ROV PLANET

The magazine of choice for Subsea Construction and ROV Professionals

2
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ABOUT

With 6000 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.

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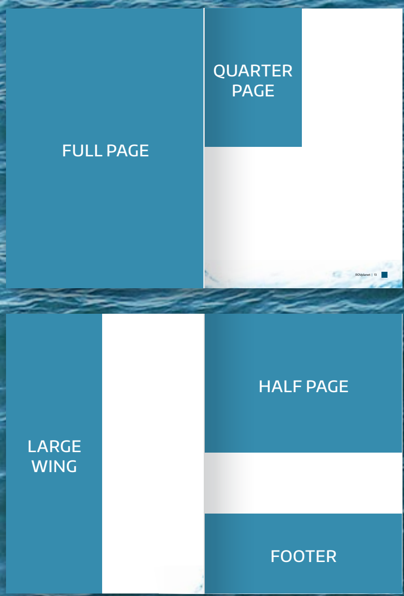

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Front Page Cover Photo: Courtesy of MATE

WELCOME TO ROV PLANET

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

Generally, I can say that the first issue was well received. Thank you so much for your positive comments and feedback on the magazine. I really appreciate it, and it really does encourage me to carry on with the publication.
Back in September ROV planet attended the Oceans'14 conference and exhibition, and the ROV Curriculum Workshop, both of which were hosted in St. John's in Newfoundland, Canada. It was an eventful week for all participants and it was great to see the locals – whether they were educators, provincial administration, or simply interested individuals - showing their enthusiasm and embracing the ocean related industries. Newfoundland has great potential to become the next Subsea hub and center of excellence, with state of the art facilities and business-encouraging-initiatives available to companies looking to strengthen their presence in the region. Given the region's experience with iceberg management and working in harsh climates, this could be the gateway for arctic oil missions in the future. In this issue we will explore this in more detail.
In October we attended both the DOT and Hydro'14 conferences and exhibitions held in Aberdeen, UK. At Hydro'14 I was lucky enough to meet with Jim McFarlane Sr. (ISE), where he talked about AUVs that are utilized in arctic under-ice explorations.
In December we attended OSEA2014 and were also invited to Ciscrea's ROV demo at the Nanyang Technological University in Singapore.
In this issue there is a report about the upcoming trends of the ROV industry, we will look at the Mariana Trench expedition which took the KAIKO to the deepest part of the World's oceans located in the western Pacific Ocean. Tom Glebas (VideoRay) shares his thoughts on ROV fleet management practices and invites you to join in with the discussion on our website (www.ROVPlanet.com) and in our LinkedIn group.
Finally I would like to apologize for the delay with the website. Creating the website was quite demanding in of itself, and since my resources are limited it is still under development. However the NEWS section is now operational and if your company has any ROV related, project or company news to share please send it over to us.

Sit back and enjoy the second issue!

Kind regards,
Richie Enzmann

UPCOMING EVENTS

10-12th February, 2015
Underwater Intervention (UI) – New Orleans, Louisiana, USA
The World's most premier event for commercial diving contractors, ROVs, and manned submersibles.

11-13th February, 2015
Subsea Expo – Aberdeen, UK
Europe's largest annual subsea exhibition and conference.

23-25th March, 2015
Arctic Technology Conference (ATC) – Copenhagen, Denmark
The World's most focused and comprehensive offshore arctic event.

24-26th March, 2015
MCE Deepwater Development – London, UK
Marine, construction & engineering deepwater development conference.

14-16th April, 2015
Ocean Business – Southampton, UK
The hands-on ocean technology and training forum and exhibition.

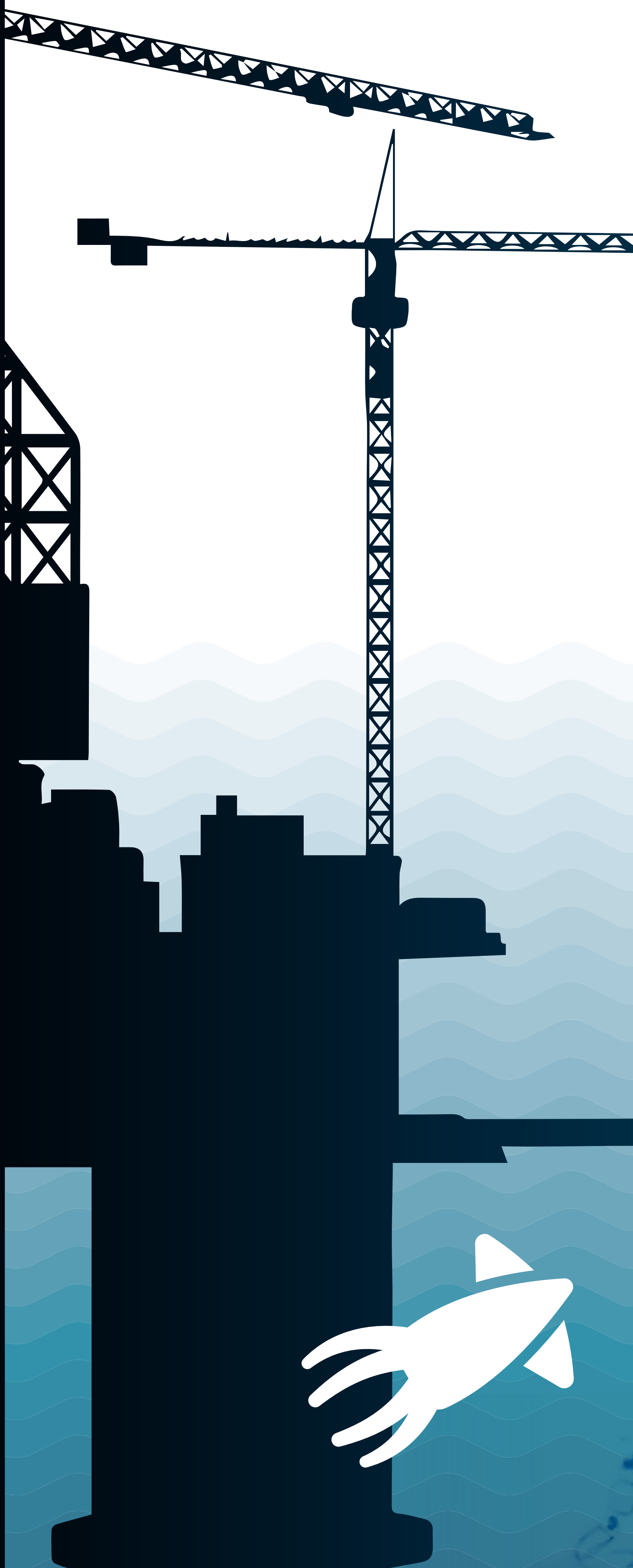
Please check out our website on:
www.ROVPlanet.com


UI
2015
FEBRUARY 10-12 • NEW ORLEANS

THE MAN BEHIND THE ROV DEMAND REPORT

The following Market Intelligence Report on the ROV industry was written by Kieran O'Brien. Kieran trained as a geologist before becoming an energy market analyst for Infield systems. One of his most recent projects was an investigation of the ROV/AUV market trends.

The forecast on demand changes of the ROV market is based on supporting data from the InfieldROV market intelligence tool and ROV databases. These tools are based on proprietary models that have been developed, assessed, and improved over the past eight years. The team of analysts, researchers, and SQL programmers are constantly striving to improve the modelling process and the primary input information, to produce some of the most reliable forecasts in the industry.



WORK CLASS ROV DEMAND CHANGES

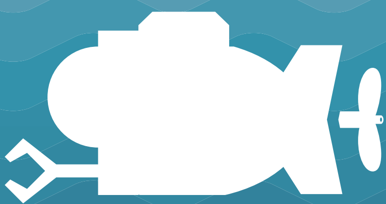
(2015–2019)

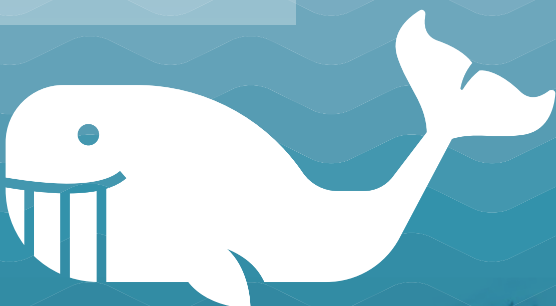
ROV demand within the oil and gas industry is driven by two distinct markets. There is the rig based market where ROVs perform observation duties and assist in work on BOPs, managing cuttings, and other seafloor-based work. The second market is the marine construction, vessel-based market, with work focussing on installation, IRM, and decommissioning. This tends to be driven by expected offshore capital expenditure (CAPEX) and operational expenditure (OPEX) levels. Variations in this market are caused by changes in the distribution of spend by operators depending on the Life of Field phase of a development.

VARIATIONS IN GROWTH RATES

Despite the stability of the ROV market as a whole, growth rates across regions and market segments are expected to vary a great deal during the forecast. The major narrative emerging from the trends in the market is higher growth in the marine construction market compared to drilling. The drilling market is largely constrained by the limits of rig numbers. The 11% forecast growth in the number of mobile drilling rigs to 2019 means there are limits on how much ROV demand can expand without a historically abnormal increase in rig utilisation rates. Rig operations will form 73% of ROV demand in 2019, a slight fall as a proportion of overall demand from 75% of the 2015 market. The dominance of the rig sector in influencing ROV market demand - and the low growth prospects from this sector - leads Infield Systems to project a low compound annual growth rate (CAGR) of just 3% globally for ROV demand.

The smaller marine construction market is anticipated to expand by 5% CAGR, with installation work growing by 11% and decommissioning by 9%. The marine construction market has good scope to grow for a variety of reasons. Basin maturation in the industry combined with a need to replace reserves drives companies to develop more complex fields, deeper water fields, or both. There is a significant amount of offshore infrastructure reaching the end of its operational life; requiring more IRM work as well as there being potential for decommissioning projects to get underway in the more mature basins. These factors could all help drive future growth for the marine construction market for ROVs.





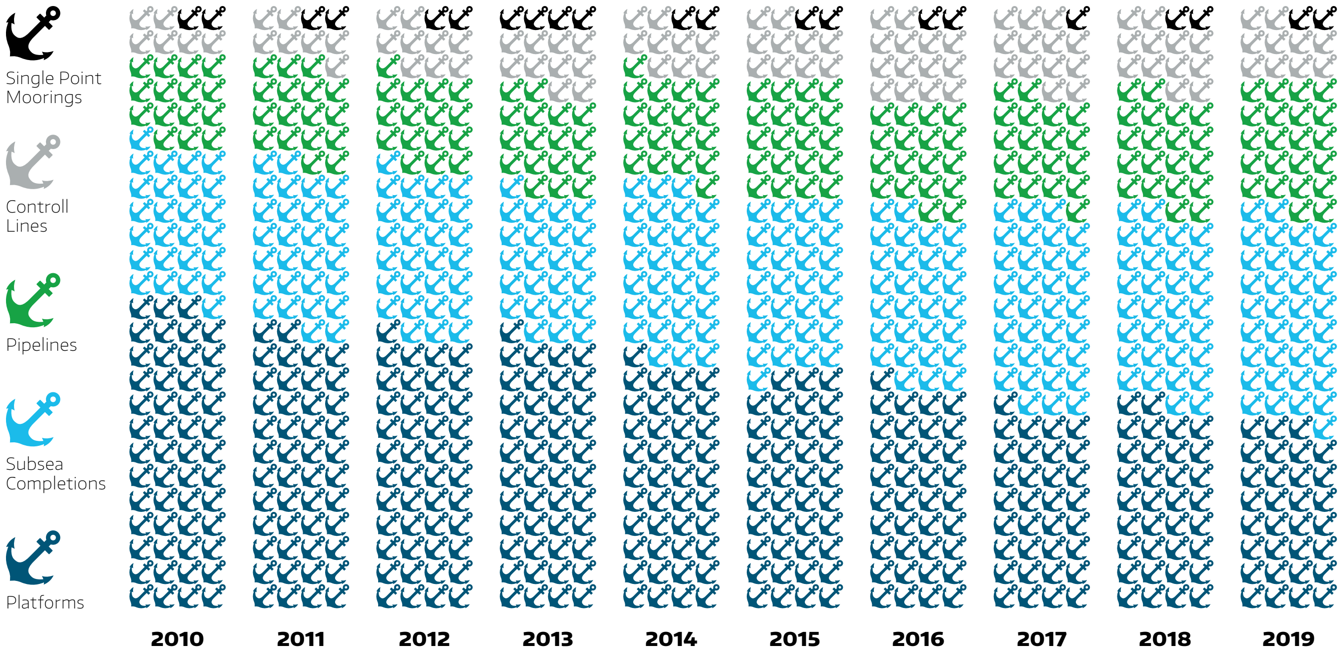


Figure 1: ROV Demand (%) by Region 2010–2019

Both the offshore drilling and marine construction markets depend heavily on ROVs for a whole range of activities. Infield Systems expects ROV usage to increase during the forecast to 2019, a consequence of poor reserve replacement prospects in shallow waters and sustained high oil prices enabling operators to work in deeper waters in search of reserves. ROVs already undertake a wide variety of work in the offshore industry and can work in competition or collaboration with divers. Divers have an edge in zero visibility conditions where ROV cameras become useless. However, the advent of truly high resolution sonar and other advanced subsea navigation equipment could begin to negate this advantage to divers even in turbulent seabed conditions.

