ROV PLANET

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The magazine of choice for Subsea Construction and ROV Professionals

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ABOUT

With 6000 email distributions and 2000 printed copies delivered to the offices of ROV & subsea construction related companies 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.

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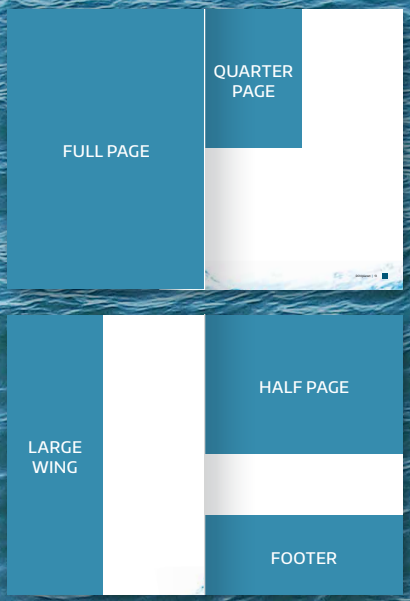

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CHAA Dive Recovery Team (CHAA-DRT)
International Submarine Engineering (ISE)
MATE Center
MATE Scotland
RGU-SRS
AC-CESS
SengS
Bluefin Robotics
Phoenix International
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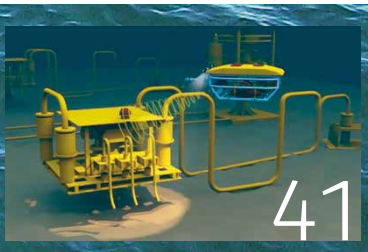


WELCOME TO ROV PLANET

My name is Richie Enzmann and I would like to welcome you all to the first issue of ROV Planet!

With this magazine and the ROVPlanet.com website I'm aiming to create a virtual place for all ROV/AUV enthusiasts in the World. This will be a place for like-minded people who share a passion for robotic submarines and thrive on technological challenges. The forum on the website will provide a platform for people involved in the ROV and subsea intervention industries.

It was in Aberdeen back in 2006 that I first encountered ROVs. I was working as an ROV base technician for Oceaneering. It was absolutely fascinating to learn about this technology. After finishing my university degree I worked for some other oil service companies including KBR, Aker Solutions, and Cameron. I gained experience in various fields including instrumentation, subsea controls, and intervention but I always maintained a keen interest in ROVs and subsea robotics.

The technology has come a long way since the first ROV was developed. However, I feel that we still have a long way to go in order to innovate and push our limits further. After all, we are the pioneers of the sea.

I hope that you will enjoy this magazine, which I intend to make a little bit different and distinctive from the other mainstream publications that are currently out there. The structure of the magazine will evolve over time and I always welcome new ideas, so if you have any interesting news, topics, photos, or technological advancements that you would like to share then you are all welcome to do so!

Best regards,
Richie Enzmann

E-MAGAZINE

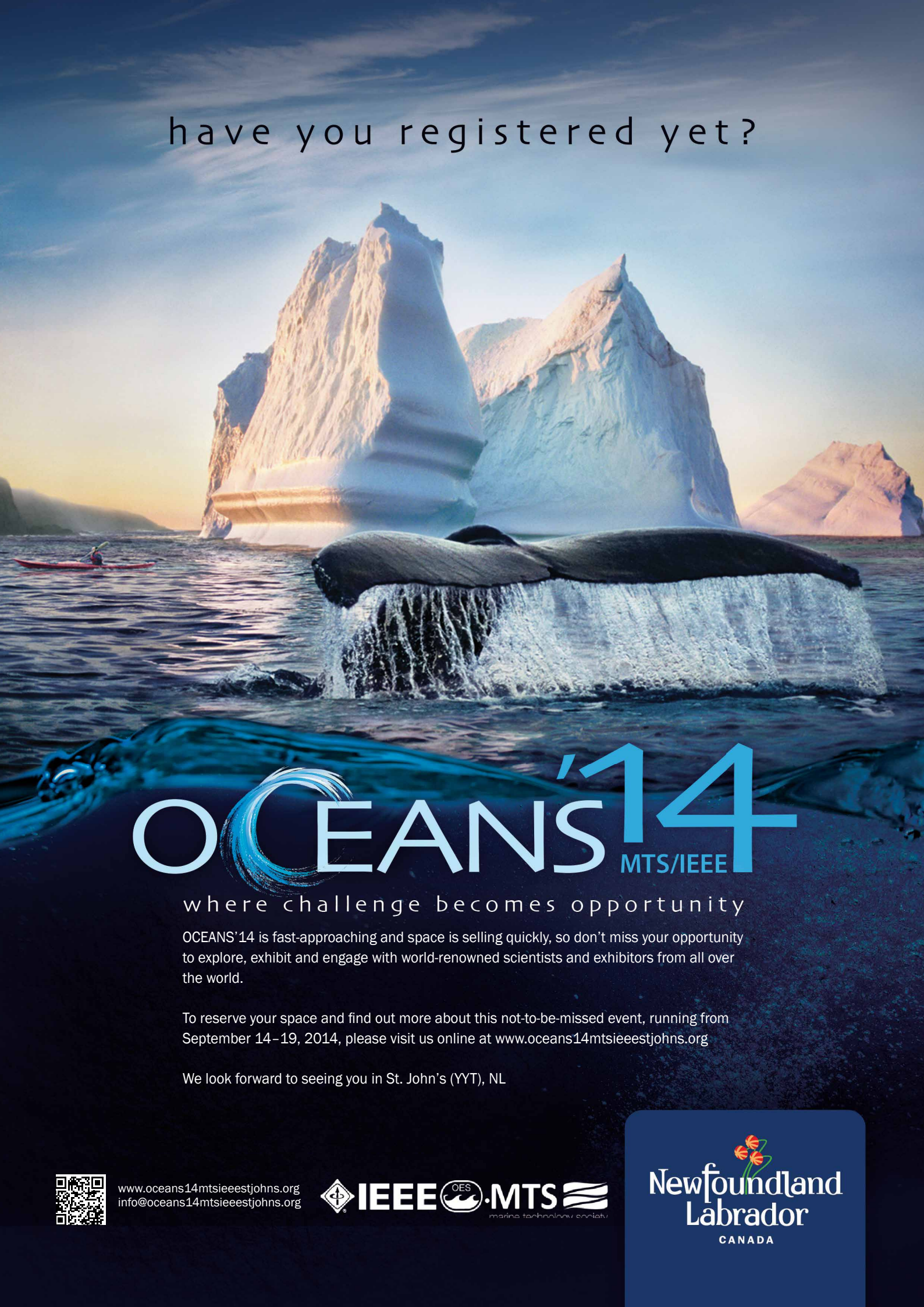
The e-magazine is embedded in the website. Once you are on the home page, all you need to do is click on the "Magazine" tab. This will take you directly to the E-magazine.

THE FORUM

After each issue has been published, the articles will also be copied on to the ROV Planet Forum. Each article can then be shared via Facebook, Twitter, or LinkedIn and commented on. This option is open to all members who have registered on the ROV Planet website. Please note that registration is free and if you already have an existing Facebook account, then you have the option for a "fast track" registration. In this case please click on the "Login with Facebook" button that will register you automatically and take you into the Forum. The Forum can be accessed through the "Forum" tab.

ROV PLANET WEBSITE

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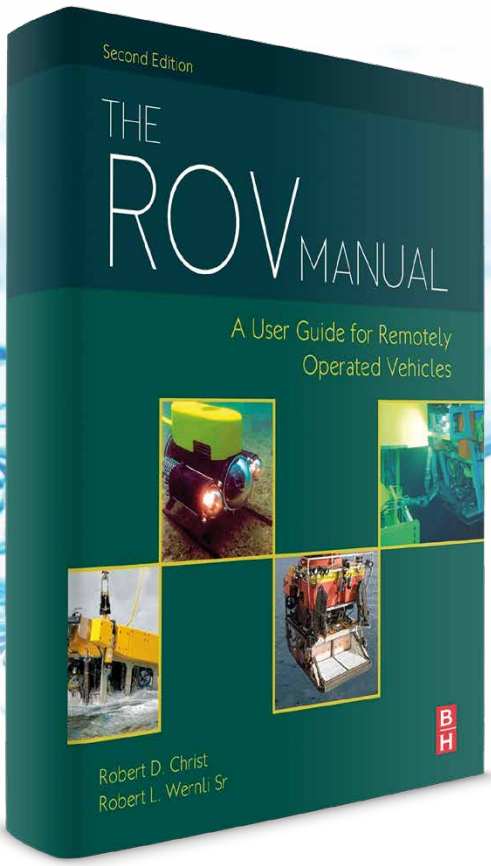

the ROV MANUAL

The 2nd edition of The ROV Manual was published at the end of last year. I took the opportunity to pre-order a copy last autumn when I first saw it advertised on Amazon. I was so excited when it arrived in the post and I finally had the finished copy in my hands. It is also available as an e-book that includes colour figures.

Now let's take a look what this book is all about. The manual is an invaluable how-to guide for any engineers and technicians using ROVs for underwater operations. It's an excellent resource guide to use when researching various ROV-related topics, and can be used as a learning tool for both brand-new trainees and ROV enthusiasts looking to get into the ROV industry. Basically, this is a must-have reference book for anyone and everyone working with ROVs!

The core of the manual was written by Robert D. Christ and Robert L. Wernli Sr., who were assisted by experts and leaders from within the industry. The authors' wealth of knowledge and experience means that quality is guaranteed.

SOME OF THE TOPICS COVERED IN THE MANUAL INCLUDE:

- THE ROV BUSINESS: a good introduction explaining mission types, the economics of the business and the different services where ROVs can be used along with the operating procedures covered in a later section.
- THE OCEAN ENVIRONMENT: dealing with the water depth, sea currents, salinity, and ballast design.
- DESIGN THEORY AND STANDARDS: this defines the basics of ROV design, showing the main specifications and standards that the design has to comply with and adhere to.
- VEHICLE DESIGN, CONTROL AND SIMULATION: tips for the main frame design, buoyancy, stability, vehicle control, stabilization, and positioning.

ABOUT THE AUTHORS

Robert D. Christ is President of SeaTrepid International (www.SeaTrepid.com), a full-service subsea robotics company operating a fleet of over 35 ROVs worldwide. He began his ROV career with Oceaneering International, before moving on to co-found VideoRay, a leading OCROV manufacturer.

Robert L. Wernli Sr. is President of First Centurion Enterprises. He is an engineering consultant with 40 years experience in the field of ROVs and undersea technology. In addition to his technical publications, he is an award-winning author in fiction where he is continuing his work on a series of underwater techno-thrillers. (www.WernliBooks.com)

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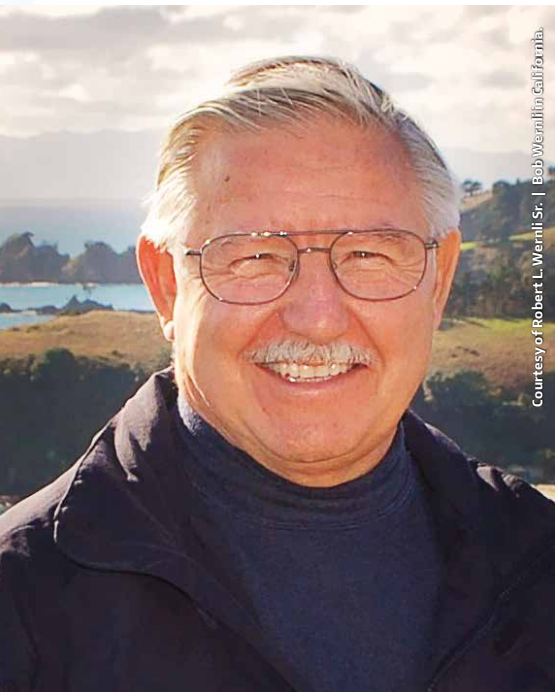
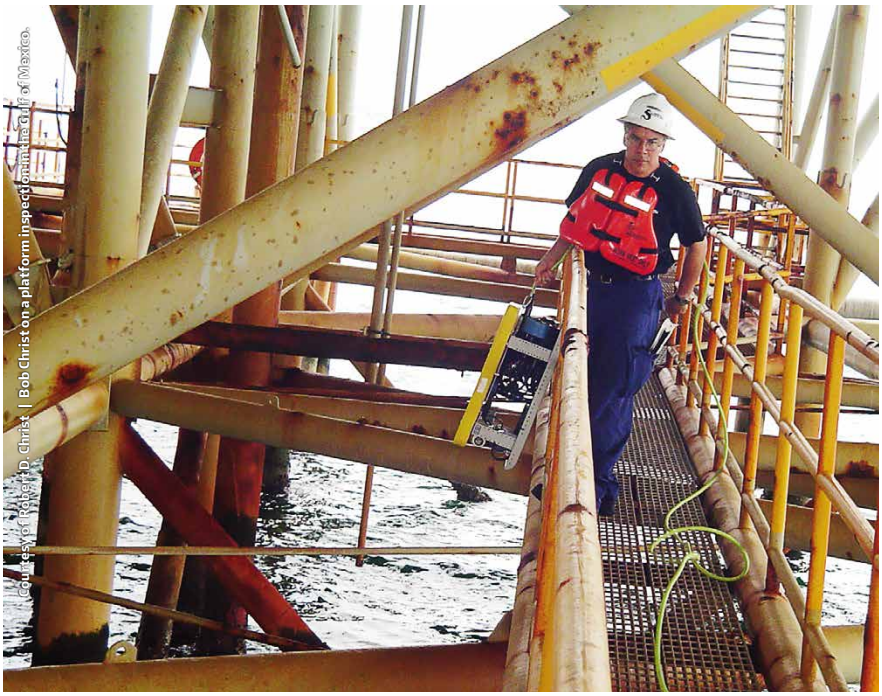


Courtesy of Robert L. Wernli Sr. | Bob Wernli in California.



Courtesy of Robert D. Christ. | Bob Christ on a platform inspection trip in the Gulf of Mexico.

