, California took second place and AMNO & CO of Seattle, Washington won third place. Highway 68 ROV Club of Salinas, California won second place in the Ranger class, while Harrington Middle School of Mt. Laurel, New Jersey came in third. A complete list of winners can be found online at **www.marinetech.org/scoring/**

During the event, which was held June 23-25 at NASA Johnson Space Center's Neutral Buoyancy Lab (NBL), student teams competed using ROVs that they designed and built. With a capacity of 6.2 million gallons and a depth of 40 feet, the NBL is the world's largest indoor pool and is used by NASA to train astronauts for spacewalks and other extravehicular space tasks.


The competing students are being evaluated by the judges (Courtesy of the MATE Center)

A real-size ROV (Courtesy of the MATE Center)

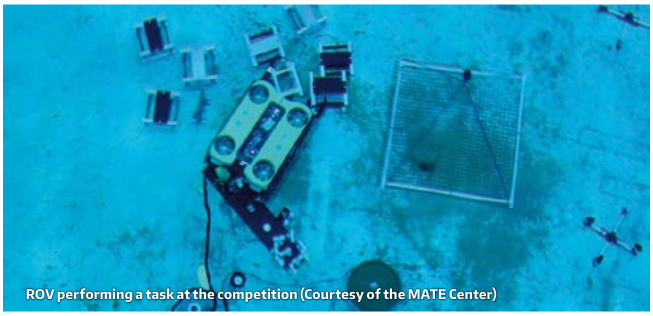

NASA's Neutral Buoyancy Lab (Courtesy of the MATE Center)


The full-scale mock-up of the International Space Station (ISS) modules (Courtesy of the MATE Center)

This year's ROV competition highlighted technologies developed for exploration and scientific use in both ocean and space environments. Sixty-nine student teams participated in underwater vehicle demonstrations that simulated realistic space and ocean missions such as turning a decommissioned oil rig into an artificial reef, collecting oil samples and coral specimens, and piloting their ROVs under the ice sheet of Jupiter's moon Europa to collect data and deploy instrumentation. Teams were also required to prepare technical documentation, create marketing displays, and make a presentation to a panel of judges comprised of industry volunteers.

Judges evaluate teams on the design, construction, and performance of their ROVs; the members' ability to communicate what they learned; and how they put their knowledge to use in developing their ROV. Teams compete in either the Explorer or Ranger class, depending on vehicle design and mission complexity.

The MATE Center and the Marine Technology Society's (MTS) ROV Committee organize the MATE ROV competition, which is supported by the MTS ROV Committee, the National Science Foundation, Oceaneering International, NASA, NOAA, and other ocean- and science-related organizations. For more information, please visit www.marinetech.org


ROV performing a task at the competition (Courtesy of the MATE Center)


ROV performing a task at the competition (Courtesy of the MATE Center)

www.marinetech.org

MEET

AEROLIFT EXPRESS,

AN EMERGING FORCE IN UNMANNED OFF-SHORE TRANSPORT

Meet AeroLift eXpress, an elite unmanned transportation provider that operates using military-grade vehicles and systems. With a focus on the energy sector, AeroLift debuted earlier this year at the Offshore Technology Conference (OTC) in partnership with Valmie Resources, Inc. (VMRI).

AeroLift eXpress, the company founded by James Stafford (CEO and Founder) who previously worked as an ROV Project Manager, has come up with the revolutionary idea that could change offshore transportation as we know it today. The idea is to transport cargo to offshore installations using Aerial Drones.

"Currently, AeroLift can deliver a sizeable payload of up to 14 pounds (approx. 6 kg) within an operating radius of 250 miles, with plans to increase the payload size to as much as 80 pounds (approx. 36 kg) in subsequent development phases," said Stafford. "This exceptional capability puts AeroLift in a prime position to become a global market leader."

"AeroLift eXpress is highly pleased about entering into the collaboration with Valmie," said Stafford. "Our know-how within areas such as executing under challenging conditions and providing anti-tampering monitoring will result in AeroLift becoming a high-performance solution for the energy sector while contributing to mutual company expansion."

According to worldwide management consulting firm McKinsey & Company, returns on capital in the oil and gas sector have halved since 2007, triggering a stronger need for curbing costs than ever before.

"AeroLift's economic and rugged transport platform is a practical alternative to high priced helicopter or marine delivery," said Stafford. "Our UAV technology can successfully operate in any conditions where a helicopter can fly, at a fraction of the cost and no risk to human life."

James Stafford shows off a scale model of the HQ-40 delivery drone (Courtesy of AeroLift eXpress)

Since its debut, the folks at AeroLift have been busy building momentum by introducing their groundbreaking unmanned delivery platform to the offshore community. Several companies are eyeing AeroLift to support offshore deliveries and to provide other unmanned aerial services.