Autonomous Underwater Vehicles (AUVs) are already proving to be highly beneficial to the industry, particularly during the exploration phase of field development, whilst technological developments around autonomous pipe inspection could help expand the AUV market.

Heavy work class ROVs will remain popular for the construction and decommissioning phases of life of field, yet there could be increasing opportunities from the production phase. Currently, light work class ROVs tend to be deployed on platforms. These are cheaper than heavy work class systems, but reduce the ability of operators to respond to unforeseen circumstances.

High rig day rates have caused the reliability of ROVs to become a critical factor in recent years, with new ROVs reaching the market that are focused on reducing downtime. This will be a major benefit to the industry in the future, as a rig can command a day rate a hundred times larger than an ROV, yet can be left idle for want of a working ROV. New ROVs require a large initial investment however, and with ROV day rates in the rigs market tending to be comparatively low, it is unclear whether these new systems will be cost effective to bring to the wider rig market.

GLOBAL AND REGIONAL DEMAND

Despite wide variations in regional growth rates, the forecast for WROV demand by region sees little fluctuation over the forecast. The high levels of inertia in the market stem from the fact that rig demand makes up the vast majority of the global ROV market, the use of rigs varies relatively little year by year on a regional scale and so proportional demand for ROVs sees little variation as a consequence.

Infield Systems forecasts Europe to retain the largest share of demand. Development and exploration drilling continues to fuel European ROV demand days; yet drilling demand growth will be relatively flat during the period to 2019. A lack of recent exploration work on the UK continental shelf (UKCS) compared to previous years and recent changes to the tax regime in the UK have depressed activity. Decommissioning in the region is expected to see a CAGR of 85%, and coupled with installation of subsea completions and control lines could drive any relative growth in European demand.

According to Infield Systems' ROV Tracker market intelligence tool, Asian ROV demand will remain the second largest globally. The South China Sea is the core market in the region, and despite the shallow waters, ROV demand is expected to grow by almost 4%CAGR. Well demand growth in the region will remain lower than the global average as the maturing basins of Southeast Asia require lower levels of drilling. Marine construction work in the region is expected to grow by 8.2%CAGR during the five years to 2019, driven by a rapid expansion in subsea completions demand; whilst pipeline installations also make up a large proportion of demand growth.

Despite starting from a low base, the Australasian requirement for ROVs is expected to grow by 3% CAGR during the forecast, potentially driven by higher demand for IRM services on pipelines and subsea completions in the Australasian market following the recent and short term forecast boom in installations in the region. However, Australasian

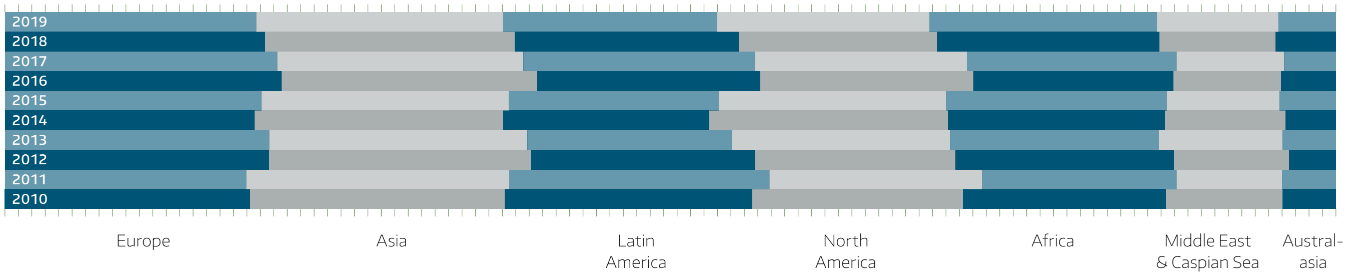


Figure 2: ROV Demand (excl. drilling) (%) by Object Type 2010–2019

WROV demand for installations is predicted to fall over the forecast, following a peak in demand in 2014, a result of high levels of pipeline and control line demand for the Ichthys development.

Most other regions are forecast to attract respectable growth in ROV demand of 4-5% CAGR, with the exception of North America, which is expected to see growth of just 1%. This can be largely attributed to lacklustre well demand growth of just over 1%, combined with a forecast fall in every marine construction work type except decommissioning. In North America, decommissioning is expected to grow by 7.5% CAGR whilst the overall marine construction market will contract slightly. The fall in marine construction work can be explained by a fall in all types of platform demand, bar installation. Platform work by ROVs will fall, a consequence of lower forecast decommissioning levels whilst current platform removals impact on future IRM work; pipeline work meanwhile will increase as a result of high levels of demand from deep and ultra-deepwater and rising levels of decommissioning demand.

PLATFORM AND SUBSEA EQUIPMENT RELATED ROV DEMAND

Platform ROV days will fall as a proportion of overall demand, as a result of higher growth levels within the subsea completions, pipelines, and control lines sectors. Single point moorings will continue to make up relatively small proportions of the overall market. Platform demand is expected to see a slight fall over the forecast of just 1% CAGR, but it is the rapid rise in other markets which contributes to the steep fall in the proportion of ROV days.

The pipeline and subsea completions markets are expected to expand by 8% and 11% CAGR respectively during the period to 2019, with strong growth across the majority of regions. The increasing use of subsea completions is driven by recent increases in the utilisation of subsea infrastructure over surface wells.

Subsea equipment is increasingly used to target reservoirs over a wider area with those fields then tied back to platforms, resulting in fewer platform installations per field development. These tend to be used particularly in deeper waters and mature basins where the profitability of developments can be improved without the need for new platforms. Deepwater developments also favour subsea equipment with FPSOs, the most common floating platform unsuitable for dry trees. The increased use of subsea equipment leads to increases in ROV demand from both the installations and IRM markets, whilst decommissioning of subsea equipment is expected to grow by 32% CAGR, the fastest forecast growth of any work type by object. Africa and Europe will drive this rapid growth in subsea decommissioning, with potentially high demand driven by just a handful of fields, with scores of trees likely to be removed in one year. The Ceiba field in Equatorial Guinea for instance, is probably largely behind the strong levels of demand for subsea completion decommissioning in 2019.

InfieldDecom – Infield Systems' decommissioning market intelligence tool suggests that pipeline demand could also be driven by potential decommissioning increases, with Europe, North America and Africa likely to lead this demand growth. Installation demand is forecast to grow by 64% CAGR in the Middle East with international export lines particularly in future Caspian Sea connections, pushing demand for pipeline installations higher.

The growth forecast for the ROV market is a result of the niche that ROVs have carved out for themselves. This is true in both the drill support activity and marine construction markets. Without advances in ROV technology, many of the currently producing deepwater developments would not have been possible. Despite the incredible advances that have been made in ROV technology, their already wide ranging repertoire in the industry will only expand as subsea developments become more complex.

MICRO-ROV FLEET MANAGEMENT

HOW MANY IS A FLEET, AND WHY SHOULD YOU CARE?

By Tom Glebas, Vice President Product Management, VideoRay LLC

This is part 1 of a series that will help you understand how managing a Micro-ROV fleet using specific techniques and tools can add value to your business or support more effective utilization of budgets and assets in the public sector. While this series has been written to address a fleet of Micro-ROVs, the concepts and practices included have applicability at any level of ownership, even if you own just one.

In 1973, Federal Express took a fleet of 14 small airplanes carrying 186 packages and revolutionized the express delivery model. Today FedEx owns the world's largest all-cargo air fleet, with a total daily lift capacity of more than 30 million pounds (13.6 million kilograms)[1]. How did they achieve that? Did FedEx invent the airplane? Don't be silly! Was FedEx the first to air ship a package? Of course not! FedEx recognized that the value of their business model was not based on simply owning technology, but in how it was managed and used to satisfy the demands of their market. There is clear evidence they clearly understood the concepts of a fleet and implemented best practices of fleet management to get and stay on top of their industry.

How does all that apply to Micro-ROVs? Do you own any Micro-ROVs? If so, do you think of and treat them as mission critical assets, or are they just another tool in the toolbox? And, if you own more than one, do you identify them as a fleet and manage them accordingly?

Before we delve into our recommendations for why you should espouse adopting a fleet management strategy (even if you own only one Micro-ROV) and share our thoughts on best practices, let's consider the technology adoption timeline of Micro-ROVs relative to another technology adoption example.

The timeframe we are in with Micro-ROVs is very analogous to many other paradigm changing phases of technological implementations such as the introduction of personal computers into the workplace. When computers were first introduced into businesses, they were mainframes or minicomputers requiring a dedicated/trained staff. When PCs entered the market and started showing up on employee's desktops, companies generally weren't ready for the transition. A company might have been lucky enough to have a PC guru who knew their potential value, understood how they worked, and was able to help others along, but in many cases there was a lack of foresight and planning necessary to deploy and manage these assets and train staff properly. The PC implementation road for many was pretty bumpy.

There comes a time when the use of new technologies has to shift from being valuable solely on the basis of an individual operator/champion, to being recognized by management as mission critical assets that deserve a more sophisticated, universal and mainstream approach to their adoption and use. In other words, at some point, management finally "gets it."

[1] http://about.van.fedex.com/fedex-opco-history

Courtesy of VideoRay

What does it take to reach that state, and are we there yet with Micro-ROVs? I believe there has to be a confluence of several critical technology evolutionary milestones before we can reach the stage of enlightenment. These milestones include:

- FEATURES AND CAPABILITIES – Micro-ROVs need to be able to do the jobs for which people want to use them in conditions where they are needed. They need to be more than just "swimming cameras," but able to work in low visibility, deeper depths, stronger currents and with more sophisticated sensor payloads and tooling. Systems should also be able to integrate data from multiple sensors for simultaneous recording, analysis and playback.

- RELIABILITY – Micro-ROVs also need to be reliable so that it doesn't take a MacGyver type individual to keep a system running and be successful – just your average guy or gal with proper training.

- CRITICAL MASS AND WIDESPREAD ACCEPTANCE – There needs to be evidence of enough systems doing enough jobs successfully so that their worth in particular situations can be easily evaluated and confirmed.

- MANAGEMENT RECOGNITION – Owners and managers need to develop an understanding of the mission critical value of these assets and willingness to make continued sustaining investments (beyond the initial purchase price) in training, maintenance and upgrades.

- VENDOR SUPPORT – Vendors need to support the ability to get service and repairs to keep systems operational, and provide not only technical support, but fleet management training and tools.