- THRUSTERS: introduction to the ROV propulsion systems currently available, and the comparison of the electrical and the hydraulic thrusters designs.
- POWER AND TELEMETRY: describing the control system and its main parts from the generator to the ROV vehicle.
- CABLES AND CONNECTORS: a comprehensive guide to the different connectors, cables, and umbilical types used in the ROV systems. There is also a section dealing with general testing (including electrical continuity and insulation testing) and troubleshooting.
- LARS AND TMS: describing the launching of the ROVs using A-frames, winches and tether management systems, highlighting important design factors that need to be considered. Heave compensation also gets mentioned here.
- VIDEO: explaining the working of the camera, the lens optics, the video image formation and the latest video compression types, such as H.264.
- VEHICLE LIGHTING: describing the spectrum and colour of light, mentioning the different light source characteristics.
- SENSORS: the different kind of sensors are listed and described, their main characteristics including sensors that are used for the vehicle navigation.
- COMMUNICATIONS: describing how data transmission takes place and detailing the RS-232/422/485 and Ethernet protocols.
- UNDERWATER ACOUSTICS: detailing how sound travels in water.
- SONAR: basic principles and the techniques for mapping the seabed.
- ACOUSTIC POSITIONING: explaining the USBL, SBL, LBL and LUSBL positioning techniques used.
- MANIPULATORS: describing the manipulator mechanics and controls, the manipulator types, and the subsea interface standards.
- TOOLING: description of the different hydraulic tooling types available.

Courtesy of Robert L. Wernli Sr. | Bob Wernli working with the largest ROV developed; the PIV (Pontoon Implantment Vehicle) designed to put 100 ton pontoons into place to raise a submarine in 1979.

There is an extensive reference list included in the manual for anybody who wishes to dig a little deeper into any of the topics.

THE ROAR OF THE HARVARDS

LOCATING THE LOST AIRMEN AND AIRCRAFT OF THE GREAT LAKES IN CANADA

Article by Shawn Wylie

The Canadian Harvard Aircraft Association (CHAA) was formed in Woodstock, Ontario in 1985 by a small group interested in keeping the memory of these iconic aircrafts alive. Thirty years on, the Association now operates from the Tillsonburg Regional Airport with a fleet of six operational Harvards, a Yale, and a Tiger Moth. They also have two other Harvards which are currently under restoration. The skies of south western Ontario are now frequently filled with the "roar of the Harvards", performing their formation displays at local air shows and other events.

CANADIAN HARVARD AIRCRAFT ASSOCIATION
CHAA
TILLSONBURG, ONTARIO

Of course, none of these spectacles of antique aerobatics would be possible without the hard work of the Association. The mandate of the CHAA is to "acquire, preserve, maintain, restore, and display" the Harvard and other British Commonwealth Air Training Plan (BCATP) and Royal Canadian Air Force (RCAF) aircraft. Being a non-profit organization they rely on their 700+ international members to help fund and support them in carrying out this mandate.

In 2001 it was decided to form the CHAA Dive Recovery Team (DRT), with the remit of "Research, Locate, Survey, and Recover". Tillsonburg is essentially surrounded by the Great Lakes and a large number of Harvards and BCATP aircraft crashed into the lakes during the war. Therefore, it was obvious that a DRT would be a useful asset to the Association.

Since that time, the DRT has grown to 16 divers – all with varying degrees of expertise – and a small "non-diving" group of support members. The team is funded through donations and fundraising efforts. While each diver supplies their own equipment, most of the support equipment (sonars, ROV's, magnetometers) has either been donated or is on loan from supporting companies and partners.

Since its inception, CHAA's Dive Recovery Team has been able to identify eight potential projects in the surrounding waters. However, they have chosen to focus on the two projects which are most likely to yield the best potential for recovery. All of the projects are provincially licensed and sanctioned by the government, and the DRT divers are also trained to follow the Nautical Archaeological Society's guidelines.

One of the DRT's current projects is located off Gananocque, Ontario in the St. Lawrence River. As it is located in approximately 60 feet of water, this target could be surveyed by divers. The second project is located in a deep channel between Kingston and Amherst Island. This particular aircraft is a Harvard MkII located in 145 feet of water.

Harvard AJ538 crashed into Lake Ontario on May 3rd, 1944 after taking off from #31 SFTS Kingston on a post-maintenance flight. Piloted by Flt Sgt Richard Elliot and with AC2 Frederick Lewis Cochshott aboard as a passenger, the aircraft was reported as being seen in a spin just prior to its descent into the waters of Lake Ontario. Crash reports and witness statements from the Accident Investigation Board reveal that at least one of the airmen was seen exiting the aircraft under a parachute at the time of the crash. Unfortunately, both men were "presumed drowned and dead" following the investigation. Their remains were recovered a few weeks later. Flt Sgt Elliot and AC2 Cochshott are now interred in Ontario gravesites.

Courtesy of Cathy Garnham | (left to right back row) William McDowell, Shawn Wylie, David Mitchell, Mark McRae, Walther Irie. (left to right Front Row) Paul Chapple and John Millar

Courtesy of Cathy Garnham | The SeaSmart ROV between two DART ROVs.

Courtesy of Cathy Garnham | (left to right) Dave Mitchell, Ken McMillan (McQuest Marine), Mark McRae & Lou Colacarro with the SeaSmart ROV

Due to the fact that the remains of the crew were recovered, this opens up the search and possible recovery of the aircraft. Harvard AJ538 was also the first NA-76 produced by North American Aviation.

Team leader Walther Irie, explains, "Due to the depth and the amount of pleasure-craft traffic, the safest approach to this survey is with using the ROV. All of our team efforts are safety driven".

The DRT has one operational SeaSmart Shadow ROV and two non-operational DART ROVs. The team has been conducting training exercises with the recently donated SeaSmart ROV, where it was introduced to the waters of a small quarry near Simcoe, Ontario, in April 2014. Since then, they have conducted a few more trials and some crucial pilot training. This training inspired some of the team to tackle the project of re-working the DART ROVs with current technology.

In light of that fact, the CHAA ROV Upgrade Team has been developed, and interest is building around the project. The project is gaining momentum, and several "non-diving"


Courtesy of Eric Dunigan

individuals have signed on to contribute their engineering, programming, and technical expertise.

The project will also benefit from several companies that have pledged their support. Of note are four companies; McQuest Marine, DiveTech Ltd, The Dive Academy, and Shark Marine. These companies have committed to the project either by donating equipment, technical assistance, or both. The ROV Team has also begun to canvass the local universities looking for interested students to participate.

"We look at this as an open-source project", remarks Irie. "Our team is made up completely of volunteers, so any information or input that we can use to leverage our projects is greatly appreciated".

The upgrade to the DART (Deep Access Reconnaissance Television) ROV will be an almost complete re-build of the working platform. CHAA's ROV team plans to upgrade almost everything, including the addition of HD cameras with pan-tilt-zoom capabilities, digitizing the manipulator, the addition of several digital sensors (depth finding, digital compass, temperature sensor, etc), and a major re-work of the thrusters and stability system. Adding the SportScan 881 sonar is on the list as well. Some newer and more powerful lights will be added, with all of the functioning systems incorporated into a self designed GUI interface and based on micro processor technology.

"With our ROV Upgrade project we hope to connect with today's generation, while at the same time allow them to explore a level of historical importance".

To learn more or to become involved with the Canadian Harvard Aircraft Association and its Dive Recovery Team visit:

The CHAA Dive Recovery Team website:

WWW.CHAA-RECOVERY.CA

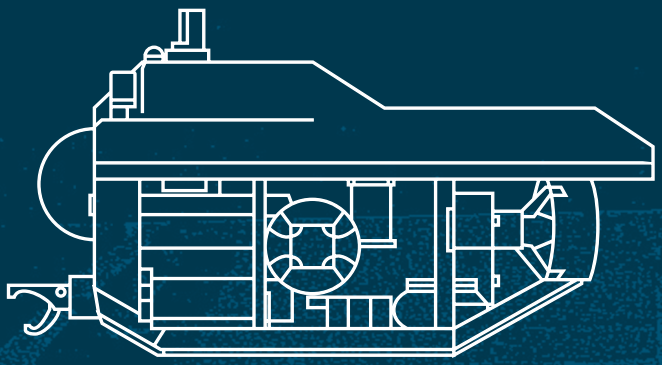
Or the Canadian Harvard Aircraft Association website:

WWW.HARVARDS.COM


Courtesy of Cathy Garnham

Courtesy of Cathy Garnham


Courtesy of Cathy Garnham | (left to right) Paul Chapple, John Millar, Dave Mitchell, Mark McRae, Walther Irie



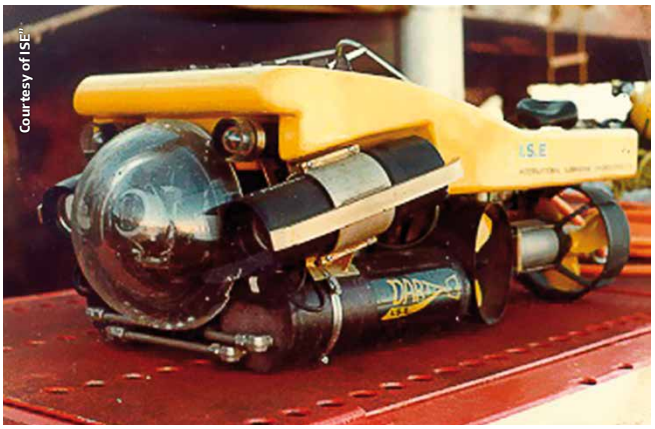
ROV HALL of FAME

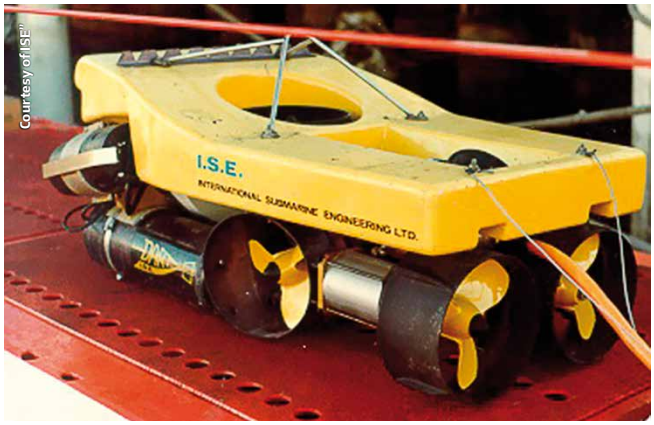
DART

Now that you've read about the fine work of the CHAA, let's take an in-depth look at one of the integral tools of their project: the DART ROV. The CHAA is rebuilding their own DART to aid in their search and recovery project. DART stands for "Deep Access Reconnaissance Television". Those who have been in the industry for a long time might remember this design, but for the younger generation - myself included - this iconic ROV is a bit of a mystery. According to Jim McFarlane Sr., the President of International Submarine Engineering (ISE), there were 28 DART ROVs manufactured overall, with the first one produced in the late 70s.

The DART Remote Vehicle System was designed as an underwater observation tool for the construction and offshore industries. In its basic form, it consists of a self-propelled closed circuit television system, with basic navigational instrumentation and lighting. Originally it was not designed to do manipulative tasks. User specified optional equipment could have been fitted separately, however, such as cameras, lights, CP monitoring, and oceanographic survey devices, and navigational beacons. These would have made the vehicle capable of performing tasks such as pipeline and platform inspections, surveying, leak detection, or under-ice operations. Later on, there were a couple of upgraded 5HP and 10HP electro hydraulic versions of the DART system which could handle tools as well.

The DART is also capable of being used in high current applications because of the high power to weight ratio. Even better, it is highly manoeuvrable due to the arrangement of its thrusters which are positioned horizontally, laterally, and vertically.





The thrusters' motors are controlled by a single joystick mounted to the pilot's console on the topside. The position of the joystick is directed to a control card which determines the corresponding motor control signals. All of the thrusters' control electronics are placed on the surface to increase vehicle simplicity. Within the umbilical each thruster is powered through a dedicated electrical conductor and a common neutral. This umbilical also contains a coaxial cable to transmit the video signal from the camera to the user, and a twisted pair of cables to power both the camera and the vehicle's onboard electronics.

At the heart of the control system is an Intel 8085 microprocessor incorporated within a motherboard. The processor has 8 I/O ports, 8kB of program memory (EPROM), and 2kB of random access memory (RAM) that is capable of controlling the whole system.

Unusually, the vehicle doesn't actually have a frame structure. Instead, it has a lateral tunnel running athwart forming the basic structural element on to which other components were mounted, including the aft thrusters, the forward instrument housing, and the buoyancy block. This design approach is slightly different from the ROVs that are on the market today, which – for the most part – have a frame-structure based design.

The structure and housing are fabricated from marine-grade aluminium (6061-T6) or stainless steel (SS316), and zinc anodes were attached to it to protect against salt water corrosion. All of these structures were rated up to 1,200 ft (366 m) as standard, with 3,000 ft (1,000 m) as optional. This depth rating was more than adequate for most operations being conducted at the time.