One of the projects under consideration is a collaboration with an international contractor that supports major providers throughout Latin America. Following an extended meeting at OTC, the contractor's president invited AeroLift to Brazil to discuss adding AeroLift to its portfolio to aid in the performance of a contract with a major oil and gas client.

Valmie and AeroLift are also in talks with a Lagos-based company to perform pipeline surveillance and inspections.

Following many successful meetings with numerous U.S. offshore operations companies, AeroLift has begun the process of obtaining Federal Aviation Administration permission to hold a live demonstration at a designated site for these and other companies.

In preparation for upcoming commercialization, Stafford recently traveled to Arizona where he met with the company's UAV hardware manufacturer to discuss the delivery timetable and the process for scheduling an initial order.

In August, AeroLift will join other influentials as a speaker at this year's Hurricanes, Major Disasters, Coastal Protection, and Rapid Recovery Conference at the University of Houston.

Although the company has made significant progress, it's clearly just the beginning for AeroLift. James Stafford invites companies interested in AeroLift's revolutionary platform to visit their website at www.aeroliftexpress.com or contact them at info@aeroliftexpress.com.

WITH THE NEW PHINS COMPACT FAMILY, IXBLUE NOW OFFERS A FULL RANGE OF INS FOR ALL AUV TYPES

Last month, on the occasion of its 'Forum on Underwater Navigation in Boston (USA)', the iXblue Group launched the Phins Compact Family, a range of fully scalable systems that cover all inertial navigation needs for any size of AUV. Based on iXblue's silent true solid state Fibre-Optic Gyroscope technology, the Phins C3, C5, and C7 guarantee high accuracy, unrivalled reliability, and proved robustness.

The iXblue's Phins Compact Family has been designed to offer the AUV industry players the ability to choose an inertial navigation system adapted to their vehicle, whatever their size and mission, from accurate navigation to survey grade. Based on iXblue's unique Fibre-Optic Gyroscope Technology, Phins C3, C5, and C7 are fully scalable systems with a similar architecture and interface. Available as an OEM version, the three products all include the same algorithm and software, which enables seamless re-use of the control system on any vehicle – regardless of size or type – via modern interfaces such as Ethernet, helping to reduce integration and non-recurring costs.

Based on iXblue's IMU 50, Phins C3 is a brand-new inertial system designed for man portable AUVs, with a small and light structure, mostly for shallow water applications. Currently being assessed by the world's leading AUV manufacturers, the system has proven efficient, reliable, and secure. The performance of Phins C5 (ex Rovins 154, IMU 90) has already convinced many customers around the world who have been operating the system for their current applications. Based on the design of the well-established Phins Surface INS, Phins C7 (IMU 120) has been optimized for a better AUV integration; now smaller and more practical, the system also includes the best connector solution.

The Phins C5 INS (Courtesy of iXblue)

Courtesy of Alamy stock photo

The Phins Compact Family benefits from the unrivalled performance of the Fibre-Optic Gyroscope Technology: the silent-true, low consumption, solid-state, and strap-down inertial systems enable stealth autonomous navigation, providing very accurate heading, roll, pitch, speed, and position. With a MTBF up to 100,000 hours and with no need for preventive maintenance, the systems guarantee high levels of reliability and robustness. Phins C3, C5, and C7 are ITAR-free, dual-use systems and are all compatible with DELPH INS post-processing software to achieve ultimate survey accuracy.

Paul Wysocki, iXblue Inertial Product Manager, comments, 'Thanks to our trusted expertise, our passion for innovation, driven by our customers' needs, we are happy to provide both the military and offshore markets saving-cost INS adapted to their AUV requirements. Perspectives truly are getting larger for this growing AUV market!'

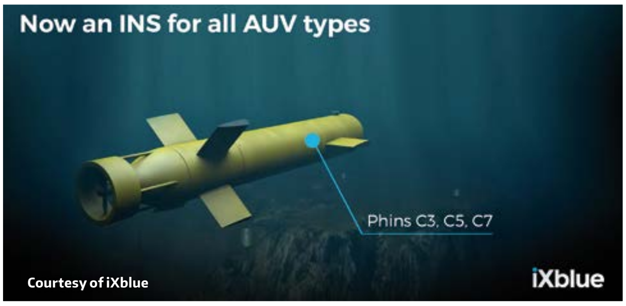
ABOUT IXBLUE

iXblue is a leading global provider of innovative solutions and services for navigation, positioning, and imaging. Civil and Defence customers rely on its systems, operations, and services for the challenges they face at sea, on land, in the air, or in space. Based on its 30 years of expertise, iXblue achieves 15–20% growth every year, with 80% of its business taking place in more than 30 countries around the world. The Group can count on full value-chain expertise; all of its systems are produced internally, from design to manufacturing. Its success is especially informed by its French know-how, from its engineering offices to its production workshops.