Additionally, there is a typical new technology adoption path that looks something like this:

- 1. VISIONARY STAGE – When someone has an idea to try something new for something that has either always been done using a different method or has never been done before using any method.

- 2. OPERATIONAL CHAMPION STAGE – When someone promotes the idea that a company can benefit from the work of a visionary and is successful in getting the company to make the initial investment in the new technology.

- 3. GO-TO GURU STAGE – When someone within the company is able to "make it go" on their own, while most individuals around them are still somewhat clueless.

- 4. MANAGEMENT CHAMPION STAGE – When management decides it needs more Go-to-Gurus and fewer clueless staff.

- 5. INSTITUTIONALIZATION STAGE – When management organizes its company's policies and programs to ensure that its use of the new technology is effective, universally adopted (among appropriate departments or staff) and sustainable.


Courtesy of VideoRay

Courtesy of VideoRay

Courtesy of VideoRay

I believe the evolutionary milestones have been achieved, with the exception that very few vendors support feet management at any level for their products and services. However, from my experience with our customers at VideoRay, most companies currently using Micro-ROVs seem to have only achieved Stage 3 along the technology adoption path. So, do you "get it" and at what stage are you?

How do you think about the Micro-ROVs in your business?

- Is there a strategic long-range plan for their use and sustainability?
- Are the operational plans and protocols governing their use for specific missions?
- Are your human resources trained and subsequently qualified to do their jobs using them?
- Are your systems well managed and cared for during operations?
- Are your system well managed and cared for between missions so they are ready to use at a moment's notice?
- Are there enough spares on hand to keep operations running?
- Is the video, sensor and other data collected well managed and archived upon mission completion?
- Do you have a close working relationship with your vendor?
- Before concluding this installment, let's return our attention to the details of specific fleet management concepts and practices, starting with the risks, costs and value proposition.

Your thoughts on this topic are invited on the ROV Planet Forum.

WWW.ROVPLANET.COM

RISKS* OF NOT IMPLEMENTING FLEET MANAGEMENT PRACTICES:

| Lost/broken items and components due to lack of control over the equipment

| Rouge operators unable to complete projects or potentially even harmful to the equipment or others and therefore a liability risk

| Inconsistent maintenance and lack of readiness of the equipment

| Increased down time

| Low quality product/deliverables for customers

* A good "Go-to Guru" could mitigate some of these risks, but that is not a reliable, consistent and well thought out strategy.

COSTS** ASSOCIATED WITH OWNING A FLEET:

| Equipment expenses (capital investment)

| Operator expenses (hourly rates)

| Training expenses

| Operations costs (mobilization and logistics)

| Maintenance and repair expenses

| Upgrade expenses (to keep fleet robust and on-par with current technologies and capabilities)

**Some of these apply whether you implement a fleet management strategy or not, but in theory, expenditures on training and other fleet management practices will likely result in overall savings in maintenance and repair expenses and improve overall quality.

VALUE PROPOSITION OF ADOPTING BEST PRACTICES OF FLEET MANAGEMENT PRINCIPLES:

| Lower total cost of ownership and increased return on investments

| More effective use of assets (matching resources – equipment and personnel with job requirements)

| Increased equipment longevity

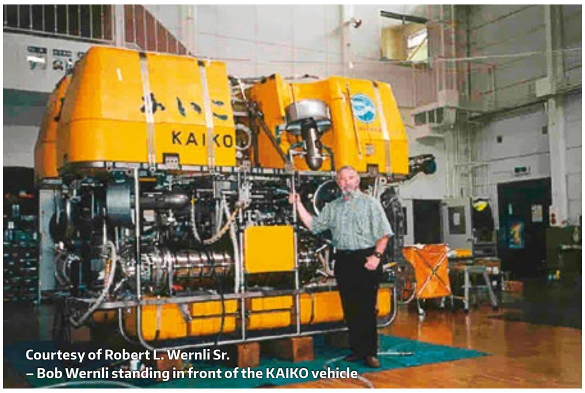
| Career development opportunities for employees

| Competitive advantages

Future installments of this series will address concepts of fleet management and best practices, the need for and a proposed model of a Micro-ROV certificate program, and a call for better vendor support of fleet management requirements and initiatives.

ROV HALL of FAME

Courtesy of Robert L. Wernli Sr.
– Bob Wernli standing in front of the KAIKO launcher



Courtesy of Robert L. Wernli Sr.
– Bob Wernli standing in front of the KAIKO vehicle

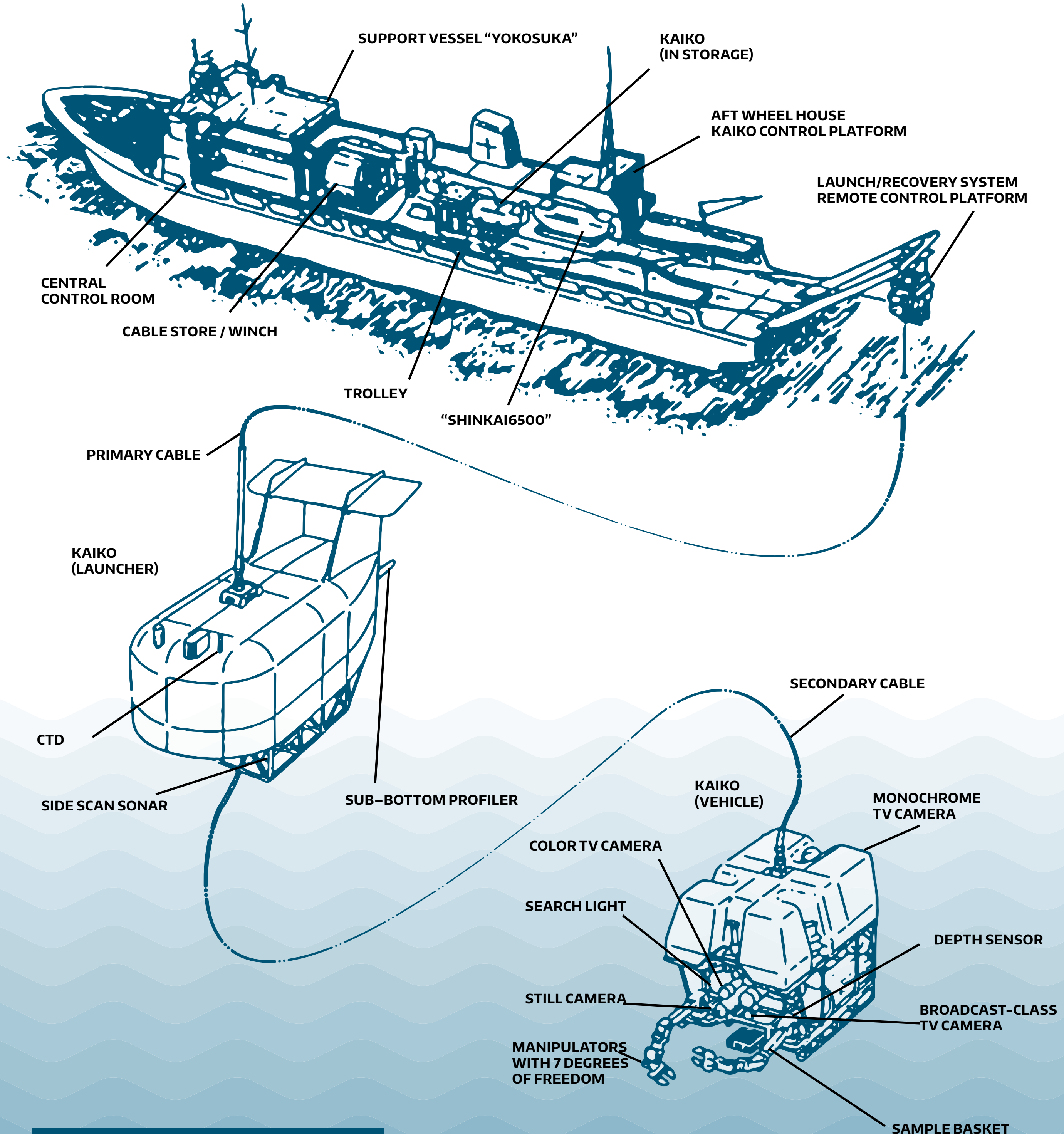
Courtesy of JAMSTEC – KAIKO vehicle & launcher

BY ROBERT WERNLI, SR.

THE KAIKO

Japan developed the KAIKO, which has reached the deepest part of the ocean-10,911.4m in the Mariana Trench. Whereas reaching a depth of 6,000m in the ocean was a tremendous feat by an ROV, the giant leap made by Japan in reaching a depth nearly twice that was truly phenomenal. The KAIKO was a two vehicle system: the launcher, which connected to the ship via the 12,000meter electro-optic primary umbilical and also handled the 250meter secondary cable to the vehicle, and the free swimming vehicle that could operate around the launcher within a 200m radius. During vehicle operations, the KAIKO launcher normally hovered at a point 100meters above the sea floor.

The KAIKO had three mission modes. The first was to survey the ocean floor down to a depth of 6,500m by towing the system, which carried a side scan sonar and a sub bottom profiler on the launcher. This provided the capability to conduct sea floor topography and investigated the stratum beneath the sea floor. The free-swimming vehicle could use its TV cameras for precise survey of the sea floor. The second mission was to extend the sea floor survey down to full ocean depth. In this case, the launcher was not towed, but hanged below the ship (depending on the current profile) while the vehicle performed a precise survey of the ocean floor. And, the third mission was to provide a rescue capability for the SHINKAI 6500 manned submersible. The KAIKO, which quite fittingly means "trench," completed its ultimate dive to the bottom of the Mariana Trench on March 24th, 1995. After a three hour trip, the vehicle reached the sea floor at 11°22.400' N and 142°35.550' E, where it conducted some research and left behind a calling card for future visitors.



KAIKO SPECIFICATIONS

VEHICLE

DIMENSIONS: 1.52m L × 2.6m W × 2.0m H

WEIGHT: 5.3 tons (in air), 3.2 tons (in water)

TOW SPEED: 1,5 knots

LAUNCHER

DIMENSIONS: 3.1m L × 2.0m W × 2.3m H

WEIGHT: 5.6 tons (in air), –10 kg (in water)

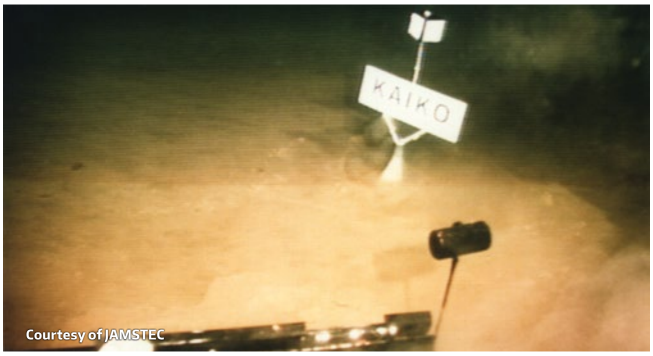
POWER: Electro-hydraulic power, 45kW

SPEED: 2 knots


Courtesy of JAMSTEC

THE MARIANA TRENCH EXPLORATION (JAMSTEC)

ROV Planet interviewed the Marine Technology and Engineering Center (MARITEC) of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), that is mainly engaged in the development of marine technology including Remotely Operated Vehicles (ROV) and Autonomous Underwater Vehicles (AUV), about the Mariana Trench Expedition to the deepest part of the ocean in 1995.