A TYPICAL DART CONFIGURATION

DIMENSIONS: (L × W × H): 41.5 x 18 x 12 inches (105 x 46 x 34 cm)

WEIGHT: 120 lb (55 kg)

DIVING DEPTH: 1,200 ft (360 m)

STRUCTURE: Aluminium or Stainless Steel 316

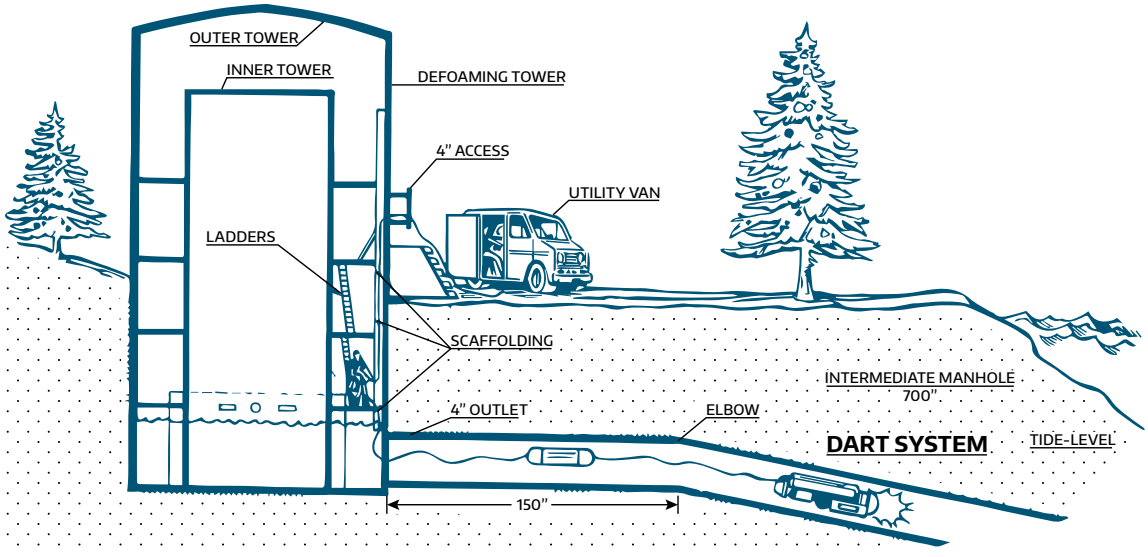
POWER SUPPLY:
220 V (centre-tapped single phase), 50/60 Hz, 4 kVA

THRUSTERS: 4 x 0.5 HP (110 V) Motors

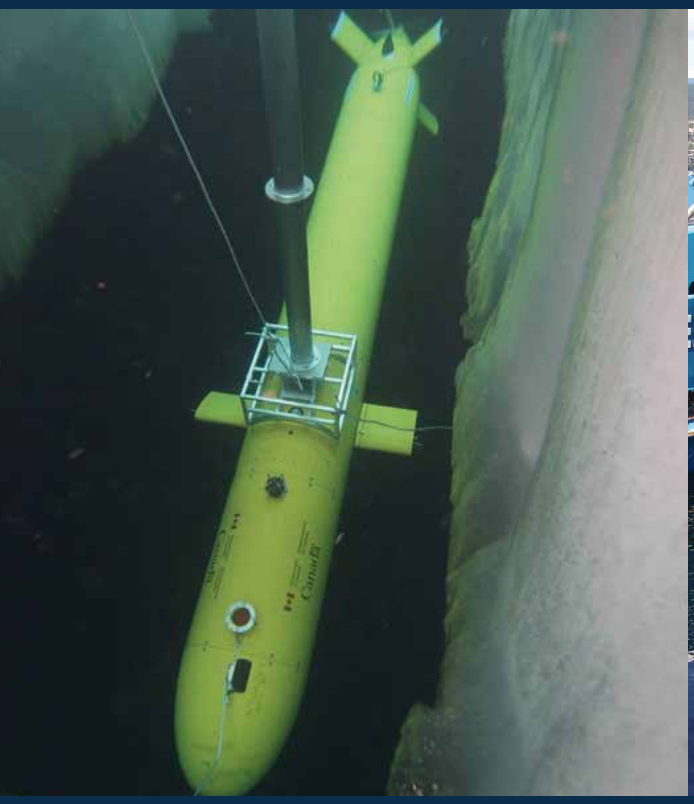
BUOYANCY: Synthetic Foam

UMBILICAL LENGTH: 750 ft (229 m) standard, 1,250 ft (381 m) ext.

CAMERA: Panasonic 1350 with 150° Pan x 150° Tilt Mount



International Submarine Engineering Ltd.



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Editor's Note: This is the first in a series of installments about the Marine Advanced Technology Education (MATE) Center, an educational organization based in the United States that focuses on preparing students for the ocean workforce. This piece will provide background information about the Center and its approach to improving marine technical education.

THE MARINE ADVANCED TECHNOLOGY EDUCATION (MATE) CENTER

Article by:
Jill Zande, Associate Director & Competition Coordinator
Deidre Sullivan, Director

Courtesy of the MATE Center and NOAA's Thunder Bay National Marine Sanctuary. MATE's ROV competitions challenge students to dive deeper into marine technology.

MARINE ADVANCED TECHNOLOGY EDUCATION (MATE) CENTER

THE MATE CENTER: **Addressing the Need for a Qualified Ocean Workforce**

For the past 17 years, the Marine Advanced Technology Education (MATE) Center has worked to understand and define the ocean workforce, connect with employers and technical professionals, and create innovative programs so that students can develop the technical skills that prepare them for the ocean science, technology, engineering, and mathematics (STEM) workforce. Along the way, the Center has built a reputation as a leader in advancing marine technical education and built a community of organizations and individuals who are committed to developing and supporting the next generation of scientists, engineers, and technicians.

ABOUT THE MATE CENTER

The MATE Center is an international network of community colleges, secondary schools, universities, research institutions, professional societies, marine industries and professionals. The Center's mission is to create interest in and improve science and technology education and provide the marine workforce with well-educated technical professionals. A hallmark of all MATE's programs, products and services is that they are aligned with ocean workforce research and trends. Headquartered at Monterey Peninsula College in Monterey, California, the MATE Center was established with funding from the U.S. National Science Foundation in 1997.

Although it is based in the U.S., the MATE Center works closely with educational institutions, technical professionals, employers, professional societies that have a global reach. Addressing the need for a qualified workforce is a worldwide problem; the solution requires collaboration amongst all organizations that have a stake in ensuring a robust and thriving ocean economy.

THE IMPORTANCE OF QUALIFIED OCEAN PROFESSIONALS

The graying trend in the ocean industry and the need for individuals with relevant technical skills is very real (1). The lack of appropriately educated workers is especially pronounced in rapidly evolving ocean fields, such as deep water ocean exploration (especially oil and gas); the engineering of specialized tools and instruments for remote, harsh environments; and the management and use of ocean resources (particularly, renewable resources) (2, 3).

U.S.-based workforce studies conducted by the MATE Center and funded by the U.S. Office of Naval Research identified more than twenty STEM-based ocean occupations that are currently limiting the growth of ocean industries because of the lack of qualified personnel. At the top of the list are electronics/marine technicians, including ROV technicians; electrical, mechanical, and civil/structural engineers; and computer scientists, including software application developers, computer programmers, and hardware developers.

However, these are not "just" engineers, technicians, and computer scientists; these are professionals that understand ocean applications within their field. For example, ROV technicians in support of ocean operations must have an understanding of ocean science in addition to engineering and computer science since all commercial ROVs possess computer-controlled systems and must be maintained, repaired, and modified in remote locations far from port. These skills sets are transferable to almost every sector of the economy that uses robotics and computer-controlled systems.

Courtesy of Oceaneering International | Jill Zande with volunteers from Oceaneering International

MATE'S KNOWLEDGE & SKILL GUIDELINES FOR OCEAN OCCUPATIONS

The process of developing a competent ocean workforce that is well prepared for employment requires collaborating with a wide range of people and organizations. One of the major focus areas of the MATE Center is to identify and define marine technical occupations and the abilities that individuals need in order to perform well in them. The major product that results from this work is a set of occupational Knowledge and Skill Guidelines (KSGs) for technical marine occupations. These guidelines, which are different for each occupation, describe what workers need to know and be able to do to perform their jobs well. The KSGs developed by the MATE Center include those for marine technicians, remotely operated vehicle (ROV) technicians, hydrographic survey technicians, aquarists, aquaculture technicians, oceanographic instrumentation technicians, and operational marine forecasters (see www.marinetech.org/marineworkforce).

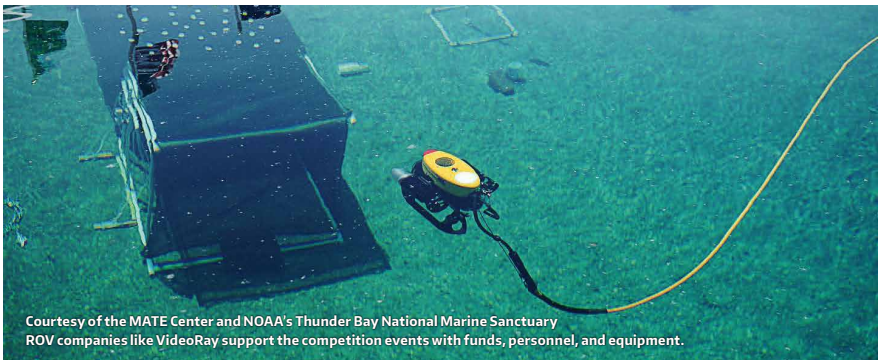

Courtesy of the MATE Center and NOAA's Thunder Bay National Marine Sanctuary
A team's ROV descends to document a mock-up of a shipwreck, one of the MATE competition tasks in 2014.


Courtesy of the MATE Center and NOAA's Thunder Bay National Marine Sanctuary
Technical professionals, including support divers assisting with MATE ROV competitions, have played a key role in the Center's success.

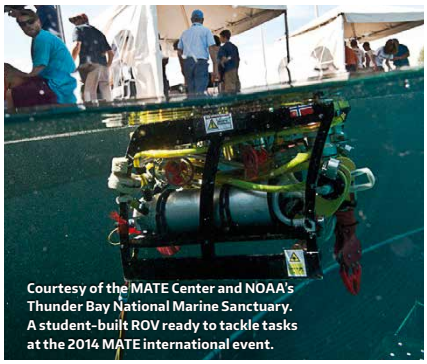

Courtesy of the MATE Center and NOAA's Thunder Bay National Marine Sanctuary
Students participating in MATE's competitions form mock companies that manufacture ROVs and market them to "customers" – in this case, the competition judges.

Courtesy of the MATE Center and NOAA's Thunder Bay National Marine Sanctuary
In addition to technical skills, students participating in the MATE ROV competition develop the ability to trouble shoot, solve problems, and work as a team.

Courtesy of the MATE Center and NOAA's Thunder Bay National Marine Sanctuary
Students test out their ROV system at their workstation during the 2014 MATE international competition.



Courtesy of the MATE Center and NOAA's Thunder Bay National Marine Sanctuary
ROV companies like VideoRay support the competition events with funds, personnel, and equipment.



Courtesy of the MATE Center and NOAA's Thunder Bay National Marine Sanctuary.
A student-built ROV ready to tackle tasks at the 2014 MATE international event.

USING WORKFORCE INFORMATION TO BRING OCEAN TECHNOLOGIES & SKILLS INTO THE CLASSROOM

MATE uses KSGs and information that it gathers from employers and working professionals to improve and develop education programs that provide students with experiences that simulate the high-performance technical workplace. These programs challenge students to apply what they learn in the classroom, which allows them to appreciate why academic subjects such as math and physics are important. These programs also encourage and facilitate collaboration, networking, and learning from other students and technical professionals. MATE's philosophy is that collaborative learning experiences help bring ocean technologies into the classroom and make these technologies more relevant to the real world. Students are placed in situations where they work in teams to brainstorm and come up with solutions to problems. They also have opportunities to work side-by-side with technical professionals, where they can see and experience first-hand what it takes to be successful in those professions. The opportunity to interact with practicing scientists, engineers, and technicians also helps students to envision themselves in those careers. And, because they can seek out and build upon what they already know and can do, their skill development, creativity, and innovation are not limited by a set curriculum or the knowledge and abilities of their instructors.

THE MATE INTERNATIONAL ROV COMPETITION

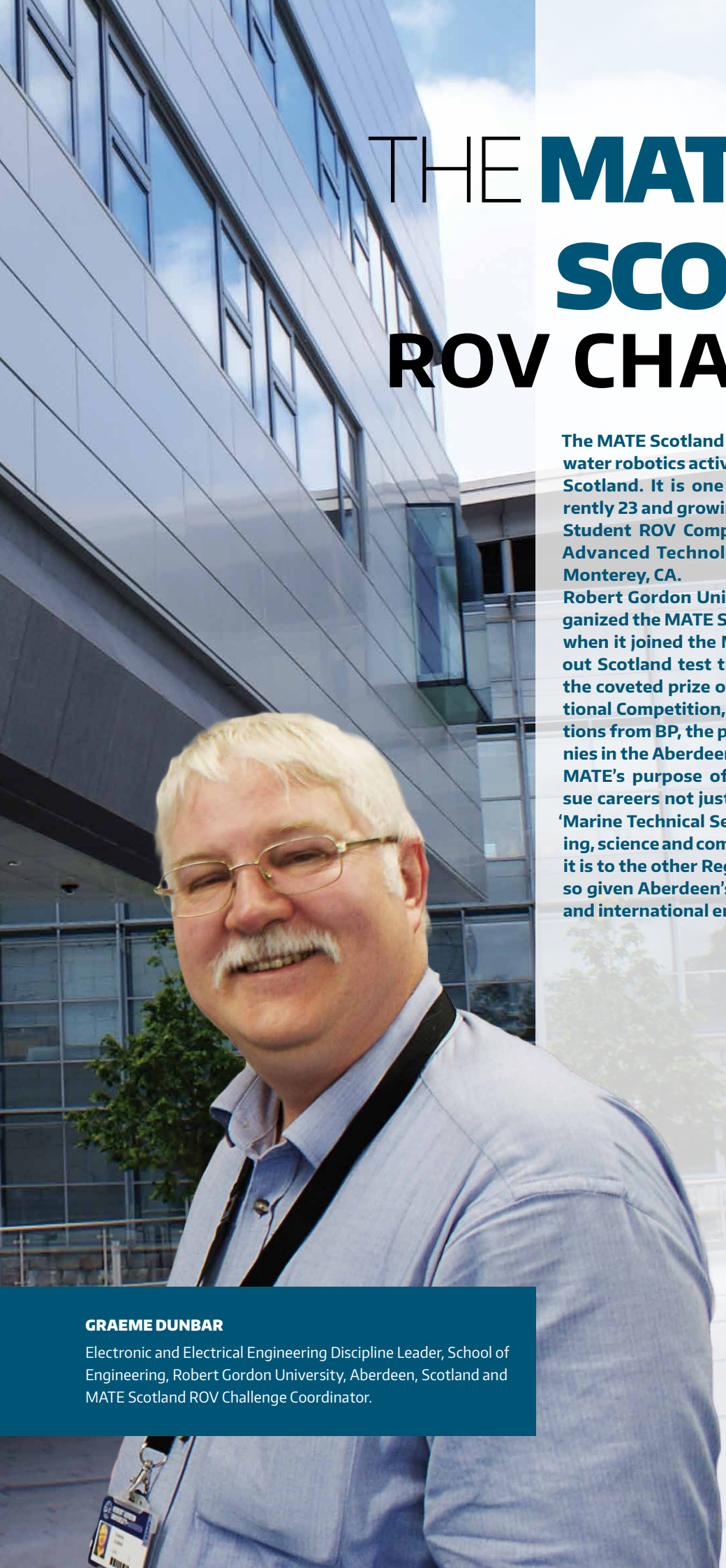
One program that the MATE Center developed to accomplish its mission is its international ROV competition. Created in partnership with the Marine Technology Society, a professional society for ocean professionals, the competition presents middle and high school, community college, and university students with research and design challenges that are modeled after scenarios from the ocean workplace. Students must apply what they learn in their academic classes – and seek out additional knowledge and skills – to engineer an ROV to accomplish a specified set of mission tasks. From developing ROVs to cap oil wells, install cabled ocean observatories, document shipwrecks, and survey WWII shipwrecks for environmental hazards, MATE's competitions challenge students to solve problems in new and innovative ways, work as part of a team, and develop an understanding of the breadth of business operations – all important workforce skills.