iXblue

	PHINS COMPACT FAMILY		
	C3	**C5**	**C7**
HEADING	0.15°	0.05°	0.01°
ROLL & PITCH	0.05°	0.01°	0.01°
POSITION DVL AIDED	0.3% TD	0.2% TD	0.1% TD
DIMENSIONS (MM)	~145×99×85 +~125×87×47	⌀ 154×315	< ⌀ 200×162
VOLUME	~0.4 L	5.9 L	4.6 L
WEIGHT	~1.6 kg	4.7 kg	3.6 kg
POWER	24 V / 12 W	24 V / 18 W	24 V / 18 W

Courtesy of Alamy stock photo



Courtesy of iXblue

ROV Control Van Mobilized at NMC's Harbor January 2015. (Courtesy of NMC)

MARINE TECHNOLOGY

AT NORTHWESTERN MICHIGAN COLLEGE

By Hans W. Van Sumeren, Director of Great Lakes Water Studies Institute, Northwestern Michigan College

Located on the shores of Grand Traverse Bay in Northern Lake Michigan, the Great Lakes Water Studies Institute at Northwestern Michigan College (NMC) is strategically positioned to deliver programmes in areas of marine technology and ROV operations. Traverse City, MI – a long-time Mecca for tourism and water recreation – has now become a leader for comprehensive training and degree programmes across a wide range of water and marine related areas.

Northwestern Michigan College

Founded in 1951, NMC was the first community college in the State of Michigan. Since then it has built several programmes of national and international recognition, and has been recognised as one of the "Best for Vets" colleges in the country.

Through a series of strategic initiatives and forward thinking approaches, NMC continues to bridge the gap between traditional academic programme offerings and the needs of the marine industries. It does this by offering several signature programmes that have been built around direct industry need and feedback. NMC programmes – accredited by the Higher Learning Commission – align with trends seen in workforce training today, including proactive approaches, competency based training, shorter time cycles, and the application/synthesis of training to real world applications.

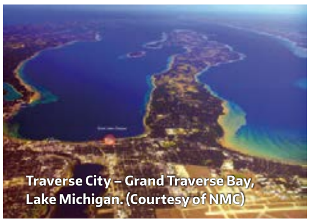
Before the launch of this latest prospectus of programmes, the college already had a long history of water-related training and academic offerings. This included the founding of the Great Lakes Water Studies Institute (2003) and Great Lakes Maritime Academy (1967). The Great Lakes Maritime Academy (GLMA) is one of seven federally authorised maritime training academies in the United States, and the only one in fresh water. The Great Lakes Water Studies Institute developed the first Freshwater Studies degree in the United States (2009).

Northwestern Michigan College Great Lakes Campus. (Courtesy of NMC)

Furthermore, it has continually increased education and training opportunities with the development of a Marine Technology associates degree (2013), Bachelors of Science in Marine Technology (2015), a comprehensive ten week ROV training programme (2015), and a series of professional development opportunities and outreach camps all designed to prepare learners to enter the marine industry.

First launched in January 2015, the comprehensive, ten week, ROV technician training programme was developed based on feedback from industry partners such as Oceaneering International, who were seeking ROV technicians with job-ready skills. In advance of this first training session, the school sent its instructors to Oceaneering's training facilities to identify exactly what competencies and outcomes were required in the industry, ensuring that graduates are adequately prepared to start their careers.

Students taking part in this course were in class nine hours a day, five days a week, learning about hydraulics, electronics, ROV and sonar operations, rigging, and safety. The first week of the training included PEC Core Compliance, First Aid/CPR, and AED certifications. The classes are limited to twelve students at a time to ensure that every student gets enough instruction and experience at the controls, and the programme is anticipated to run year-round, with a new batch of students getting started whenever there is enough demand for the course.



Traverse City – Grand Traverse Bay, Lake Michigan. (Courtesy of NMC)

ROV Control Van Mobilized at NMC's Harbor January 2015. (Courtesy of NMC)

Students learn basic to advanced skills in understanding and troubleshooting electronics and hydraulics. This includes Ohm's law, ROV electronic circuitry, and practising techniques such as hydraulic hose construction, pumps, pumping systems, soldering, splicing, and working with fibre optics. Students use diagnostic equipment including OTDR's, meggers, multimeters, oscilloscopes and spectrum analysers for fault finding, and learn about underwater equipment such as tether, manipulators, cameras, scanning sonar, acoustics and positioning systems.

The majority of this equipment was purchased through a 2.8 million dollar award in 2015 from the State of Michigan to NMC to support skilled trades training programmes, like the marine technology programme. Investments in equipment were targeted toward the marine and unmanned aerial systems programmes and included a new hydraulics laboratory, new electronics laboratory, indoor training tank, Falcon ROV system with five function manipulator and Kongsberg M3 multibeam sonar, UAS simulator, and UAS platforms including UAV Factory Penguin C and two Sensefly Ebee drones.