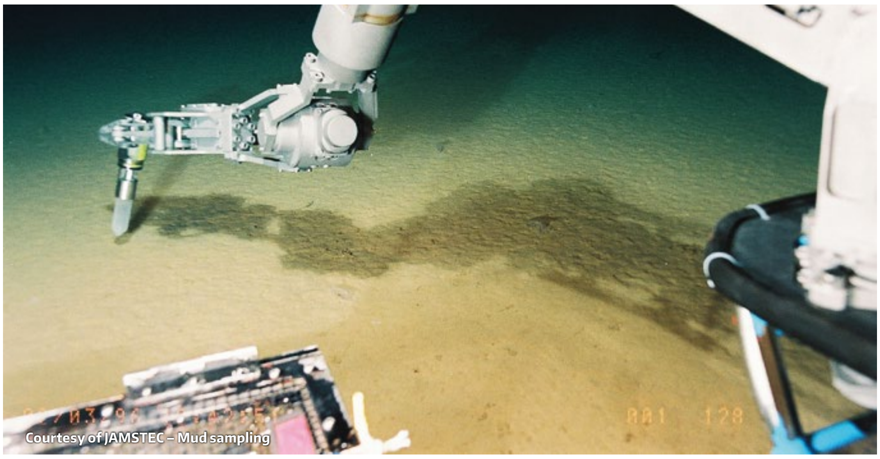


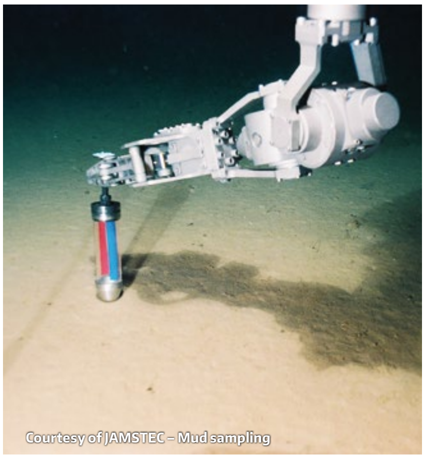
Courtesy of JAMSTEC

| RICHIE ENZMANN: How did JAMSTEC come up with the idea to explore the Mariana Trench? What was the purpose or motivation behind this expedition?

| MARITEC: In 1985 a plan was developed to construct an 11,000 m class ROV *KAIKO*, when the design of a support vessel, *YOKOSUKA* for a manned research submersible, *SHINKAI 6500* was suggested. The original purpose of this ROV was not to explore the Mariana Trench. *KAIKO's* construction was originally planned for the purpose of emergency rescue operations and preliminary surveys for the *SHINKAI 6500* manned submersible. Due to the existing regulations at the time, *SHINKAI 6500* required a pressure resistant depth of 10,050 meters, or more. Therefore, the maximum dive depth of *KAIKO* was considered to be 10,050 meters.

| When the final specifications were examined, the maximum depth of *KAIKO* was determined to be 11,000 meters so that it could reach the maximum depth of the ocean. There weren't any technical difficulties involved in increasing the maximum depth by an additional 1,000 meters.


Courtesy of JAMSTEC – Mud sampling


Courtesy of JAMSTEC – Mud sampling

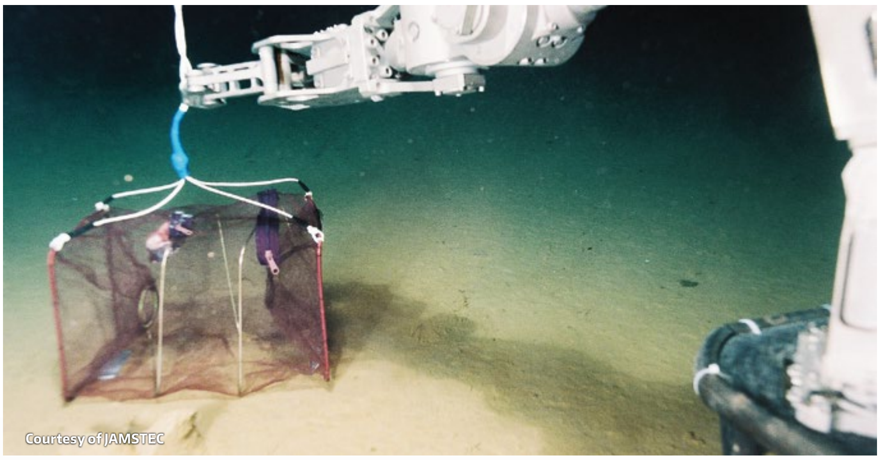
This allowed *KAIKO* to explore any ocean floor around the world, except areas covered by sea ice. Thus, the idea of exploring the Mariana Trench came from technical abilities rather than scientific needs. No equipment capable of exploring the Earth`s deepest point (Challenger Deep – at 10,898 m depth) had been available at that time.

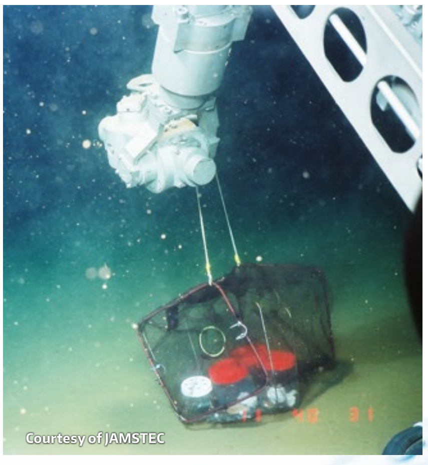
| RE: What have you found on the bottom of the sea? Have you collected any samples? What were the water conditions and currents like?

| MARITEC: There were no currents with very good visibility which created a very somber impression of the ocean floor. Between 1995 and 2003 the *KAIKO* achieved 19 dives to the Mariana Trench Challenger Deep, until 2003 when she lost her vehicle through a snapping of the secondary cable. During the dives, the *KAIKO* successfully discovered and collected deep sea creatures and micro-organisms. In 1995 when *KAIKO* reached the Challenger Deep for the first time, no living organisms were clearly observed through the monitor camera. However, several days later, it was found out that a shrimp-like creature was photographed. In May 1998, for the first time in the World, *KAIKO* successfully collected a sample of a benthic organism, Hirondellea gigas (approx. 4.5cm long) at Challenger Deep, 10,900m deep. In March 1996, *KAIKO* was sampling almost 20 ml of sediment at Challenger Deep. About 180 species of micro-organisms were identified from the mud samples. This achievement by *KAIKO* led to new areas of research in marine extremophiles. In May 1998, for the first time in the world, *KAIKO* successfully collected a sample of a benthic organism, Hirondellea gigas (approx. 4.5cm long) at Challenger Deep, 10,900m deep.

| RE: How many people were involved in this project, and who were the major manufacturers?

| MARITEC: The ROV development team was made up of approximately 15 members, and the team was led primarily by the Deep Sea Technology Development Department of the Japan Marine Science and Technology Center (JAMSTEC). The manufacturers included Mitsui Engineering and Shipbuilding Co., Ltd. They were the prime constructors of the vehicle itself, the onboard operating system, and the primary cable handling system. Mitsubishi Heavy Industries Ltd. assisted in building the launcher, operation decision support system, and the data processing equipment. Sumitomo Electric Industries Ltd. created the multiplexed data transmission system for the ROV's optical communication system, and Fujikura Ltd. built both the primary and secondary cables. Finally, Kawasaki Heavey Industries Ltd. were responsible for a range of components, including the movable carriages, the launch and recovery system, and the acoustic positioning system.


Courtesy of JAMSTEC

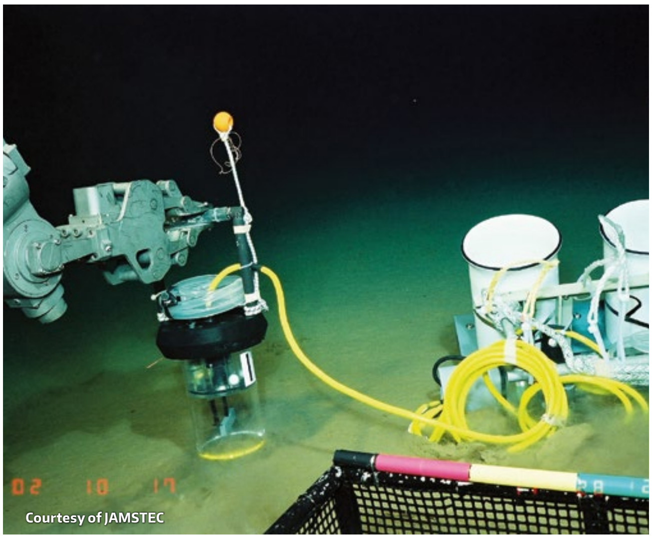

Courtesy of JAMSTEC

| RE: Please tell me more about the preparation for the expedition?

| MARITEC: Pressure levels at 11,000 m are approximately 1,100kg/cm². To develop a remotely operated vehicle normally various technologies were developed using test facilities on land.
The Hyperbaric Chambers allowed us to reproduce pressure conditions of the deep sea at a depth of 14,000m. They were used for pressure-tolerance tests, operations tests for various deep-sea instruments and materials such as manipulators, the underwater camera, and cable performance check. They had a maximum pressure of 147 MPa (approx. 21,321 PSI) with dimensions of 1.4m (inner diameter) × 3m (height) = 4.61m³ (volume) and with dimensions of 0.6 m (inner diameters) × 1.6m (height) = 0.49m³ (volume).
The ultrasonic tank was used for checking the capacity of the underwater acoustic transducer and other underwater acoustic instruments. Made out of Ferro-concrete material the tank dimensions were: 9m (length) × 9m (width) × 9m (depth). The anechoic device used: Acoustic absorbent (Meyer rubber) attached to all sides and bottom (5 surfaces).
A large tank (owned by Tamano Works, Mitsui Engineering & Shipbuilding Co. Ltd.) was used for underwater performance tests on the *KAIKO's* launcher and vehicle with dimensions of: 11m (length) × 8m (width) × 7m (depth).

| RE: What were the biggest challenges involved in this expedition? What memories will stick in your mind when you think back on the trench expedition?

| MARITEC: The development of *KAIKO* – a machine designed to traverse the deepest parts of the world's oceans - was a big technological challenge for us. Many companies and engineers worked together using the best technologies available in Japan. As result, it took eight years from initial development to successful diving to the Mariana Trench. During this period, the team was faced with various difficulties including damage sustained to the launcher's outer surface, secondary cable troubles, blackouts, and cracks in buoyancy materials. When *KAIKO* successfully reached the 11,000 m dive at the Mariana Trench in March 1995, all of those concerned were extremely moved. *KAIKO's* completion led to many breakthroughs in research areas of earth science, deep-sea organisms, and micro-organisms.
In May 2003, *KAIKO* lost her vehicle through a snapping of the secondary cable. Upon scientists' strong requests, JAMSTEC introduced a 7000m class deep sea ROV, *UROV7K* for replacement to operate *KAIKO 7000*. This was remodeled and has been operated as *KAIKO 7000 II*. Then, JAMSTEC developed a new ROV, *KAIKO Mk-IV* as the fourth *KAIKO* vehicle with a maximum diving capability of 7,000m. In 2014, the primary cable was exchanged. By the end of 2014, JAMSTEC aims to complete remodeling of *KAIKO Mk-IV* to enable diving as deep as 11,000m. In the near future, the sea trial will be planned to reach the maximum depth at Challenger Deep in the Mariana Trench.