In addition to constructing an ROV, students are required to submit technical documentation and deliver engineering presentations to a panel of technical professionals from the ocean workplace. The students are also required to create poster displays to communicate to the layperson information about their vehicle design, the problem they were tasked to solve, and how this problem relates to real-world events.

The competition program currently consists of one international event and a network of 23 (and growing) regional events that are held annually. To date, more than 12,000 students in grades 5-16 around the world have participated, gaining essential technical as well as teamwork, critical thinking, problem-solving, project management skills as well as exposure to potential careers.

Learn more about the MATE competition in the next installment, which will include a list of MATE's regional partners and competition events as well as examples of previous mission challenges and the solutions that students have engineered to tackle them.

THE MATE SCOTLAND ROV CHALLENGE



GRAEME DUNBAR

Electronic and Electrical Engineering Discipline Leader, School of Engineering, Robert Gordon University, Aberdeen, Scotland and MATE Scotland ROV Challenge Coordinator.

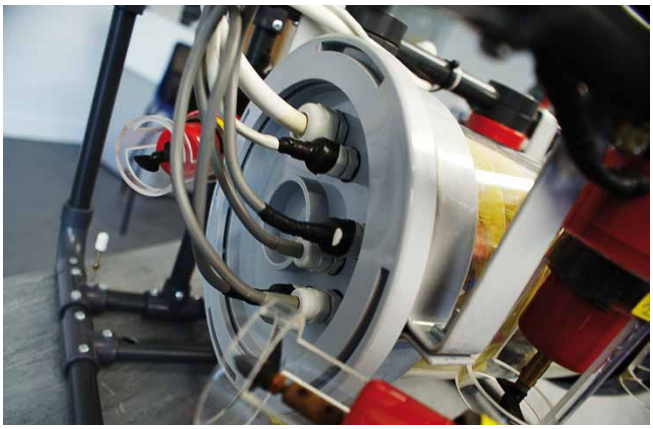
The MATE Scotland ROV Challenge is an annual underwater robotics activity for schoolchildren throughout Scotland. It is one of many Regional Contests (currently 23 and growing) that make up the International Student ROV Competition organized by the Marine Advanced Technology Education (MATE) Center in Monterey, CA.

Robert Gordon University (RGU) in Aberdeen has organized the MATE Scotland ROV Challenge since 2008 when it joined the MATE community. Teams throughout Scotland test themselves against each other for the coveted prize of a trip to take part in the International Competition, made possible by generous donations from BP, the principal sponsor and other companies in the Aberdeen area.

MATE's purpose of encouraging youngsters to pursue careers not just in ROV operations but the whole 'Marine Technical Sector' and other areas of engineering, science and commerce is as relevant to Scotland as it is to the other Regional centres: perhaps even more so given Aberdeen's central position in the North Sea and international energy industry.

ORIGINS

In 2007 RGU was given the opportunity to work with BP to develop activities within the School of Engineering for our own students and to support Science, Technology, Engineering and Mathematics (STEM) teaching in schools. As a result, the School of Engineering has established three annual events: Activity Week and the RGU MATE EXPLORER Class ROV team for our own students and most importantly here, the MATE Scotland ROV Challenge (RANGER Class) for schools. As these events have matured, the three parts have become more integrated with RGU students taking on the role of organizing outreach activities and working as Engineering Ambassadors.



In first year Activity Week, normal timetabled classes are suspended for the week and students undertake a variety of professional development activities, including industrial visits, talks from invited speakers and groups of students designing and building small ROVs. This is an opportunity for students to apply theory learned in their introductory mechanical and electrical engineering classes. They work in teams using initiative and creativity to turn readily available items including plastic pipe, motors, switches and wire into working ROVs within the space of two days and then complete a series of tasks in the School's test tank.

Encouragement from another MATE Regional Coordinator led to RGU students forming a team to take part in the MATE International ROV Competition at the Marine Institute, Memorial University, St John's Newfoundland in 2007. With support for travel from Subsea 7, Oceaneering and other companies, this team led the way in showing that taking part in the MATE International Student ROV Competition was a practical proposition. Members of that team are now in senior positions in the industry. Two were interviewed and employed immediately on returning from the competition. Consequently, the MATE Scotland ROV Challenge was set up with the winners of the RANGER Class competition accompanied by the RGU EXPLORER team taking part in the annual international competition.

THE RELEVANCE OF MATE

In the UK there are many STEM-related activities for children of school age, but when we were looking for a framework, MATE struck us as unique. Even though it is based in the USA it attracts participants from around the world and is a truly international event. One of its great strengths is the way the partnership between schools, colleges, universities, industry, professional bodies and national institutions operates. This results in activities and outcomes being relevant to all concerned. The activity makes use of technology appropriate to the age group to solve problems that are based on real-world ROV tasks, designed by the engineers and scientists actually involved in those activities. The theme of the competition changes every year: past competitions have centred on underwater archaeology, submarine rescue and marine biology as well as the energy industry.

The ROVs produced by teams, some members of which are in their early teens, are no mere toys. They are real ROVs, carrying out real tasks, albeit operating in only a few metres of water and many being made from hardware store components. They still require good understanding of the underlying physics and engineering behind ROVs in order to design them, and skill and teamwork to make and operate them.

A technical challenge is at the heart of the activity, but it is not one dimensional. It is a complete project with teams learning teamwork and being involved in research, project management, fund-raising, financial management, documentation, presentations and media outreach. It is an activity that can involve a whole class and develop the transferrable skills that employers desire.

THE SCOTTISH PERSPECTIVE

A major educational initiative by the Scottish Government is Curriculum for Excellence (CfE) 1 for lifelong learning. Its purpose is to develop the skills for life and for work as summed up in the four capacities for: successful learning, confident individuals, responsible citizens and effective contributors. New qualifications, National 4 and National 5, are replacing Standard and Intermediate Grades and 'new look Highers' are being introduced in August 2014. An interesting development relevant to the MATE ROV competition is the new Higher Engineering Science 2. With its constituent Units on Engineering Contexts and Challenges, Electronics and Control, and Mechanisms and Structures and the overall aims of CfE, the match with MATE philosophy is remarkable.

Although Scotland does not possess a direct equivalent to MATE, Young Engineers and Science Clubs (YESC) Scotland 3, funded through the Scottish Council for Development and Industry (SCDI) are often the vehicle through which schools take part in the MATE Scotland ROV Challenge. Many YESCs are run as lunchtime or after-school activities within schools though some are organized externally to serve more than one school. As well as taking part in the Challenge, teams enter their ROV in events such as the YESC's annual Celebration of Engineering. With over 900 clubs throughout Scotland, regional YESC representatives play an important role in promoting and supporting the ROV Challenge.

Courtesy of Rosslyn Shanks

LINKS WITH INDUSTRY

The MATE Scotland ROV Challenge would not exist but for the support from industry. Sponsorship is most visible form of support, though team mentors are highly sought after and valued. We endeavour to pair each team with an industry mentor, who need not be ROV experts, but are willing to share their industrial experience and can learn along with the teams. Our judges also come from industry and although it is a very intensive activity they find it rewarding and are keen to come back year after year.

The greater part of our sponsorship goes towards funding the winning team and their teacher to take part in the international competition which normally takes place in the USA. Without this funding it would not be possible for the winning team to take part due to the difficulty in raising the considerable sums required in the short time between winning the regional and travelling to the international competition. Funding is also used to 'pump prime' teams and it would be very good to be able to offer assistance for travel to allow teams from further afield to take place.

An excellent new initiative this year was the ROV Open Day where Oceaneering invited teams to see and operate real ROVs and learn about their operation. Links with industry need not be based only around ROV companies. Individual teams would benefit from links with many different companies to learn about technology.

The winners of the regional competition for the past two years, Mintlaw Academy and the RGU team have been very active in promoting MATE. The two teams manned a stand at Subsea Expo 2014 in Aberdeen and the Mintlaw team addressed the formal conference dinner. Both teams have taken part in Subsea UK evening events, demonstrating their ROVs. It would be good to see this develop further.

REFLECTIONS AND FUTURE DEVELOPMENTS

Four teams took part in the first MATE Scotland ROV Challenge in 2008 and the number has grown to ten or more competing annually, with more registering an interest though not completing. Established teams set the bar ever higher each year so it becomes increasingly daunting for new teams to participate. Interest in schools that have done well in the past has blossomed and teachers are looking for ways to involve younger pupils. We are considering the introduction of junior classes (SCOUT and NAVIGATOR) that do not lead directly to participation in the international competition to meet this demand. They would require significant extra resources but their introduction would be a good way to bring on younger participants where there are established teams and provide a graduated introduction to MATE for new teams to enable them to develop experience and confidence.

An essential quality of the MATE programme is that the work is that of the teams, not of the teachers. Indeed, instructors are prohibited for assisting teams when under competition conditions. However, good counselling is important and teachers should be able to guide their charges to follow realistic and achievable paths. The MATE framework within the USA has provision for workshops for new teams, for school teachers and other team instructors. This is highly desirable for MATE Scotland too. However it is very resource intensive and requires significant additional funding and practical support. One option being considered is to offer a beginner's kit along the lines of those available in the USA, but using locally sourced materials.

MATE is more than just a competition; it is a learning resource and an opportunity for partnership between schools and industry to set youngsters on the path to interesting careers and attract enthusiastic future employees.

The MATE Scotland ROV Challenge is the only regional competition in Europe. We get enquiries from teams outwith our catchment area and have played host to teams wishing to gain experience. While we are justly proud of this situation, it would be very good to see new Regionals start up.

DEEPWATER INTERVENTION FORUM – GALVESTON

ROV Planet has traveled to the Deepwater Intervention Forum in Galveston, Texas to look around what is happening in the industry. Unfortunately the editorial deadlines for the magazine prevented us from providing a detailed report in this Issue No.01. However in the later issues we will try to cover some of the ROV relevant topics that we have come across during the forum and exhibition.

SOME INTERESTING ROV RELATED TOPICS AT THE FORUM

"High Resolution Subsea Laser Scanning for Inspection and Maintenance" by Mark Hardy, Co-Founder of 3D at Depth LLC.

A panel discussion on "Purpose Built vs. Vessels of Opportunities" chaired by Dave Medeiros, President of Advanced Undersea Vehicles, Colin Buchan, Well Delivery Manager of Shell, and Jim McAllister, CWI Supervisor of Shell.

"Developing Ultra-High Electrical Conductivity Polymer Nanotube Umbilical" by Dr. Christopher Dyke, PhD, PMP of NanoRidge Materials, Inc.

"Subsea Decommissioning" by Bruce Crager, Executive Vice President of Endeavor Management.


ROV
PLANET
in Texas!
"Sometimes it's nice to
come back onshore for a rest!"

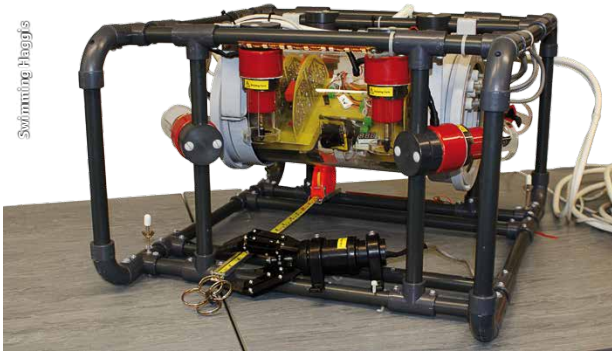
Photo: Tony Devine – Devine Imaging

HALEY DEMOS

Apart from modelling for ROV Planet, Haley Demos also excels in various fields within engineering and mathematics! Currently she is studying for a Bachelor's degree in Industrial Engineering at Texas A&M. For her Gold Award Project – as a Girl Scout – she organized Robotics Camp 2010 with the aim to teach underprivileged children and expand their knowledge of Science Technology Engineering and Maths (STEM). The robotics camp was independently created by Haley where she taught the participants herself and had a guest speaker from the Southwest Research Institute in San Antonio, Texas. For several years she has also been a tutor of robotics at iDTech Camps. Haley is a very talented girl and I hope she will choose Subsea Robotics and the ROV Industry after finishing her studies at the University!

TONY DEVINE

Tony Devine has been active in photography since 1988. His experience was broadened by his international and domestic military service, where he further developed his style with the love of creating images with impact, beauty, theme or abstract art. He worked as a combat camera photographer in the mid 90's while serving in the US Army as a combat medic. In 1997 he went professional after getting his combat footage published. The same year Tony started working in the fashion and glamour industry while being based in Germany and Italy until 2004. During this time the Devine Imaging logo and watermark was registered and published. Photography is Tony's passion; the lens his stylus and the model his canvas. Tony's art is the expression of the mind, body and soul.