Though the ten week ROV training programme will prepare graduates for entry-level jobs in ROV operations, the college also offers more extensive programmes. These include the first associate's degree in freshwater studies in the U.S., an associate's degree with a marine technology major, and a new bachelor's degree with a marine technology major. The bachelor's degree programme – which launched in autumn 2015 – focuses on the areas of marine vehicles and instrumentation, marine data processing and management, marine acoustics and sonar platforms, and project planning and management. It prepares students for careers in marine mapping and hydrography, marine construction, exploration, science and research, and environmental monitoring.

Students then participate in training missions on the school's privately owned harbour on Lake Michigan, a 10,000-square-meter basin measuring 5.5 m deep. The school uses two research vessels: the Northwestern, measuring 56 ft. in length with a 20-person capacity, and the Hawkowl, a towable, 21 ft. vessel with the capacity to hold seven people.

The school has an Outland 1000 ROV with 800 ft. of copper tether and a SAAB Seaeye Falcon ROV with 1,475 ft. of fibre tether, and is equipped with an M3 multibeam sonar system, a Hydrolek five-function manipulator, an ultra-short baseline (USBL) acoustic positioning system, and Greensea automation software. Both ROVs have a 1,000 ft. depth rating, and Grand Traverse Bay is about 600 ft. deep, enabling students to fly the ROV at relatively great depths.

Wherever possible, students are placed in different situations. ROV's are multipurpose and can be used for archaeological surveys, oil and gas, fisheries research, infrastructure surveys, diver support, or hydroelectric facilities. It's important that students understand that this is a tool that works across many different sectors of industry and science.

The Great Lakes Water Studies Institute has a 66,000 gallon indoor training tank in which students first learn how to pilot ROVs. The indoor facility allows for very detailed mission planning. The ROVs are very modular, so the students can take them apart and reconfigure them for different missions, with both time and budgetary concerns in mind. This allows for a deeper understanding of how long it takes to do these things. The students get a feel for what a job might entail, and they're doing the work that a tech would do to fix an ROV in the field.

NMC's primary objective is to create a competent person who can be a good hand in the field. This means everything from proper mission planning, mobilisation of gear, operations, troubleshooting, and developing a final product or outcome for a job.

NMC are very interested and capable of adapting to what the needs of the industry are. That's how they've formed their training and education programmes. What the college teaches today is probably going to be different in two years or even less because of how quickly technology changes. With that in mind, NMC are trying to stay current with those who do this work on a day-to-day basis.

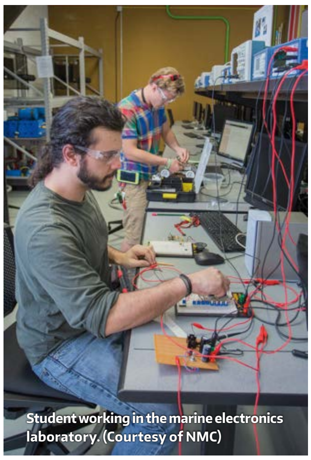
So, if you're interested in joining the industry or are looking to develop your skills with a school that boasts superior training facilities, a range of learning opportunities, and authentic skills develop for real-world scenarios, why not give Northwestern Michigan College a try? We're ready to help you dive into a world of opportunities.


The ROV class laboratory. (Courtesy of NMC)


Students performing 200 foot ROV storm water tunnel inspection in 36 inch pipe. (Courtesy of NMC)


NMC's 56 foot RV Northwestern. (Courtesy of NMC)


SAAB Seaeye Falcon with integrated 5 function manipulator arm. It also has a multibeam sonar attachment. (Courtesy of NMC)


Student working in the marine electronics laboratory. (Courtesy of NMC)

FORUM™
ENERGY TECHNOLOGIES

everything remotely possible™

What's Your Challenge?

Let's Talk ROV Manufacturing and Upgrading

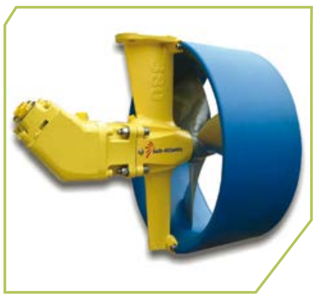
Forum has proven solutions to meet your challenges.

- 260+ ROV LARS supplied
- 1,000+ WROV buoyancy modules
- 25,000+ ROV components

Proven, extensive range of OEM products.

DYNACON LAUNCH AND RECOVERY SYSTEMS

SYNTECH BUOYANCY



SUB-ATLANTIC COMPONENTS

Let's Talk

f-e-t.com/yourforum

everythingremotelypossible@f-e-t.com