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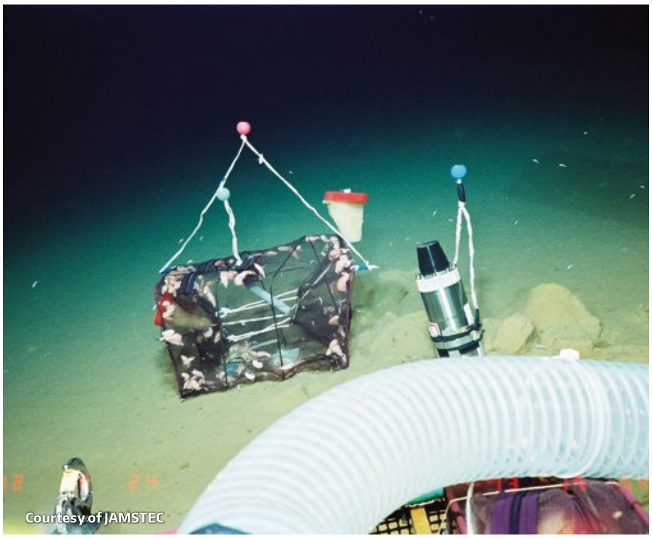


Courtesy of JAMSTEC

TIMELINE

It took eight years of development for the KAIKO to reach the deepest point of the Mariana Trench in 1995, with development starting in 1988.

| 1988: Basic design

| 1989-1990: Detailed design

| 1990: Started construction

| 1992: Almost completed construction and land test. Also, remodeled YOKOSUKA with equipment of

| the primary cable handling system and KAIKO control panel, and implemented test operation at the quay.

| 1993: Cruising test

| March 1, 1994: Sea trial at Challenger Deep (However, the trial was suspended around 2m above the seabed due to black out of the optical communication system.)

| March 24, 1995: Successfully reached 10,911.4m at the Mariana Trench during the sea trial

HALLIN MARINE ROVS

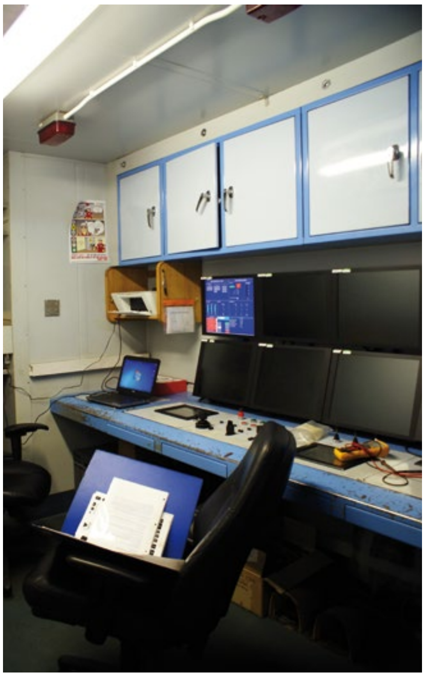
LOOKING FOR A GOOD HOME...

By Richie Enzmann

The closure of Hallin Marine, an integrated subsea contractor with an ROV fleet headquartered in Singapore, has come as a surprise not only for the industry, but also for most of the company's employees. The news was even more surprising when you consider the generally positive outlook reflected by most of the industry last year.

I remember seeing a report last summer where David Dunlap, the CEO of Superior Energy Services, talked about restructuring the business to pursue more opportunities in North and Latin America, and focusing more on the bread and butter type businesses such as hydraulic fracturing, service rigs, and rental tools to create a better execution model for their customers. Also, with Mexico very recently opening up its oil fields to foreign companies this could create an attractive deal which would allow many companies to focus on the Gulf of Mexico region in order to get a slice of this new cake.

SES bought Hallin Marine a few years ago as a part of its subsea strategy. However, following the Deepwater Horizon disaster in the Gulf of Mexico, new tightened regulations were introduced, impacting on the company plans to utilise Hallin vessels and subsea equipment in the deepwater well intervention market. Hallin were left to continue operations under the guidance of founder and CEO John Giddens but suffered from under-utilization issues with their assets and were beset with other challenges. This created many losses for a company that had been otherwise very successful.



After the plans for restructuring Hallin were made by SES in 2013, the decision was taken to sell off Hallin Marine. The company had been for sale since last February but has not been sold due to long negotiations with the potential buyers, with no agreement reached on a purchase. As this has been dragging out for so long with further losses incurred, the decision was made to close down the company and sell off the assets.

I had a look around the Hallin Marine yard in Westhill and there are some perfectly good ROVs there; some are even brand new and available for potential buyers. These assets are just waiting for someone to make a great investment. Office and field personnel have been retained by the company in order to manage and close out ongoing operations and maintain and operate the remaining assets until all of them are sold off.

It's always sad to see a company cease to exist for whatever reason. However I'm hoping that these ROVs and their experienced personnel will quickly become valuable assets either for the established ROV operators or for the fast expanding smaller ROV startup companies! In fact, many personnel and assets have already found a new home in the industry.

OSEA2014 WITH ROV DEMO IN SINGAPORE

In December ROV Planet has visited the Offshore South East Asia (OSEA2014) conference and exhibition. Despite the recent worrying low oil price phenomenon, it was still business as usual in Singapore the South East Asian business capital. The exhibition has occupied 3 full levels of the iconic Marina Bay Conference Center and was very well attended. The ROV industry was also well represented with ROV manufacturers (Oceaneering, SMD, Forum, Fugro, IKM, Seaye, Teledyne-Seabotix, CISCREA, Ageotec) occupying impressive booths and showcasing their underwater vehicles.

Using OSEA14, CISCREA together with their Singaporean partner Precision Technology, finally introduced the "JACK" Mini-ROV to the South East Asian public during a pool demo at Nanyang Technological University (NTU).
CISCREA, a French engineering company specializing in the design and manufacture of complex multidisciplinary systems in hostile and industrial environments, co-developed JACK as a modular, open, and easy to use Mini-ROV system.
"The numerous pay- and workload options of the Mini-ROV platform, the open specs, and the accessible command and control protocols make JACK an ideal tool for diving contractors, port authorities, research labs and defense forces in the Singapore Strait shallow water region, something that was reflected by the visiting crowd." said Andreas Pinsker, the Sales and Marketing Manager of CISCREA.
“Working with and learning from the industry, serves as a pathway to innovation. Systems like the Mini-ROV could be used as a platform to study new ROV applications, and test new payloads.”, said Remy Christian Izendooren, R&D Engineer at the Marine & Offshore Technology Centre of Innovation at Ngee Ann Polytechnic, Singapore. The Centre is also a part of the Singapore Maritime Institute, which drives and coordinates maritime research and education initiatives within Singapore to serve the growth of the industry.
Tasked with the establishment of an Underwater Vehicles and Technology laboratory, Remy frequently attends relevant industry events to seek collaborators and ensure a thorough understanding of the education, training and research needs of the industry.

David Bouchaud, President of CISCREA demonstrating the capabilities of the JACK Mini-ROV


CISCREA

PLANET

CISCREA MINI-ROV JACK 100

TYPE OF ROV: Observation and Inspection

PERFORMANCE :

Depth Rating: 100m / 300m (standard)

Weight in Air: 13Kg / 15 Kg (standard)

Dimensions: 570 x 415 x 260 mm (standard)

No. of Thrusters: 6

Thrust Speed: 3 knots (boost)

Thrust: 1.4 kgf (Vertical) / 2.4 kgf (Horizontal)

Power: Battery or 230VAC

Lighting: 4 LED Spot Lights

Camera:
+/- 40°Tilt / (Auto)Switch B/W – Color PAL

Auto Functions: Depth & Heading

Optional: additional sensors & manipulator

MTS BBQ

Courtesy of Delta Subsea

Courtesy of Delta Subsea

Delta SubSea LLC. has held the annual MTS BBQ on Thursday, October 23rd for MTS (Marine Technology Society) members and students. The event, which was held at the new Delta SubSea Tooling Solutions Facility in northwest Houston, helped raise money for scholarships for students interested in pursuing careers in the offshore oil & gas and marine industries. A total of 700 people pre-registered, 599 plates of BBQ were served and $60,000 was raised for scholarships; the most the organization has ever earned.

"The MTS BBQ was a great opportunity to not only showcase Delta SubSea's new tooling facility and test tank, but to also raise money for a good cause," said Scott Dingman, President – CEO of Delta SubSea. "We're extremely pleased with the turnout at the event and look forward to continued participation as sponsor for many years to come."

Delta SubSea would like to extend its sincerest gratitude to all parties involved in making the MTS BBQ such a tremendous success.

To learn more about participating in future MTS events please visit: www.mtshouston.org.
For more information about Delta SubSea please visit: www.deltasubsea-rov.com


Courtesy of Delta Subsea

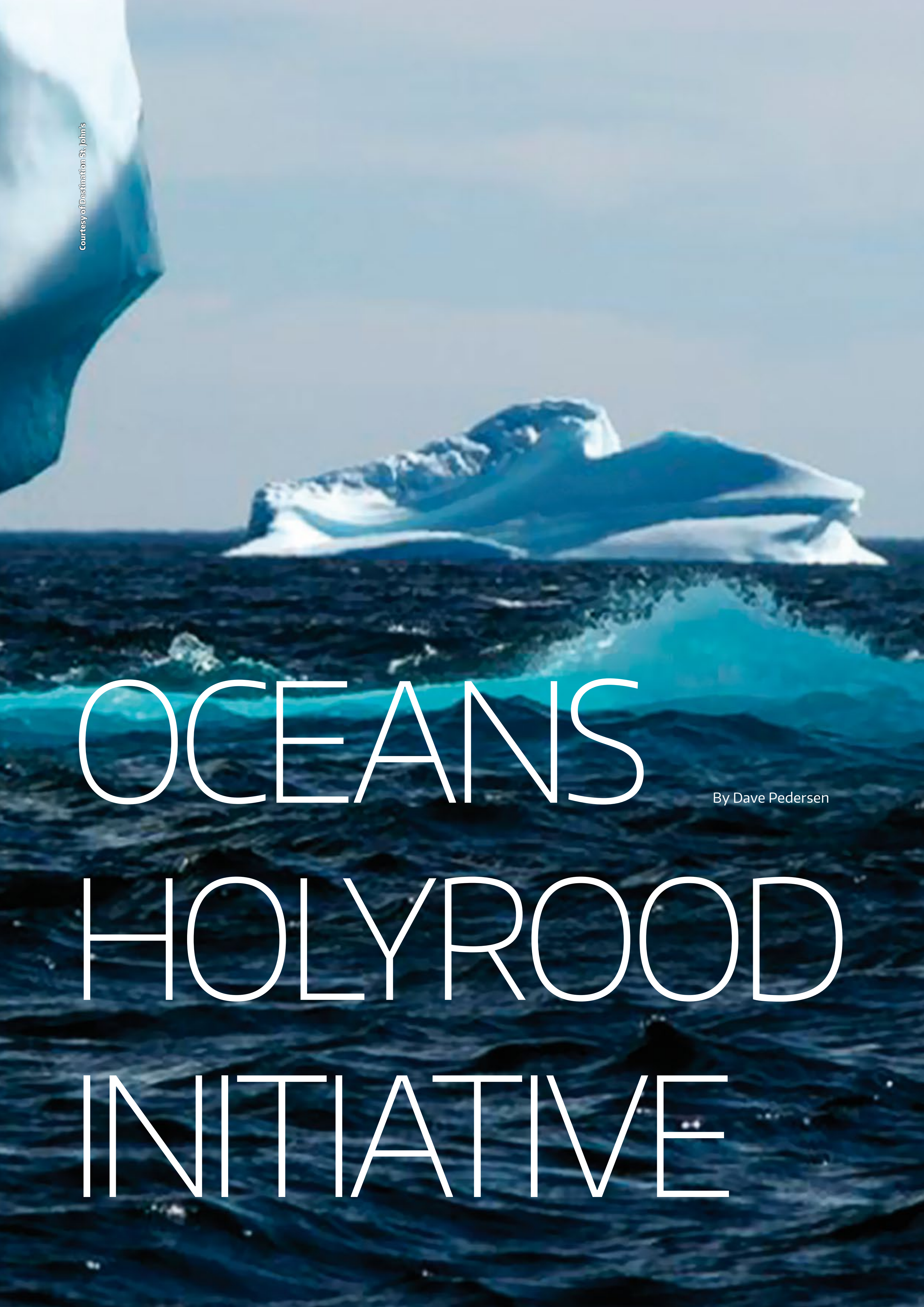

Courtesy of Delta Subsea

Courtesy of Delta Subsea


Courtesy of Delta Subsea


Courtesy of Delta Subsea


Courtesy of Delta Subsea



Courtesy of Destination St. John's

OCEANS HOLYROOD INITIATIVE

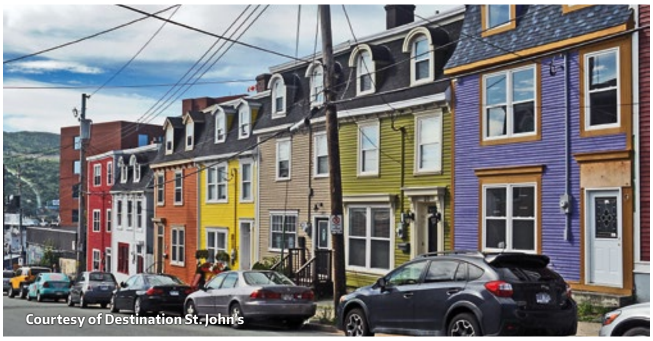
By Dave Pedersen

Jutting out into the middle of the North Atlantic Ocean sits the Canadian Province of Newfoundland and Labrador. Despite the fact that it is an island surrounded by the most notorious stretch of cold ocean, the surrounding waters are also full of rich sealife and a growing offshore industry. With the shared experience of over 400 years of life influenced by an ocean that is both giving and foreboding, through necessity and love Newfoundlanders and Labradorians have developed a special relationship with the sea. The island of Newfoundland itself is the home of both the first settlement in North America, as well as the continent's oldest city, Newfoundland's capital St. John's.