Swimming Haggis

Courtesy of MATE Center

THE RGU SRS TEAM

The Robert Gordon University Special Service (RGU SRS) Team consisting of Robbie Williams, Ross Tempeton, Matthew Head, Matthew Downie, and Bruce Bob MacKenzie have worked tirelessly to build a reliable ROV called the "Swimming Haggis" to compete at the international MATE ROV competition. The competition requires the teams to undertake realistic simulated tasks that emulate ROV missions.

In 2014, MATE has taken the competition to Thunder Bay Marine Sanctuary in Alpena, MI with the theme of conservation, archaeology, environmental protection and scientific research. Thunder Bay hosts intriguing sinkholes with interesting scientific properties, shipwrecks to be explored and categorized, biological life that can damage marine heritage and manmade waste that requires removal. Missions in the 2014 MATE ROV competition address and simulate all of these real tasks.

Courtesy of Steve Allardyce

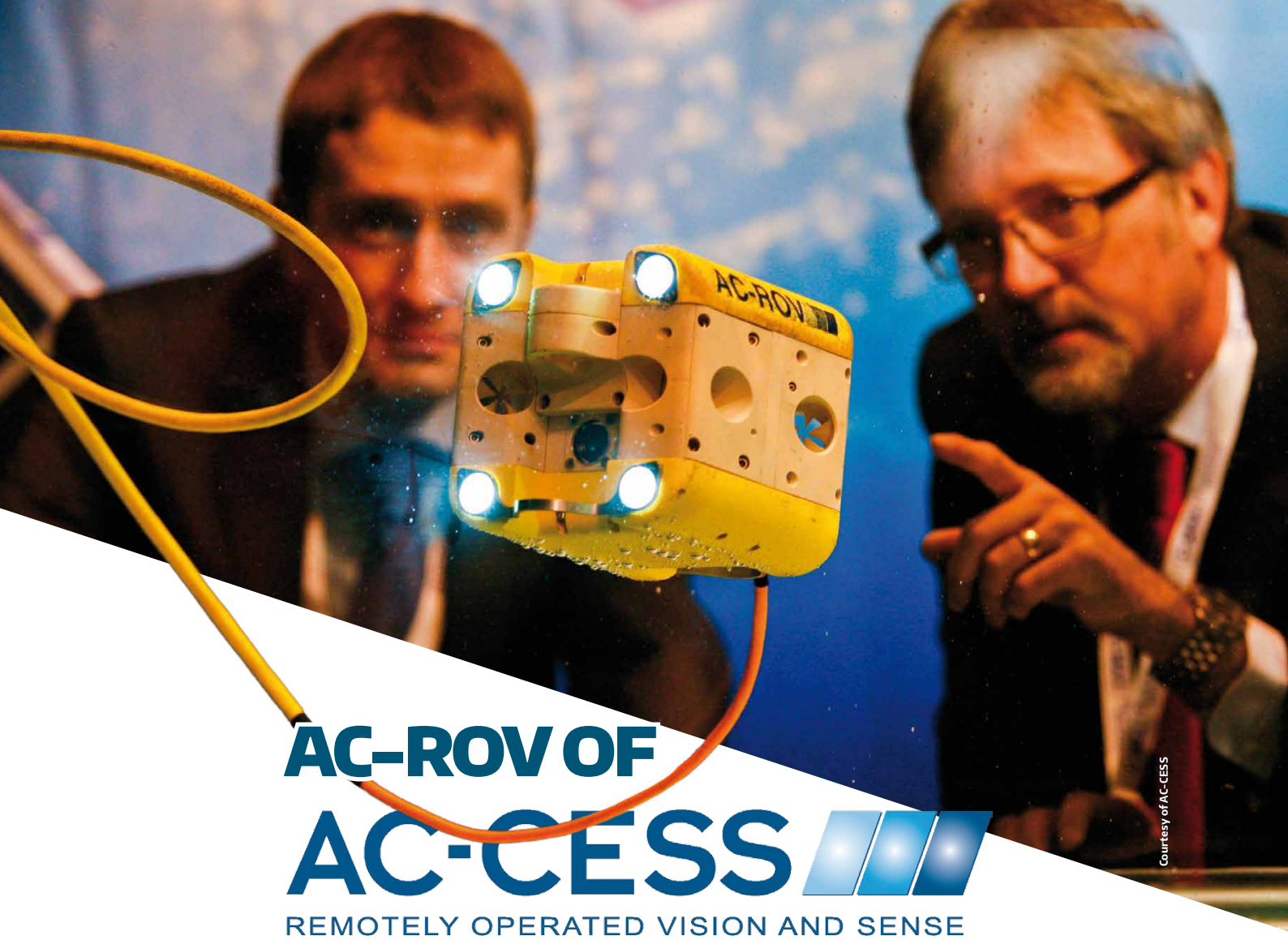
The Swimming Haggis features a multi-purpose claw for deploying the sensor array, retrieving debris and accessing the cargo container. Two custom designed light boards coated in electrical insulating lacquer provide illumination for investigating inside wrecks. A measuring tape customized with metal hoops allows measurement of the shipwreck whilst a skid is specifically designed for collecting the plate from inside.

"The competition didn't start off the best for us, because something has happened to our ROV in transit. When we powered it up for the first time it blew the whole low voltage side of the system. This killed the cameras, the lights, the camera servo, three voltage regulators, the manipulator and the power to the on board processor. We spent the whole of the first day rebuilding the circuits of the ROV with the spares we had, but then discovered that our spare camera was faulty. After a trip to Walmart and two striped apart CCTV cams later we had cameras. We got everything back together and working on the second day just 45 minutes before our first run where we scored 80 points. Unfortunately we have missed our practice run because of the camera problems. For the seconded run we trimmed the ROV better and got 120 points. This finally got us to the 9th place in the pool placing. We achieved this with a not working manipulator. Our team ended up at 9th place overall in the competition with high scores for our poster, report and engineering presentation. We received three awards: "No guts, no glory" (for persevering and fixing the major problem we had), "Best bang for buck" (for getting the most points with the smallest build cost), and "Design elegance" (for the best ROV design)"Matthew Head summarized the Team's challenges and experiences.

Well done guys! It's a great achievement, especially with having to troubleshoot all those problems on the spot. It made your ROV challenge even more realistic. Conditions in real life are never perfect either and operation in the field can also pose their challenges.

Courtesy of Rosslyn Shanks

Courtesy of Steve Allardyce



Courtesy of AC-CESS

AC-ROV OF AC-CESS

REMOTELY OPERATED VISION AND SENSE

The picturesque Aberdeenshire countryside is not the backdrop one would typically associate with cutting-edge ROV design. Still, only a 5 minute drive from Aberdeen Airport is where you will find the company headquarters of AC-CESS, an ROV manufacturer with 10 years of successful operational history and some highly innovative designs to boot.

I traveled to the premises myself where I was greeted by the company's managing director, Brian Abel. He informed me that both the brand and the company were established back in 2004 by All Oceans Engineering, Ltd. Since then they've managed to shift several hundred units. Surprisingly, I was also told that the entire project was carried out in-house, by the All Oceans team experienced with the design of TMS, LARS, and all manner of underwater solutions.

Brian's explanation of how the product evolved was enlightening "Firstly the ROV development started out with a 99% focus on the thruster design. That's what we needed to get right, before advancing any further with an overall system design. This was crucial in the development of the AC-ROV. The target size that we had in mind dictated that the thrusters had to be centerless as there would be no room for motors in the traditional sense.

"Once we had worked through many variations of thruster and drive design, the best ones were progressed through to over-speed and overload endurance testing. This got us to the point where we knew we had a reliable and powerful thruster unit.

"The AC-ROV shape and size then followed, the only constraint being that it had to have four horizontal vectored thrusters and be cubic in shape for equal thrust and speed in all directions. The benefit of this design is that the ROV can stay on target when turning in a current. It also had to have two vertical thrusters because tilting a camera takes up space, so the space saving option was to tilt the ROV.

All Oceans are known for their mechanical engineering solutions, and it may be that this led us to approach ROV design in the way that we did. Then again we did set ourselves a big challenge by wanting to arrive at an end product that could fly through an 8" (200mm) hole. This aspiration meant that we would not be in conflict with many of All Oceans' customers who are ROV manufacturers."

Control was another area which would demand some unconventional thinking. The most common approach to ROV control is to use a joystick or sticks, but because the AC-ROV was to be a true single-operator system a new approach was needed. It had to be one handed and suitable for both right and left handed pilots. The reason for this was that the pilot / operator needs a free hand to attend to the tether. They may also want to take notes or even speak to someone on their phone.

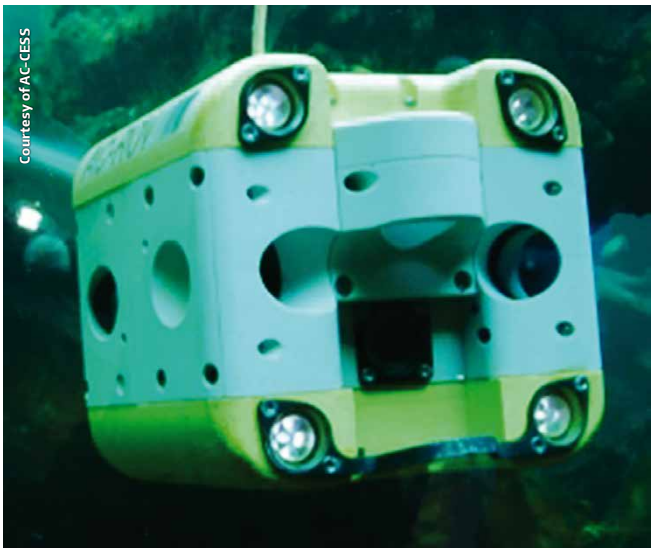
The AC-ROV hand controller is a true 3D control device with a central puck that you can grip with either hand. The pilot moves the puck exactly in the direction that they want the AC-ROV to move. Just imagine that you are holding the top of the AC-ROV: if you want to go up you lift up, to go forward without tilting you move it forward. If you want to tilt or rotate, you tilt or rotate the puck. The puck system is fully intuitive unlike most joystick systems where the forward command normally involves a tilting action. Joysticks involve a lot of mental gymnastics and practice to master whereas the 3D controller simplifies control to the extent that training is not required and proficiency needs a minimum amount of practice.

The thrusters are unique in that they are centerless, simple and reliable. This is what the development team put so much effort into and it has paid off. The propeller elements, even all of the prototype variations, were specially manufactured using the latest rapid prototyping technologies that were available 10 years ago. It's interesting to see how many products are now being made in this way and the current abundance of 3D printers. The AC-ROV design has been tweaked and very few changes were required to realize a 3000m depth rated AC-ROV product complete with a custom designed and manufactured TMS. These systems are mounted on larger ROVs, where they are typically used for "buddy" and "scouting" support.

The centerless thruster design has proven to be foul proof as there are no records of jamming or failure due to line or weed getting caught inside. Therefore this type of ROV can be operated in environments where there is a lot of growth, such as seaweed or freshwater weed.

Inside Brian's boardroom I had a chance to inspect one of the ROVs up close. The ROV design itself is compact and modular. Each thruster can easily be removed, serviced or replaced within minutes as they attach to the outside of the body. The whole design has a solid feel to it, with the shape and its modularity reminded me of a Rubik's cube. The sample ROV that I had in front of me was placed inside an acrylic tube, demonstrating the AC-ROV's ability to inspect places that no other ROV can. Brian told me that this ROV has been used in the inspection of pipes as small as 8" both horizontal and vertical. It has even been used to inspect FPSO chains for wear and any damage, and in many cases it can actually fly through an individual chain link.

Courtesy of AC-CESS

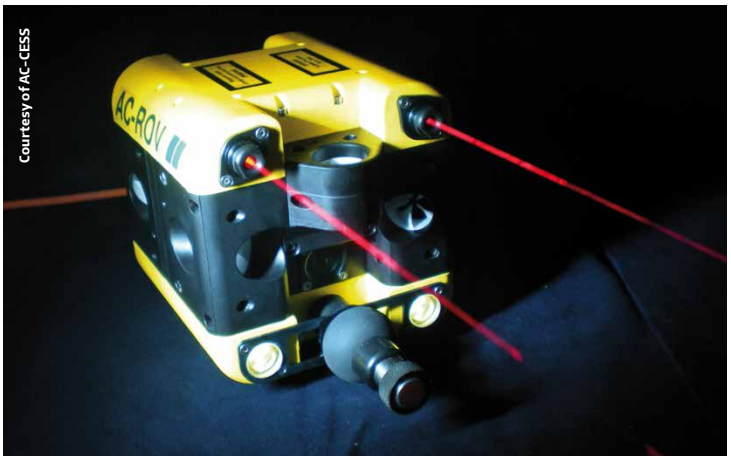


The vehicle's cube-like shape provides stability against currents even when the vehicle is turning onto an inspection target. This is possible because the drag profile of the vehicle remains constant as does its thrust capability in all horizontal directions. This helps the ROV stay on target as opposed to being "blown" away as it turns.
The AC-ROV is fundamentally an underwater visual inspection tool. It is a single operator system and hand portable by one person. These are very important attributes for getting used in remote out of the way locations where power may not be available and there is limited space for both the system and or the operator. There are several retro-fit options available ranging from sonar, through wall thickness measurement and even a two function manipulator.
He went on to describe how the market responded to the AC-ROV pre-launch.

"Back in 2004 when the "raw" product was introduced to the world at Oceanology International in London, we had the following valuable feedback from the market:
First, they wanted a vehicle system that could be hand carried all in on case. Two or more cases were no use, because the need for underwater visual inspection can often be in the most inaccessible of places. If there isn't a power supply available, then the operator would need to be carrying a small generator with them and that's both hands full!

"Second, they wanted an ROV with multiple power settings. Each setting could be selected according to the environmental conditions like currents and to suit the different stages of the operation.
Finally, they wanted a quality camera system that would derive good quality still images that can be evaluated after the dive. Real time video is needed to pilot any ROV but when it comes to reports and evaluations; it is still pictures that are most valuable. Therefore the AC-ROV has a range of flight assist options to help stabilization on a target and uses the highest quality CCD camera available given the space constraints so that picture grabs from the video are as good as you can get.

"We took all these great ideas on-board, and more to close out the AC-ROV product specification which is how it was when it went on sale mid 2004" said Brian.
This lead to the development of two custom AC-ROVs: a standard one (AC-ROV 100) rated for 100m, and an extended one (AC-ROV 3000) rated for 3000m complete with a TMS and electronics package for use a s a "Fly-out" from a host ROV or any type of submersible for that matter.
We can state that in general, when it comes to ROVs, the success of the operation depends a great deal on dive planning. The AC-ROV is a good tool for any underwater inspection or observation type operation and even for more complex operations that require progression to the use of bigger ROVs or the intervention of divers. As the demand for ROVs of all sizes and capabilities keeps growing so too will the demand for small ones. The AC-ROV may be considered a niche market product but it's well placed to corner the need for "small niche" underwater inspection.



Courtesy of SengS

MURRAY'S JOURNEY

FROM ROV TOOLING TO ENTREPRENEURSHIP

The following article is the motivating story of Murray Kerr. Knowing him from Oceaneering many years back, I have visited him at his new company premises in Ellon, UK, after I heard about his new ROV and subsea engineering venture being shortlisted for the 2014 Grampian Awards For Business Excellence under the 'Business Success Under 3 years' category.

SengS Subsea Engineering Solutions Ltd. was incorporated in July 2012 by its Managing Director Murray Kerr. A multi-discipline consultancy, the company was set up to deliver engineering design, subsea controls, project management, subsea engineering, repair and refurbishment, testing and flushing, and tool rentals to the global energy sector.

Murray began his career with the British Royal Navy's Search and Rescue Branch, having left school at 15 with no qualifications. Despite his lack of academic success, the navy recognized his potential and supported him through a number of qualifications including HNC and HNDs in mechanical, electronic, aeronautical and electrical engineering, and business management. Having achieved these qualifications, Murray then completed a BEng in Aeronautical Engineering. After five years of service, he chose to leave the navy in order to spend more time with his family. He sought ROV Tooling and Subsea Engineering roles in the oil and gas industry and worked for companies such as Oceaneering, Shell, GE Oil and Gas, Technip, and Genesis, before Murray – at just 30 years old – decided to launch his own subsea engineering business.

Murray established SengS to provide a unique approach to subsea engineering challenges. He recognized that his competitors did not offer bespoke solutions readily and that projects were often delayed or took longer to complete than was necessary. Unlike other subsea consultancies, SengS delivers turnkey packages to its clients, from the concept phase to aftermarket support.

"In its first 18 months the company has developed strong customer relationships based on its core values: providing clients with straightforward and clear advice; tailoring solutions specifically to client challenges; working quickly and efficiently to bring projects to fruition; and delivering projects on schedule every time.

"One of the main elements that separates the firm from its competition is its ability to deliver projects more quickly and efficiently. In some cases it has been able to shorten projects from the twelve week lead time quoted by other companies to just one. SengS's innovative approach to problem solving also means that it is able to deliver significant cost savings. For example, we developed ROV-installed clamp assemblies in order to repair a perforated caisson offshore. This clamp design has now been used in four locations, saving on average £200,000 per client in vessel hire costs. SengS has a number of key clients in the oil and gas sector, including Bibby Offshore, ConocoPhillips, Centrica Energy, Nexen Petroleum, and Bibby Remote Intervention Ltd. To date SengS has never lost a client." said Murray.

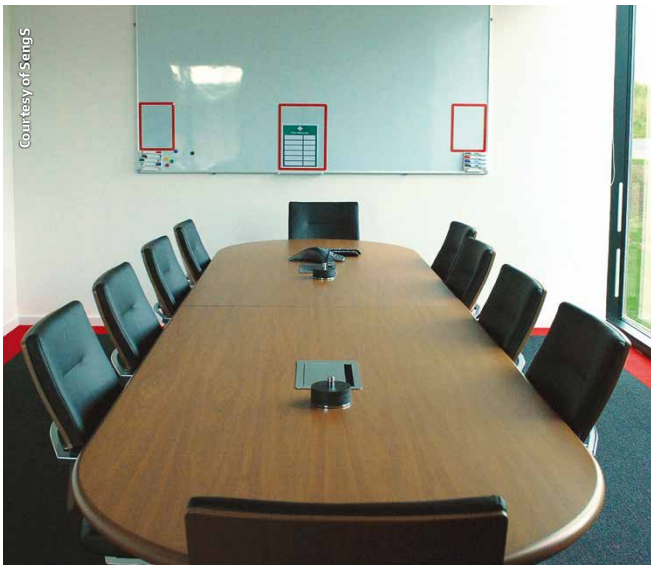
In setting up SengS, Murray faced significant challenges, particularly in relation to funding the business. He required approximately £1.6million in finance to achieve the core aims of his business plan. This list included the purchase of commercial land and the commissioning of purpose-built premises to enable the fledgling business to develop its client offering. Though the banks and Business Gateway approved of his business plan, they declined to give him funds

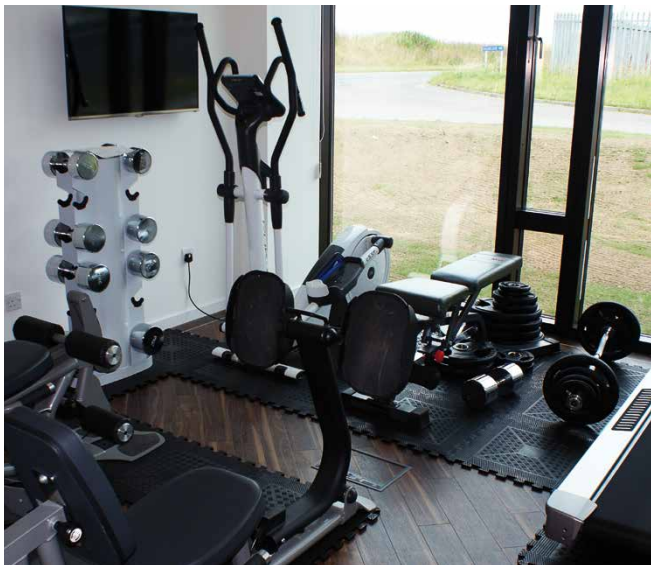
Courtesy of SengS | The new built SengS offices and workshop in Ellon, UK.

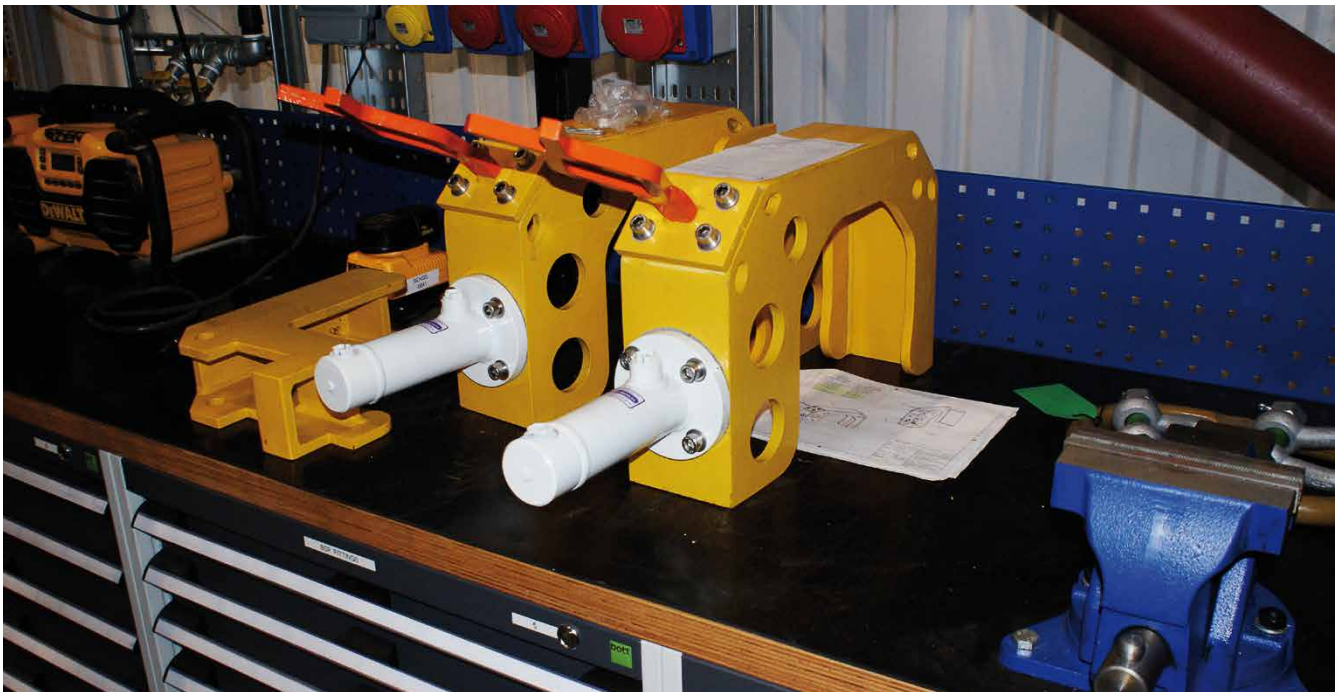
because he was deemed high risk. Undeterred, Murray re-mortgaged his home, obtaining £100,000 and began working 16 hour days, 7 days a week to establish a client base. In four months he achieved a net profit of £150,000 and was awarded an RSA grant of £220,000 by Business Gateway. However, in order to obtain the first £60,000 of this award, the business had to raise £340,000. After six months the bank offered SengS £630,000 in finance, as it had proven that its financial projections were accurate, but again it had to raise £900,000 to receive the funds.

Despite these setbacks, in January 2013 SengS was able to purchase an acre of commercial land in the Balmacassie Business Park in Ellon - 15 miles from Aberdeen. Soon after, the firm employed an architect, structural engineer, and quantity surveyor to design its premises. In August 2013, Murray commissioned a building contractor to begin site works. SengS achieved the £900,000 target set by the bank in January 2014, unlocking the funds it had committed to providing. However, to date the company has not utilized these funds because the business generated enough income to complete its premises, which has recently opened in April 2014.

From SengS's launch in 2012 until April 2013, Murray worked alone to develop the business and deliver its projects. In April 2013, he employed two Senior Engineers, – Chris Waller and Barry Forbes. Since then, the company has grown and now employs a team of 12 including an accounts manager, project engineer, and CAD operators. The firm expects to employ a further 18 members of staff by the end of 2014.







In its second financial year the business achieved a turnover of £2.4million, with a gross profit of £1.6million. Financial projections indicate that the company will achieve sales growth of 40% each year for the next two years.

SengS operates an efficient business management system and is DNV certified to ISO 9001 and 14001. It has invested £100,000 in research and development for 2014, in order to establish a new tool rental division. Later this year SengS will begin expanding its new premises in preparation for the development of a cutting services department in 2015. It expects to purchase a further 2.5 acres of land in 2015 for future expansion.

Having made Ellon in the UK its base, Murray has strived to give something back to the local community. He has already provided financial support to Ellon Mental Health Community Team and the Ellon Football Gala and sponsors Ellon Meadows Under 8s football team. As a result of his own experiences, Murray hopes to offer low achieving school leavers from Ellon Academy placements at SengS in 2014.


SEARCH FOR
MALAYSIAN AIRLINES
FLIGHT MH370
Courtesy of RAN

After hearing about the disappearance of Malaysian Airlines Flight MH370, I'm sure everybody in the ROV community was curious to learn not only about the reasons of the airplane's disappearance, but also the technology being used to find it. The following article, with input from Pete LeHardy and Tim Janaitis of Phoenix International, takes a brief look at the subsea side of the search.

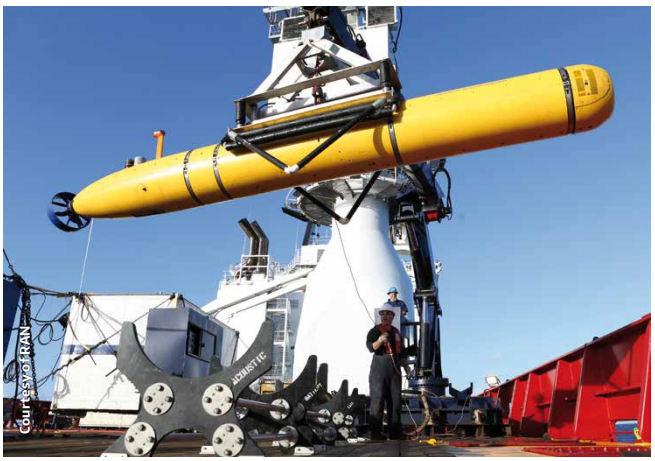
Two of the tools used in the search were the U.S. Navy's towed pinger locator (TPL) and Phoenix International Holdings Inc's (Phoenix) autonomous underwater vehicle (AUV), Artemis. Both systems were operated by Phoenix personnel in support of the U.S. Navy's contribution to the 26 nation search effort in the southern Indian Ocean. Phoenix is the U.S. Navy's prime contractor for worldwide undersea search and recovery operations.

Phoenix's Artemis AUV was manufactured by Bluefin Robotics, an American company based in Quincy, Massachusetts. Bluefin Robotics is a spin-off company from MIT that builds a range of AUVs. Phoenix's Artemis is a highly modular autonomous underwater vehicle capable of carrying multiple sensor payloads in interchangeable bays. Artemis boasts a high energy battery capacity that enables extended operations even at the greatest depths. The AUV has immense capability but is also easily transportable and flexible enough to operate worldwide from various ships of opportunity.

The Australian Defense Vessel (ADV) Ocean Shield was used in support of the MH370 search mission. Some readers may already be familiar with this vessel, and some may have even worked on it. Before being sold to the Australian Navy, this vessel was named Skandi Bergen. It was being used in oil and gas ventures by DOF Subsea as a Multi-Role ROV and Intervention Vessel.