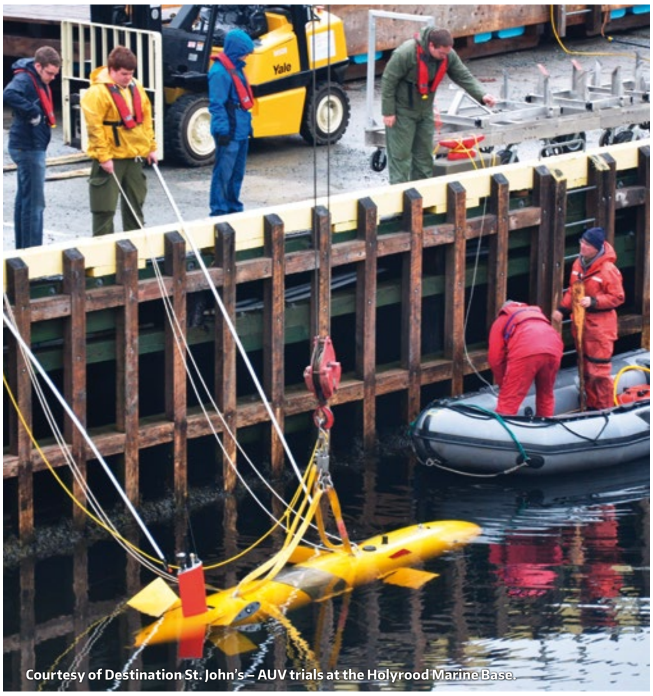
Perfectly positioned on the Avalon peninsula, Holyrood sits just off the Trans-Canada Highway; minutes away from the St. John's International Airport, and all major economic engines of the Province including the Long Harbour mine; the Bull Arm offshore construction site; and the ferry terminal at Argentia. This strategic location gives rise to Holyrood's position as a great place to live, learn, work and play.

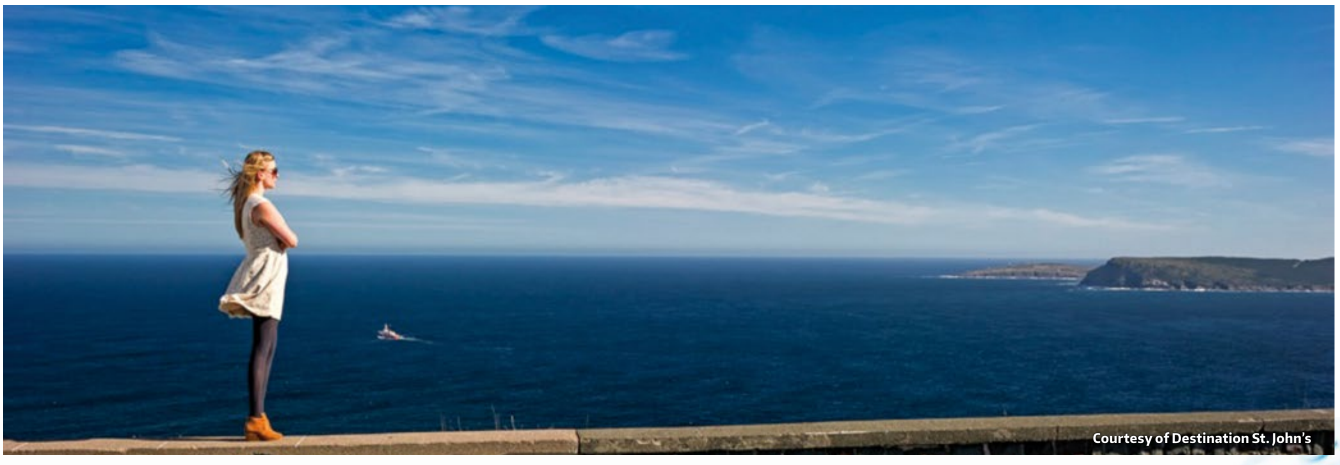
Holyrood itself traces its history as far back as 1675, and is proving to be a popular destination for folks settling on the Avalon. At a time when some Canadian coastal communities are dwindling, Holyrood is a far different story. Home to majestic hills and coastline, beautiful walking trails, and pristine ocean, Holyrood has long been a destination for outdoor enthusiasts and nature lovers alike and now others have taken notice. Fuelled by an active, energetic and deliberate injection of an innovative development plan, Holyrood is placing itself on the edge of the ocean technology sector while retaining its simple, safe, family oriented appeal.

In 2009 Conception Bay was the second bay on the island to become a 'SmartBay'. SmartBays have sophisticated weatherstations that can measure and/or calculate apparent wind speed and direction, barometric pressure, air temperature, relative humidity, dew point, wind chill, and visibility. The project is the result of an alliance between education centres in both Nova Scotia, Newfoundland, and Labrador called the SmartAtlantic Alliance; with all information recorded being provided online free of charge in


Courtesy of Destination St. John's


Courtesy of Destination St. John's – Birds eye view of the city of St.John's


Courtesy of Destination St. John's – AUV trials at the Holyrood Marine Base.


Courtesy of Destination St. John's

near-real time. Holyrood's SmartBay buoy system was significantly upgraded in April of this year, and has been a significant asset to both local mariners and researchers alike. Taking notice of the growth and opportunity in the area, in 2012 The Fisheries and Marine Institute of Memorial University of Newfoundland (MI) decided to expand its research capability by moving its Centre of Applied Ocean Technology to Holyrood. This 10,000 sq ft marine base located on the Holyrood harbour front allows the institute to conduct at-sea product development, testing, training, and experiential learning, for both industry and students alike. The Marine Institute also keeps its research vessel at its Holyrood Marine Base; the 116ft 'Anne Pierce' is available 24-7 – weather permitting – for a host of research applications. The move has proved very valuable, so valuable in fact that the Marine Institute is seeking funding to increase its presence in Holyrood four-fold. In addition to expanding its facility to 40,000 sq ft, the university is also planning to build a breakwater and wharf at its base. This improved infrastructure opens the possibilities of new and innovative growth in the oceans sector.

THE OCEANS HOLYROOD INITIATIVE

To foster and promote the ocean technology sector in the community, the Holyrood Town Council created the Oceans Holyrood Initiative (OHI) in 2013. Gary Corbett CAO and the Towns lead on the OHI file says that "This initiative seeks to position Holyrood to become a Community of Practice for applied cold oceans technology".
Corbett indicates "Encouraging companies to "Come Ashore" in Holyrood, the initiative takes its direction from the OHI Advisory board, which includes members from the Marine institute Holyrood Marine Base, Memorial University of Newfoundland, members of the private sector, OceansAdvance Inc. (the NL based technology cluster), representatives from the town, the provincial department for Business, Tourism, Culture and Rural Development, the Atlantic Canada Opportunities Agency (ACOA), as well as other related disciplines in the public sector.
The ocean based powerhouse has moved quickly. The town has since set aside over 100 acres dedicated to an ocean technology industrial park, with plans to expand to 1000 acres over the course of the next 20 years. The industrial park concept has been developed with industry needs in mind, developing the infrastructure to include lay-down areas and minimal traffic lights into and out of the park and looking forward to ensure development has the space to grow and change as dictated by a new generation of thinkers. The goal is to maximize industry activity while minimizing the impact between existing industry and residents.

THE IDEA IN PRACTICE

Recently Schlumberger, a major player in oil and gas and the technologies associated with that sector, has moved some of its operations to Holyrood and they've been followed by a number of ocean technology companies. Corbett says, "It seems as though the phrase, 'If you build it, they will come' rings true for Holyrood". However the OHI Advisory board is not content to sit and wait for business to come. Working from the success of their recent developments, OHI has reached out to promote the town and action its planned growth. Appearing at Oceanology in London, England - as well as MTS/IEEE Oceans'14 in St. John's - the initiative has been actively engaged with key ocean industry stakeholders to not only promote and attract new opportunities, but to learn the lessons of other similar initiatives.
Although the cold ocean sector is heating up in Holyrood, residents still enjoy the peaceful rural Newfoundland and Labrador lifestyle. They can still look out into the bay and see a Menke Whale breach, although nowadays they might see the odd ROV or UAV which has Come Ashore to Holyrood as well.

Courtesy of Christa Turnbull – Marjorie Gibbons (Economic Development Officer), Gus Hawco (Chairperson OHI), Christa Turnbull (Executive Assistant to CAO), Richie Enzmann (ROV Planet Editor), Gary Corbett (CAO – Town of Holyrood), Marie Searle (Manager of Payroll & Finance) at Oceans'14.

DAVE PEDERSEN

Dave is a Naval Architecture student at the Fisheries and Marine institute of Memorial University of Newfoundland, and a former Paramedic for over 10 years. In addition to his educational pursuits, he and his wife and children can be found outdoors enjoying many of the outdoor adventures Newfoundland provides.

He can be reached at: pedersen_dca@yahoo.com

Courtesy of Destination St. John's

"SUPERIOR" ROV TECHNICIAN TRAINING AT THE MARINE INSTITUTE

By Dwight Howse, Head, School of Ocean Technology, Marine Institute

Courtesy of Marine Institute - Seabotix ROV in Ice at MI's Holyrood Marine Base.

It might be that they are intrigued by the opportunity to work with high-tech robotics. Maybe it's the prospect of a long term career, the opportunity to travel, exploring marine archaeological sites, a general fascination with the ocean, or the misconception that they will be paid to play a video game. Whatever the motivation, there is no doubt that the ROV Technician program offered by the Marine institute of Memorial University in St. John's, Newfoundland and Labrador, Canada is attracting a lot of young people from around the globe to prepare for careers as ROV Technicians.

Since its inception in 2008, the two-year technician program has produced over 130 ROV technicians who are now working in their chosen field in various locations around the world, primarily serving the offshore oil and gas industry. This program is unique in that it provides an opportunity for qualified high school graduates to engage in a program that specifically targets ROV Technician careers. It should be noted immediately that this program is much more than a "Learn to Fly" course. In addition to the piloting training, it is also a full-fledged electro-mechanical engineering technician program. Graduates from the program will have learned how all of the systems on an ROV work as well as how to operate and maintain them. The program also provides graduates with the necessary safety courses to enable them to go to work offshore.