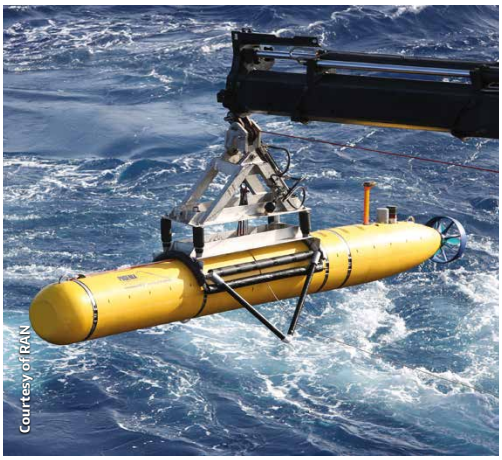
Courtesy of RAN

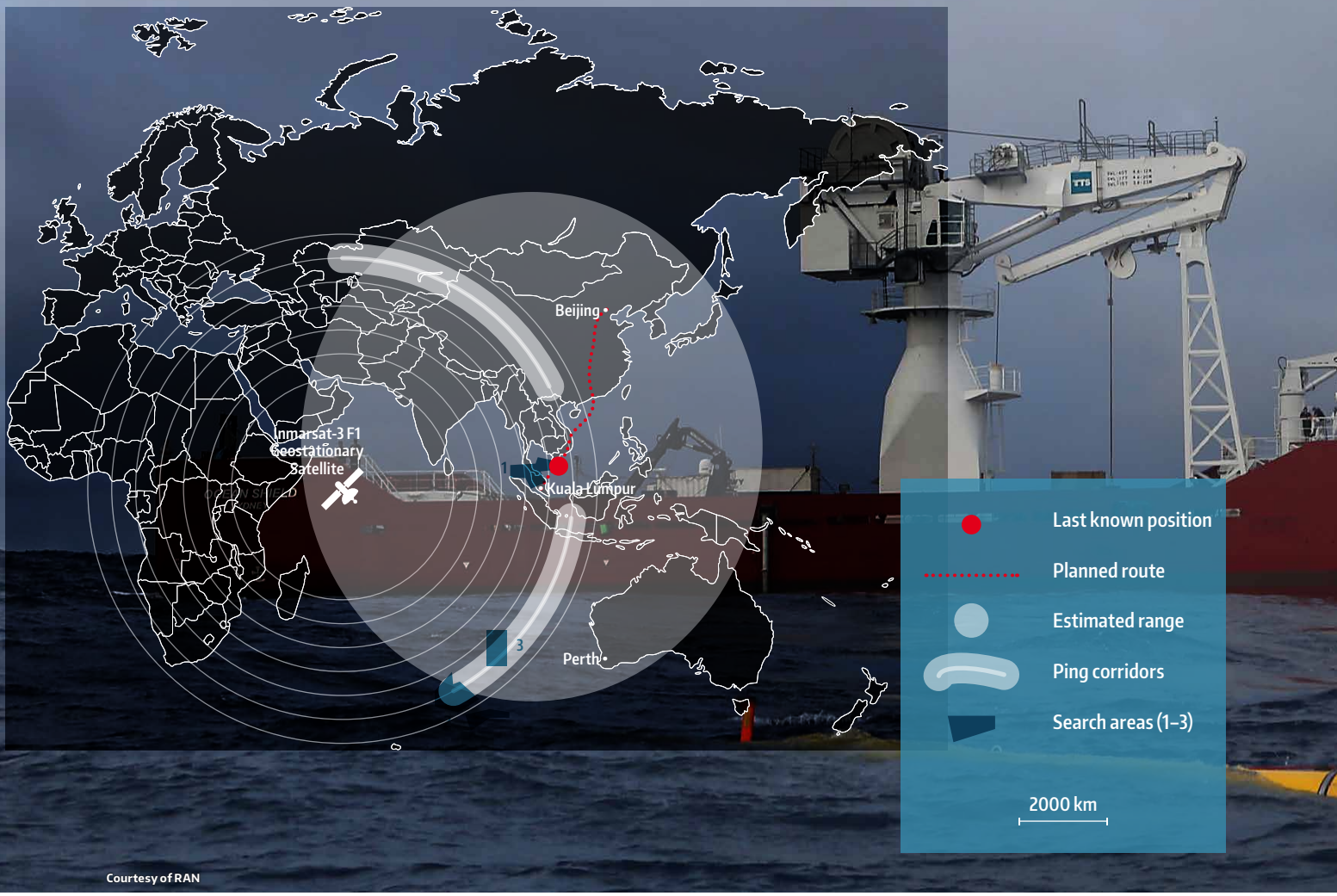

Courtesy of RAN



The big search question was where to begin looking for MH370. INMARSAT performed an initial analysis of the electronic "handshakes" between MH370 and the INMARSAT satellite positioned over the Indian Ocean which resulted in the identification of an "arc of probability" located approximately 1600 km west of Perth, Australia. While Ocean Shield was en route to the area, a British hydrographic survey ship and a Chinese vessel separately reported hearing acoustic signals (pings) along a northern portion of the INMARSAT "arc of probability". Based on these reports, ADV Ocean Shield was directed to investigate the area where these acoustic signals were heard.

The U.S. Navy TPL is equipped with a specialized listening device, called a hydrophone, that is capable of hearing the standardized 37.5 kHz acoustic signals expected to be automatically sent by all commercial aircraft Flight Data and Cockpit Voice Recorders (the black boxes) upon their being submerged in seawater. Consequently, the TPL was the first system deployed from Ocean Shield. The TPL randomly detected signals that were presumed to be coming from the MH370 flight's black boxes, but these signals were neither of sufficient duration nor of the expected frequency to allow positive confirmation of the crash site. Nonetheless, authorities directed that a search of the area be done using the Artemis AUV with its side scan sonar as the search sensor. The ocean depth in the search area was believed to be between 2,000 m and 4,000 m (6.560 ft

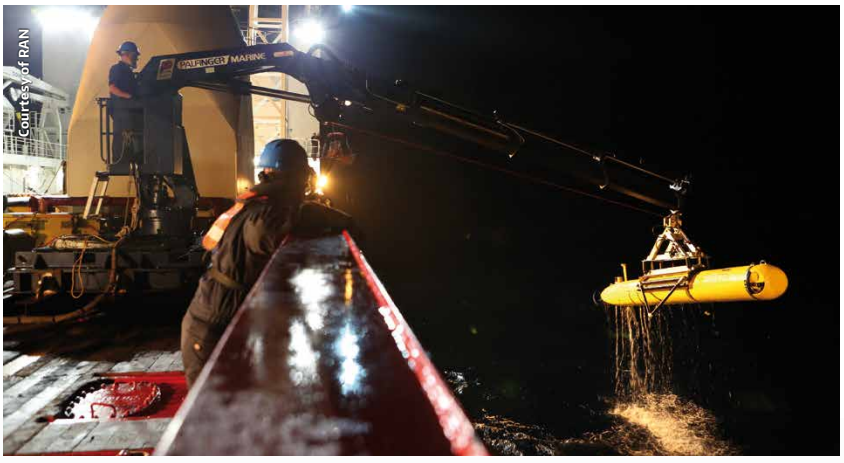


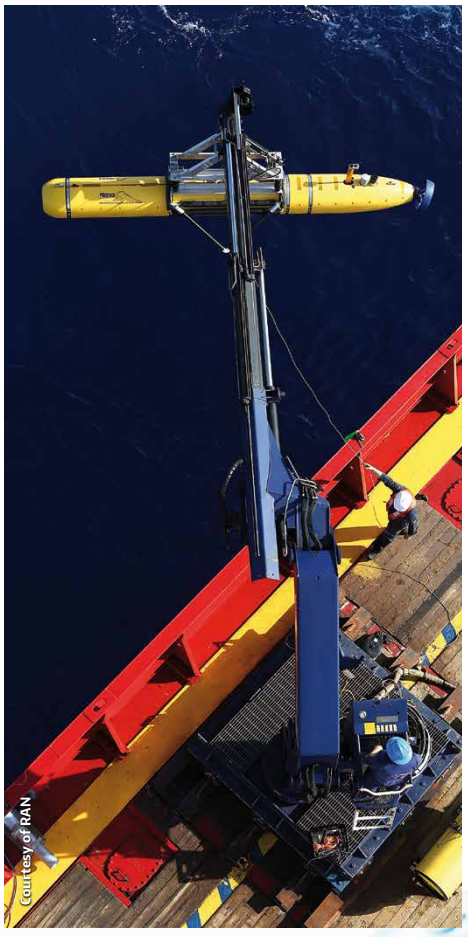


Courtesy of RAN

and 13,120 ft). However, AUV operations soon demonstrated that the ocean depths exceeded Artemis's 4,500 m (14,760ft) depth capability. On scene AUV system engineering analysis and software adjustments to Artemis's operating parameters subsequently allowed Artemis to increase its search operations to 5,000 m (16,400 ft) water depths. Overall, Artemis conducted 70 days of programmed search operations that extended 22-25 hours per day and covered 860 square kilometers (330 sq miles) of seafloor.

Unfortunately nothing has been found yet and the mystery is still waiting to unfold. The Australian Transportation Safety Board is expected to soon issue a competitive commercial contract to continue the search for MH370 in hopes of discovering what had happened onboard the aircraft that caused the loss of 239 souls.


Courtesy of RAN


Courtesy of RAN

INTERVIEW
IAN CROWTHER OF WFS

Earlier this year when I visited the Subsea 2014 exhibition in Aberdeen, I noticed a company running a small stand at the side of the exhibition hall. The company in question was WFS, and I found out that – in spite of their size – they are coming up with great innovative solutions that are making a substantial impact on ROV and subsea operations. Their ideas piqued my interest, and I started a conversation with the Vice President of WFS, Ian Crowther.

| RICHIE ENZMANN: Please tell me about yourself how long have you been working for WFS, and when did you first got involved in the Subsea Oil and Gas industry?

| IAN CROWTHER: I joined WFS's Energy & Environmental Division in 2007, and was appointed to the board in 2011 to lead the company's global sales and marketing activity. I have over 15 years' experience of international business development, leading technology businesses into new markets, with a focus on optics, acoustics, and radio. I have operated in various markets including medical devices, automotive, and consumer electronics.
WFS is the first opportunity I have had to operate in the Subsea Oil and Gas industry. To open up that business I have spent lots of time in Aberdeen - as you would expect - but I also spent time in Rio, Perth, Singapore, and for 2 years I was based in Houston.

| RE: It sounds like you've been around the world's biggest subsea hubs before returning to the UK. So, what about WFS: Where are you based? How many people are working for you? How did you come up with the idea to build wireless networking devices underwater?

| IC: WFS Technologies was founded in 2003 by Brendan Hyland. There are currently 20 talented staff and consultants located in offices in Livingston, 10 minutes from Edinburgh airport.
Much of WFS's early work in underwater radio was for defense contracts, where RF had been used extensively in the past for submarine communications. Commercial applications for underwater wireless communications - until recently - had been almost exclusively implemented using acoustic systems, with radio communication being largely neglected in the digital communication era. WFS identified a market in the subsea oil and gas industry for short-range, high-speed wireless communications, similar to the functionality delivered by Bluetooth and WiFi in homes, offices, and industrial facilities.

| RE: So basically the technology has already been used by the defence sector. It's only recently that it's been introduced into the commercial sector. What is the principle, briefly, of operation for subsea wireless communication? How do you overcome the signal attenuation in water?

| IC: WFS has developed underwater radio communication techniques that are unaffected by hostile environmental conditions. This technology enables new ways of working; it delivers improved safety, capital and operating cost savings, increased flexibility, and reliability in the oil and gas market.

Of course we work within the laws of physics, and radio signals are attenuated as they pass through conductive media. We focus on delivering value in short-range, high-speed applications, where fast and reliable communications and control are required.
Additionally, Seatooth® technology supports data transmission across multiple media, such as water/air and ground/air boundaries. Signals penetrate the seabed, ice, concrete walls, and steel barriers. This enables us to provide information to operators in previously inaccessible areas.

RE: Can the wireless devices work where strong currents are present or in murky water conditions?

IC: Underwater radio technology has the distinct advantage when operating in adverse water conditions, such as in the presence of gas bubbles or high turbidity. Radio signals are unaffected by acoustic noise or biofouling, and are free from multipathing problems. As a result, Seatooth® is often the only technology that can offer reliable data transmission in the real operating environment.

RE: That's very interesting! But how many modems have you sold so far? What is the feedback from your clients? Are they happy trying out your devices? I'm asking that because I know that the oil and gas industry can be very conservative at times, when it comes to new technologies and solutions.

IC: In the last 5 years the company has delivered more than 7,000 communication and control devices across the globe, and secured design-ins with major blue-chip customers.
We have found that adoption of technology is easier if you are delivering more of the complete solution. We supply integrated instrumentation and control systems; the wireless communication interface is just one part of the solution. Our products range from wireless video cameras to support ROV construction operations, to wireless temperature and pressure sensors for monitoring pipeline integrity.
Some of our products have been recently deployed by leading companies such as Baker Hughes and Subsea 7. Their feedback was very positive, pointing out that without the use of our wireless communication modems their projects would have been delayed, impacting their budget and schedules.

RE: I see companies are buying into the idea of using subsea wireless devices. What are the potential cost savings from using wireless technology?

IC: We are pleased to be able to help our customers save money in different ways, for example using subsea wireless systems for survey or construction operations saves time, which in this industry means saving money. In many applications we can remove the need for a second ROV, which reduces cost and downtime associated with servicing the vehicle. Wireless collection of data is faster and more reliable than physically retrieving data loggers, or making underwater wet-mate connections.
In addition to cost savings, there is a significant economic benefit to deploying wireless instrumentation systems for asset integrity management. By providing more data, more reliably and more easily, we help our customers make decisions that can extend the life of the asset. This enables them to operate for longer and increase their output.

RE: How do you ensure longer battery life? Wouldn't the battery life affect the longevity of subsea wireless devices?