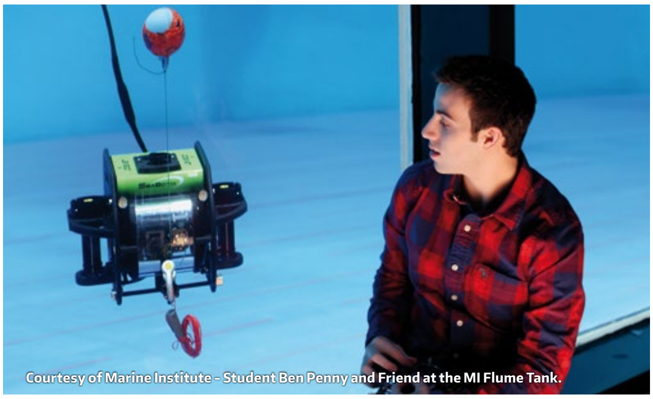
Today's ROV systems are marvels of robotic engineering, from the generators to the end effectors, specialized tools, and launch and recovery systems. They integrate electrical power systems, electronic communications and controls, hydraulic components and actuators, a human-machine interface, video, oceanographic sensors, sonar, mechanics, structures, propulsion, and flotation. It is no wonder that it takes two years to become familiar with the operation and maintenance of ROV systems. To quote Richard VanderVoort, former offshore ROV Supervisor and now an instructor in the program, "Our graduates are not just electronic technicians or mechanical technicians. They are renaissance technicians with a working knowledge of all of the components of an ROV system."

The Marine Institute (MI) is now celebrating its 50th year. In 1964, MI was created as the College of Fisheries, Navigation, Marine Engineering, and Electronics. As the original name indicates, the college was conceived as an institution that would prepare young people for marine careers. Over the past 50 years, technologies, career focuses and career scopes have changed. Programs have been launched, expanded, and curtailed in response to industry needs, but MI is still focused on providing opportunities for young people in the marine sector. With the development of the oil and gas activity on Canada's east coast through the 1990s, and the increasing reliance on ROVs for construction, operation, and maintenance of offshore oil and gas installations, MI undertook a consultation with the ROV industry. This allowed them to investigate the potential for ROV training relative to its existing facilities and expertise.

Students who engage in the ROV technician program at MI now benefit from access to some fabulous facilities, equipment, and expertise in support of ROV training. Electrical and electronics controls and communication labs were already well established to support pre-existing programs. Likewise, hydraulics, machining, fitting, and welding shops were all in place to support pre-existing programs. Furthermore, since the Marine Institute was already providing the safety and survival as well as the fire-fighting for the offshore industry, this capacity was also well in hand. Equipment gaps that had to be addressed included the acquisition of fiber-optic training equipment and a fleet of ROVs. In addition, three ROV simulators were acquired from GRI Simulations, widely acknowledged as being among the best ROV simulators in the world.

MI also considered it critical to hire instructors with ROV experience in the offshore oil and gas industry to focus the engineers, technicians, and technologists who were already part of the faculty. With the support of industry and govern-

Courtesy of Marine Institute - ROV Instructor Richard VanderVoort with GRI Simulator.


Courtesy of Marine Institute - Student Ben Penny and Friend at the MI Flume Tank.

Courtesy of Kufre Bassey - Student Kufre Bassey on Work Placement in Nigeria.

ment, these gaps have all been closed and the program has been attracting students since 2008.

The program is structured to be delivered over a period of two years. However, individuals who have already completed a three-year technology or engineering program may be given advanced standing and can complete in one year.

Following a few years of tweaking to improve the program, in 2013, the program was submitted to the Diver Certification Board of Canada (DCBC) for certification. DCBC has agreed to monitor ROV training and certify graduates of approved programs as ROV Pilot Technicians. In addition, the program has been submitted to the Canadian Technology Accreditation Board (CTAB) for accreditation. The primary significance of this move is that with CTAB accreditation, the graduates will be recognized as Engineering Technicians under the Dublin Accord. The Dublin Accord has been signed by eight countries: Australia, Canada, Ireland, South Korea, New Zealand, South Africa, the United Kingdom and the United States. The primary goal of the accord is to recognize the technician credentials from programs that have been accredited in each of the signatory countries in order to improve international mobility of engineering technicians. Given that the ROV industry is a global industry, international mobility of technicians is a significant asset.

MI believes that the technician training model that it has established can be emulated by other training institutions and has proposed that it be used as the basis for a standardized approach to ROV technician training globally. To that end, MI is actively engaged with the International Marine Contractors Association (IMCA) and the Marine Advanced Technology Education (MATE) center promoting an international ROV Technician training standard. MI envisions a global network of training institutions working toward high-quality ROV technician training that is responsive to the needs of industry and developing technologies. As an example, the MI is now working with the University of Sao Paulo in Brazil to assist that institution to deliver ROV technicians for the Brazilian industry.

MI is also concerned about the long term careers of its graduates. Accordingly, the ROV technician program has been designed to ladder efficiently into an MI Bachelor of Technology program with a focus on underwater vehicles. This requires a further two years of study. Following that, graduates also have the ability to take a Master of Technology Management (MTM) program from MI. The MTM program is offered entirely online and is designed to enable graduates to take on roles as leaders within the industry.

The efficacy of the program is best demonstrated by considering the success of the graduates. Consider the case of Travis Gosse who started the ROV Technician program at MI as a recent high school graduate in 2008 and graduated in 2010. Travis went to work with Acergy immediately upon graduation and stayed with the company through its merger with Subsea7. Travis's work with Subsea7 has taken

THE PROGRAM CURRICULUM IS COMPRISED OF SEVEN BLOCKS

1. A 15-week term comprised primarily of what might be considered fundamental technical courses such as Technical Communications, Mathematics, Physics, Chemistry, Computer Programming, and Electrotechnology
2. A 15-week term that extends student's capability in Mathematics, Physics, and Electrotechnology but then introduces Engineering Graphics, Control Electronics, Oceanography, and provides an Introduction to ROV Systems.
3. A 6-week term focuses on Electronic Fabrication Techniques, Electrical Machines and Power Systems, and an opportunity for the students to gain some at-sea experience while learning about and using Oceanographic Instrumentation.
4. A 15-week term addressing Mechanics, Hydraulics, High Voltage Safety, Digital Logic, Industrial Controls, Workshop Practice (Welding, Machining, Fitting), and ROV Operations.
5. A 15-week term covering Interfacing, Data Communications, Electrical Troubleshooting, Launch & Recovery Systems, ROV Maintenance and Underwater Acoustics
6. A 6-week term that provides Safety and Survival Training, ROV Piloting skills development, and ROV/Ship Interaction
7. Finally, the program requires a minimum 320 hour work placement with an ROV company. This placement is evaluated by both the company and an ROV instructor and requires a passing grade from both in order for an ROV Technician credential to be awarded.

him to Angola, multiple locations in the North Sea including Norway, UK, and Denmark, as well as to the oil and gas fields off Nova Scotia, Newfoundland and Labrador on the east coast of Canada. Travis became a Senior Pilot Technician in 2011 and in 2013 was designated as an ROV Submersible Technician. He is now working on his competencies towards becoming an ROV Supervisor. Needless to say, Travis is happily developing his career in the ROV field.

Likewise, consider the case of Kufre (Peter) Bassey, a student from Nigeria who joined the program in 2013 with advanced standing having completed a subsea engineering degree. Kufre has just completed his work placement for the program. Kufre spent two months working with Tilone Subsea in Nigeria on an ExxonMobil project. During his work placement, he was involved in pipeline inspections and ROV maintenance. Kufre reported that the training he received at the Marine institute was "superior" and prepared him well for his role. He was thrilled to put his learning into practice.

Further information on the Marine Institute and its programs may be found at www.mi.mun.ca.

Courtesy of Marine Institute
- Students Thom Smith and Will Glatt Working in the MI ROV Shop.

AUV
UNDER-ICE OPERATIONS

The Hydro'14 conference and exhibition organised by the Hydrographic Society UK was hosted at the Aberdeen Exhibition & Convention Centre (AECC) last year. This 3 day event featured everything including technical workshops, an exhibition, and even a reception at the Aberdeen Maritime Museum.

One of the technical presenters at the conference was Jim McFarlane, Sr. President of International Submarine Engineering (ISE). His presentation focused on the history of under-ice operations performed by AUVs. With the arctic waters being among the last remaining frontiers of this planet with only uninhibited landmasses nearby the autonomous systems are the most cost effective tools to explore them.

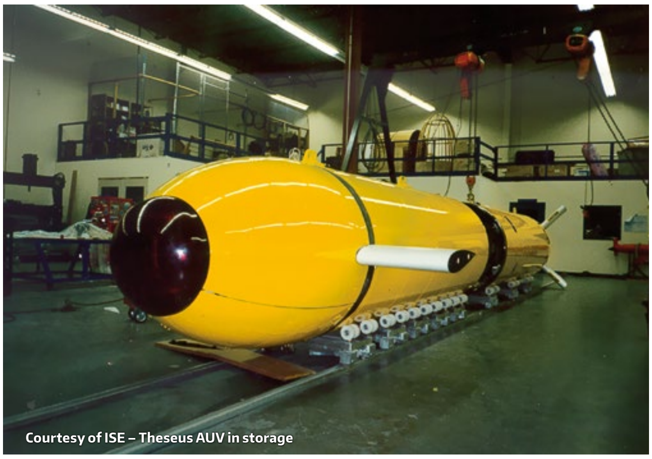
The audience were given an insight into the brief history of undersea vehicles; starting with manned submersibles, then the development of ROVs and finally the AUVs, showing this natural evolution-like progress through the examples of the Theseus and Explorer AUVs.

Indeed the ISE manufactured Theseus was one of the first AUVs to accomplish an under-ice mission in the arctic. This autonomous vehicle was specially designed to lay fibre-optic cable in the icy waters near Ellesmere Island in Northern Canada. The large size of the vehicle with a length of 10.7m (35ft) and diameter of 127cm (50in) was a direct result from the volume (for buoyancy) and weight (cable) requirement of the mission. It had to deliver up to 220 km of cable making the overall weight of the vehicle 8,600 kg while a specially designed auto-ballast system had to compensate with the weight lost during the cable lay. Basically when the cable was being laid on the seabed, the ballast tank was continuously being filled with water in order to compensate for the weight loss. Furthermore the Theseus had its own operating system, obstacle avoiding system and the vehicle was designed to accommodate the extreme ambient temperatures in and out of the water.

This was a very interesting presentation from Jim, looking a bit into the past, but also showing the lessons learnt from it for the future.

Jim McFarlane Sr. at Hydro'14


Courtesy of ISE – Theseus AUV during an under-ice operation


Courtesy of ISE – Theseus AUV in storage


Courtesy of ISE – Theseus AUV deployment

Courtesy of IFREMER - OCTANS subsea Gen III

Courtesy of iXBlue - OCTANS Nano in the field

THE NANO

GOOD THINGS COME IN SMALL PACKAGES

By Paul Wysocki - Product Manager, iXBlue

iXBlue is a leading provider of subsea navigation and positioning solutions and a world leader in fibre-optic gyroscope technology. Since the year 1999, iXBlue has supplied more than 4,000 Attitude and Heading Reference Sensors (AHRS) and Inertial Navigation Systems (INS) to the major Subsea Surveying, Engineering and Construction companies and other demanding organisations around the world.

iXBlue products have become the benchmark for robust performance and reliability in offshore applications iXBlue products are designed and developed to address the many challenges of shallow and deep water construction and inspection in depths up to 6,000 meters.

"IXBLUE PRODUCTS HAVE BECOME THE BENCHMARK FOR ROBUST PERFORMANCE AND RELIABILITY IN OFFSHORE APPLICATIONS".

One of the pioneer products in the iXBlue product line is the Octans 3000, originally developed in 1999, a unique solid state sub-sea gyrocompass and motion sensor that has become the industry standard, delivering the best available performance on the market, high reliability, long life time and maintenance free. Many of the industry's leading companies have helped us ensure the Octans successful evolution. Through four generations, customers have benefited significant enhancements, including temperature gradient immunity, protection, more (five) serial interfaces, Ethernet (as standard), web graphical user interface, and field upgradablity into a full inertial navigation system (INS).

It is upon this backdrop the OCTANS Nano, a Gyrocompass and attitude sensor dedicated to ROV Navigation, came onto the market in the spring of 2014.

The Nano was designed, developed and tested in under a year of the market requesting the solution. The success is thanks to the commonality of the design with iXBlues other inertial products, and the in-house capabilities; the IMU with its FOG, the electronics, the software, the algorithm and the production process (from the Optical Fibre, to the calibration tables are all designed and manufactured by divisions of iXBlue).