IC: A number of factors help support long-term deployments of wireless instrumentation systems.
First, Seatooth® is a very low power technology: not much power is consumed when the system is in operation. Also, it has an ultra-low power sleep mode which is quite unique.
Second, by transferring data at very high data-rates the system is only in its operational mode for short periods of time, so it can stay in sleep mode for longer, consuming less power.
Third, Seatooth® systems operate as wireless controllers. Devices can be switched on/off, or reconfigured over a wireless link, and this technique can be used to extend battery life.
Finally, the batteries are electrically disconnected, but can be turned on wirelessly, and this allows the battery life to be further extended. All of these factors - along with developments in battery technology, – mean that we can deploy systems for periods of up to 10 years.

RE: I like this idea of the possibility to switch off the devices when they are not in use. It sounds like an elegant solution to preserving the battery life and ten years is a considerable length of time. What are the advantages of wireless devices compared to devices using cables, electrical flying leads, and wet mate connectors?

IC: Our customers tell us that cables and connectors are common sources of downtime, either through failure or servicing. By transferring power and data wirelessly we remove the risk associated by aligning pins and servicing electrical connections.
Wireless technology makes it simpler and therefore quicker to make and break subsea connections, and WFS supplies a range of underwater 'wireless connectors' to applications including, subsea vehicles and subsea equipment.

RE: Do you think that wireless technology could become main stream? How do you ensure interoperability and that all devices will talk on the same protocol?

IC: I believe that wireless is already established in the subsea industry; for many applications it is the primary method of managing data. The sector has grown to include a number of providers and an industry partnership: the Subsea Wireless Group.

WFS is a founding member of the Subsea Wireless Group, an oil industry initiative to promote adoption and interoperability of wireless technology. This has included developing the first standard in underwater radio communications. All segments of the industry are represented. Members include BP, ConocoPhillips, Statoil, Chevron, GE, OneSubsea, Technip, and Subsea 7. It is really exciting to see leading companies in the industry committing resources to advance the deployment of wireless technologies subsea. The group is growing, and I would encourage anyone with an interest in underwater wireless technology to check out the website and come along to a meeting.

RE: This sounds like a valuable opportunity for wireless tech stakeholders to have a say in developing the standards of underwater communication. WFS seem like an R&D company that thrives on innovation. Apart from the subsea wireless camera transmissions, have you also got any other patents or ideas that you want to develop and make a reality?

IC: Innovation is an important part of what we do, and we have a strong patent portfolio. More important though, is building high quality products that deliver value to customers.
For example, one of our most recent product innovations is Seatooth® PipeLogger, a pipe-mounted sensor that measures temperature data at the pipe surface under a thermal insulating 'cover' to monitor core pipe temperature. It is designed to support asset integrity management by identifying thermal fatigue issues, and highlighting the risk of upheaval buckling. Sensors can be added to the PipeLogger platform to monitor pipeline vibration and wall thickness.
Another product recently added to the Seatooth® family and deployed by Baker Hughes in the Liwan 3-1 gas field in South China Sea, is Seatooth® PPC. This is a wireless datalogger for pipeline pre-commissioning. Hydrotest data can be captured, stored, and downloaded reliably at data rates of up to 156kbps. Fast wireless data collection frees up the ROV to undertake other tasks.
As an extension to the PPC product we have Seatooth® WiPS, an integrated subsea system that provides real-time pressure data. It comprises a high accuracy pressure sensor, a wireless datalogger, and an LED display, and provides pressure measurements up to 20,000 psi in depths up to 4000m. This is used for hydrotest applications measuring pipeline pressure, or survey operations providing precise depth measurements.

RE: Ian, it's been great talking to you, and I hope that we can see some more cool stuff that's been developed by WFS in the future!

Courtesy of WFS | The WFS offices in Houston

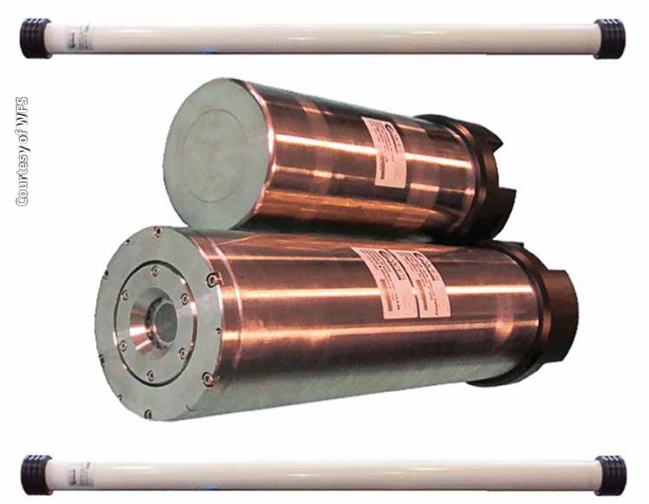
SEATOOTH

SUBSEA WIRELESS VIDEO CAMERA FROM WFS

Seatooth Video (previously also branded as Viewtooth) is a subsea wireless video camera solution for subsea construction and IRM activities that removes the need for a 2nd monitoring ROV. It's compact, portable, easily operated, and can be set up operational in a short space of time. There is no need for a lengthy installation process and can be used for deep water applications up to 3000m. The Seatooth housing is not camera specific and so can "wirelessly enable" a number of subsea cameras on the market. The system also has a wireless switch included to put the Seatooth Video into an ultra-low power or "sleep" mode.

Elimination of cabling to make the camera wireless increases the reliability, flexibility and deployment possibilities across a wide range of industries. From offshore troubleshooting to monitoring of subsea installations, wireless technology reduces vessel retrieval costs by allowing extended deployment of subsea equipment and significantly reduces the cost and risk of ROV operations. Applications supported with multi-perspective views provided by Seatooth are hot stab applications or intervention operations where "right-first-time" is critical and also in subsea construction projects, replacement of ROV tools at depth, remote monitoring of equipment and inspection and monitoring applications where a clearer view can decrease mission length and complexity. Available as a standard sized modem, as a hybrid solution with camera, acoustic or power transfer capability, or as PCB only for OEM integration, Seatooth communicates reliably in challenging environments where traditional underwater communications methods can suffer poor performance. Seatooth is not affected by an acoustically noisy environment, presence of contaminants or by the effects of shallow, congested or turbid waters making it suitable for applications in an offshore environment.

WFS TECHNOLOGIES



SEATOOTH® PRODUCT SPECIFICATION

OPERATING RANGE / ENVIRONMENT

RANGE

Internal Antenna: 3 m in seawater; 4.5 m in air

External Antenna: up to 4.5m in water; 6.4 m in air

Wireless Control/Switch: 6.4 m in seawater

DEPTH RATING

Standard: 1000 m; Optional: 4000 m

OPERATING & STORAGE TEMPERATURE

Operating 0 to +40 °C,
Storage –10 to +50 °C

DATA

SEATOOTH® VIDEO

H.264 format, 10 frames-per-second

Using 78kbps: Resolution = CIF (352x288)

File output .asf format

DATA INTERFACES

Ethernet

DATA RATE

78 kbps

POWER SUPPLY

Standard: External 24V

Optional: Internal 24V

Optional: 24V output for external lights

POWER CONSUMPTION

Seatooth Video Module:
Transmit: 19W, Receive: 7.5W Sleep: 0.35mW

Seatooth S300 Control Module:
Transmit: 19W, Receive: 4.5W, Sleep: 0.35mW

PHYSICAL CHARACTERISTICS

ANTENNA

Standard: 1.3 m

Optional: 4 m

DIMENSIONS

Seatooth Video Module: 150 mm × 599 mm

Seatooth S300 Control Module: 150 mm × 407 mm

WEIGHT

Seatooth® Video Module: 32.3 kg in air / 22 kg in water

Seatooth® S300 Control Module: 23.6 kg in air / 16.7 kg in water

ROV PLANET

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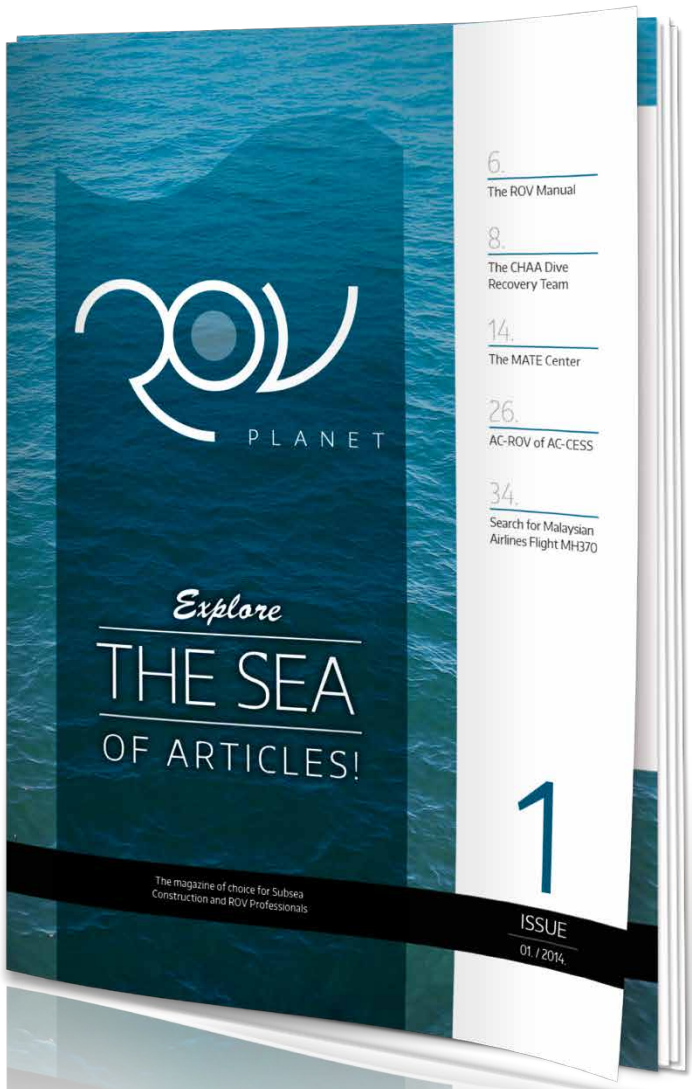
THE SEA OF ARTICLES!

With 6000 email distributions and 2000 printed copies delivered to the offices of ROV & subsea construction related companies 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.



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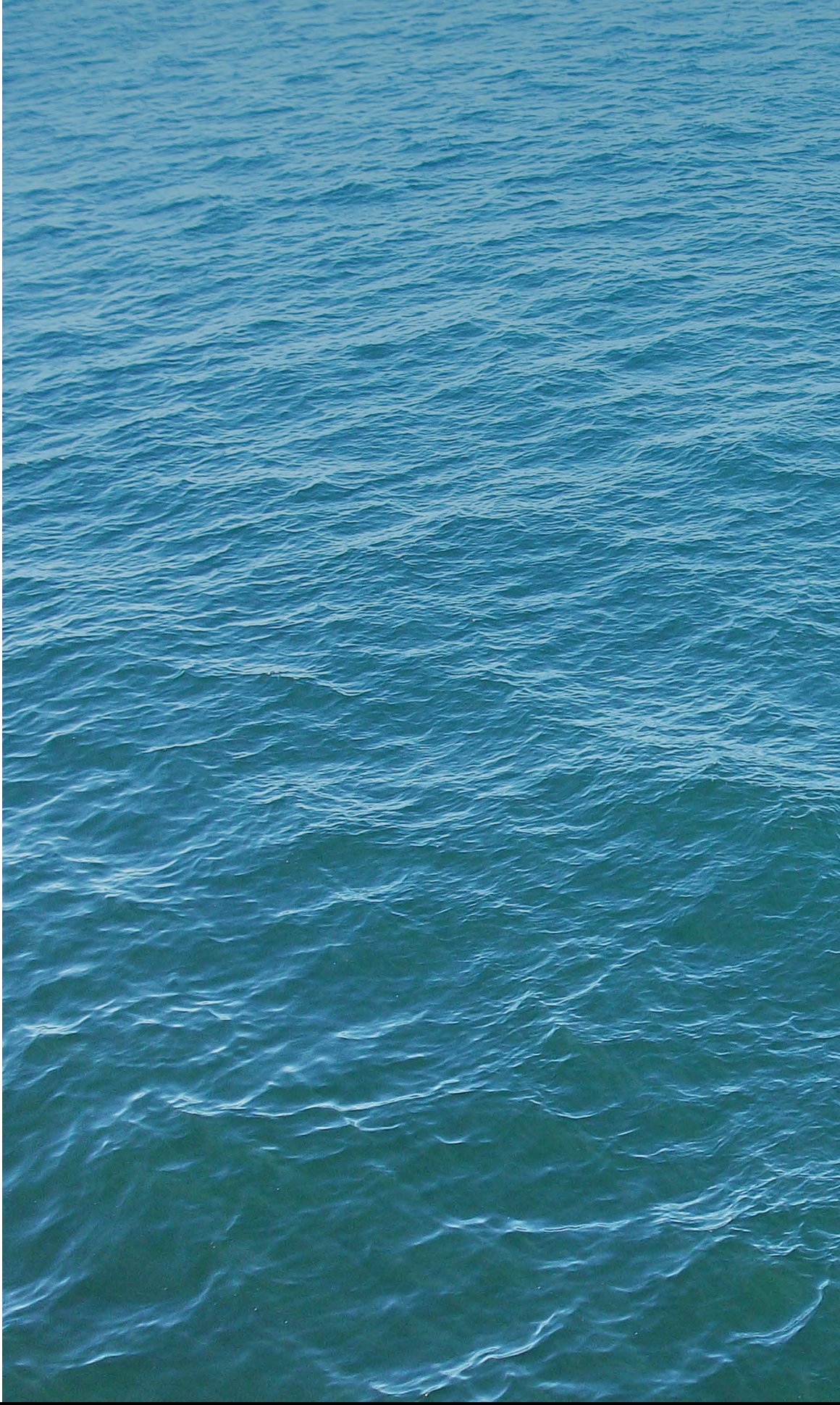

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