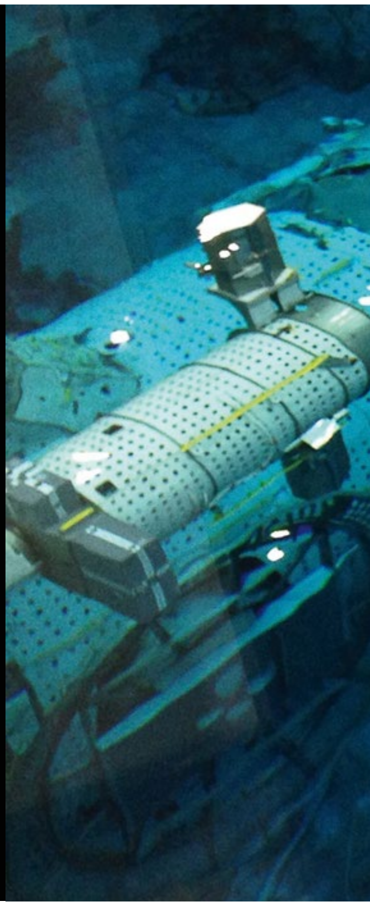
OCTANS NANO SPECIFICATIONS

- True North Heading, 0.5° accuracy, immune to metallic structure thanks to FOG technology
- Roll and pitch: 0.1° accuracy
- 4000m depth rate in a 6 litres full titanium housing
- User friendly configurable Serial and Ethernet interface

For more information please visit
the iXBlue Website at **WWW.IXBLUE.COM**

DEEPWATER WELLS *and* OUTER SPACE

By Fernando Hernandez & Everett Chase, Reaching Ultra



The concept of tele-operated arms was first conceived by Robert Heinlein in 1942, in his short story Waldo. In the story, Waldoes – commonly known as manipulators or robotic arms today - were used within an enclosed environment in outer space, to enhance the main character's physical limitations. The intellectual framework for tele-operated arms was now set. However, it would require the nuclear age to bring these 'Waldoes' to life.

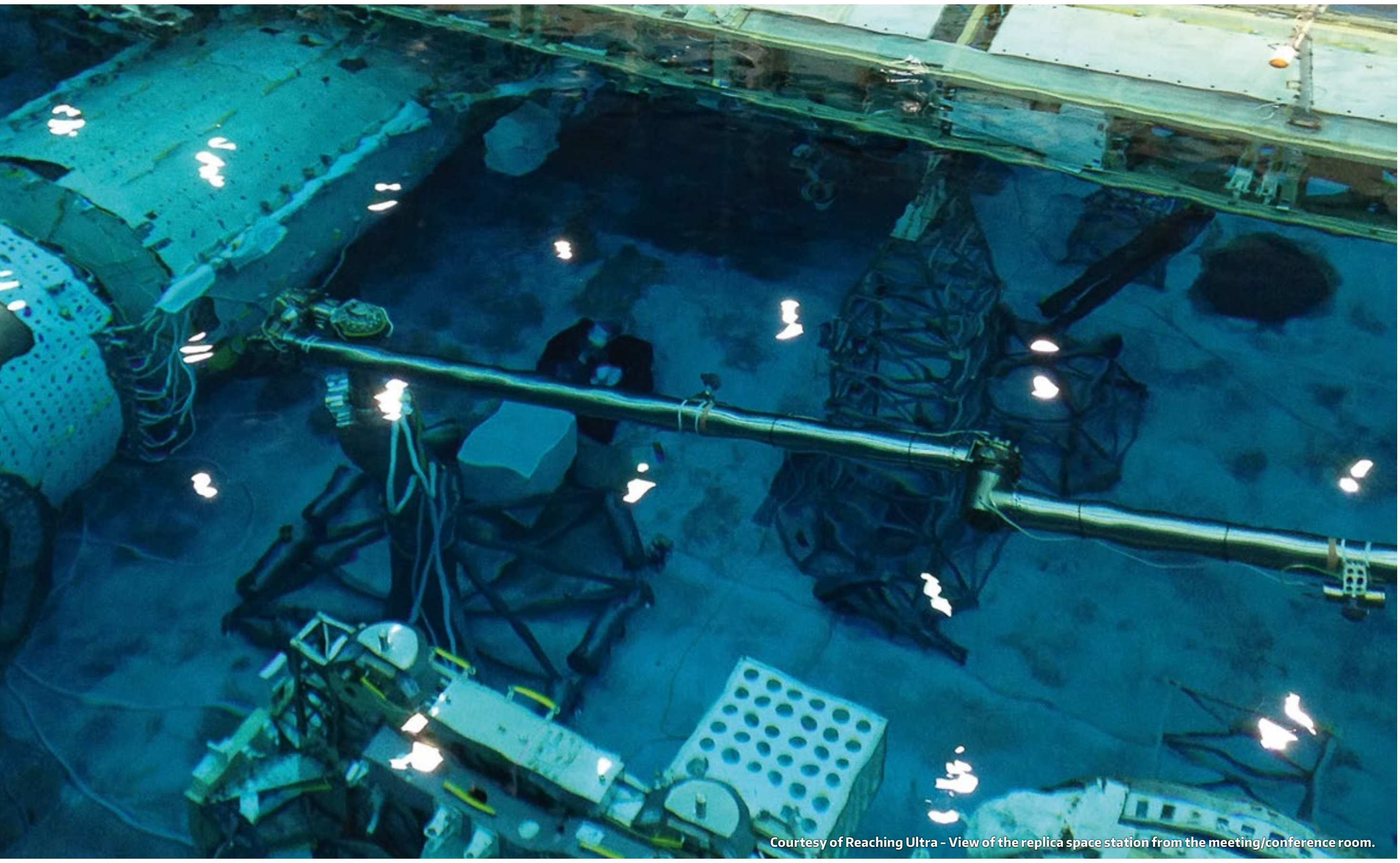
The offshore industry removed Hughes Tools' land based manipulators, which were used in a radioactive setting by the Atomic Energy Commission and proceeded to put them to work on underwater well heads. This happened in 1962, via MOBOT the first offshore specific Remotely Operated Vehicle (ROV). NASA, followed suit in 1981, and sent a Canadian built robotic arm to space on a space shuttle, as noted by Brandi Dean of NASA's Johnson Space Center. In both cases operating in a remote and harsh environment necessitated the use of manipulators.

Because of this, it should come of no surprise of NASA collaborating with the Oil and Gas industry to provide offshore training and testing at NASA's National Buoyancy Laboratory (NBL), which contains a replica of the space station. At Reaching Ultra (RU), we had the opportunity to experience first-hand the meshing of the two disciplines when we visited NBL. The result: RU gained a thorough experience of the multidimensional facility, and key insights into these interlinked disciplines.

SIMILARITIES

Presently, the similarities between these two fields continue to be accepted by the offshore industry. This was demonstrated by a paper presented by NASA's Jet Propulsion Laboratory in 2012, at the coveted Offshore Technology Conference stating: 'In both (space and offshore applications), systems are deployed at remote locations with limited access for intervention, maintenance or repair...(Both) environments are often hostile with harsh temperatures and pressures and corrosive materials, (which makes reliability extremely important). Operations in the respective environments have high risk and the capabilities for replicating environmental conditions for testing and failure mitigation are limited'[1]. In spite of such high risks and the challenge of replicating environmental conditions, methods exist by which to assess, mitigate, and prepare for anomalous scenarios.

One such example is NBL's laboratory. The lab contains a pool that holds 6.2 million gallons of water. One side of the pool is allotted to NASA specific functions, and this is where the replica station lies. The other end is designated for offshore specific purposes, such as Helicopter Underwater Egress Training (HUET); water survival training; and System Integration Tests (SIT) of offshore equipment.



Courtesy of Reaching Ultra - View of the replica space station from the meeting/conference room.

Courtesy of Reaching Ultra - Exterior of Sonny Carter Facility

Courtesy of Reaching Ultra - Entry point to the laboratory

SPACE STATION LAYOUT

A key characteristic of NBL's layout is the meeting and conference room. This is at the center of the pool, giving way to a panoramic view of the submerged replica space station from above. Here, astronauts can be viewed working in conjunction with divers, while performing underwater simulations in and around the space station. And just like SITs, the training can be intimately observed via multiple, high resolution, underwater cameras. Mike Bloomfield, a former NASA astronaut expands on NBL's benefits: 'If I could train for a mission by using (NBL), which mimics weightlessness, I would be better prepared and much more efficient once I got into space.'

It is important to note that SITs and water trials - that are carried out globally and apart from NBL – from a top level have multiple aims, that include replicating subsea conditions prior to equipment being deployed;testing layouts and equipment arrangements on land; and ensuring all items of interest work optimally. In addition, SITs also aim to prepare and train all involved parties for contingent and non-contingent scenarios.

SIT FURTHER EXPLAINED

Another similarity shared by these two industries is highlighted by Bloomfield when he states 'It can take two to three days to get to the International Space Station, while some wells are now 10,000 feet underwater. (In both cases) If you forget a tool or it doesn't work, it's difficult to go back and do the work'. This difficulty can be equally applied to subsea assets such as Pipeline End Termination Manifolds, Christmas Trees and Routing Manifolds, all of which make up subsea production schemes. In addition, the aforementioned are expected to operate at depths in excess of 9,000 feet; export a well's content; endure freezing temperatures; and handle high pressures (Internal pressure is seen by flow path circuitry, while hydrostatic pressure is seen at all external points of the asset). Furthermore, subsea assets are expected to operate for multiple years; for this reason SIT testing is of the utmost importance.

It is not uncommon on large projects to have the aforementioned assets laid out and interlinked during an SIT in the same manner as they would be installed on the sea floor. Because of this, ROVs as well as mock up ROVs are used to navigate through this interlinked scheme. This is done via a


Courtesy of Reaching Ultra
– Orion scale model staged next to the Work Class ROV

crane to simulate an ROV moving through water. The intent of this is to ensure that an ROV has complete accessibility and maneuverability. Failing to do these flying simulations has severe implications, especially for future work where an unplanned intervention is required.

Additionally, an ROV's manipulators are used to extensively test all interface and actuation points. This is done in order to find and resolve anomalies. Overlooking an anomaly can have severe implications should a manifold cease to function properly. This is especially true when multiple wells tie in to it, resulting in the connected wells being shut in and resulting in millions of dollars in lost revenue. This is compounded by the fact that the manifold will have to be recovered and fixed, increasing monetary losses.

TESTING OF TOOLS AND INTERVENTION

Another key feature of NBL lies in the operators having the ability to test tools, as highlighted by Bloomfield: 'We tested three tools designed to cut off well heads (So as to assess their workability and reduce risk).' He explains 'The first one worked...The second did not...and the third was less efficient by a factor of six. So they (An oil and gas company) were able to figure out why, and they were able to make a fix. Now they have tools they know will work, (and, in turn, minimize potential downtime).' However, even when SITs and tooling tests are conducted, unplanned interventions—as previously mentioned—do arise, a prime example: when a valve stem on a subseaasset is damaged. When this occurs, developing alternative tools and methods is imperative to repair said stem, so as to bypass recovering a manifold. Moreover, intervention tools must equally undergo rigorous testing prior to being shipped to location.

Conversely, when an unplanned intervention arises offshore, it is not uncommon for ROV crews and subsea intervention personnel shaving to devise a widget or tool, so as to deliver a solution on site. This is especially true when an alternate tool may take days to be built on land.

Similarly, NASA has had to provide in-space and on-location intervention, as explained by Dean with NASA's Johnson Space Center, when the arm installed on a shuttle had to perform troubleshooting operations in 1985. Dean explains how 'A satellite carried up by the shuttle got stuck in the wrong orbit when its rockets didn't fire after it was unloaded'. As a result of this, the space crew created a 'Fly swatter' tool, by way of hardware that was readily available on board. Dean details how the swatter was then attached to 'The end of the arm and (Used it to flip) the switch on the satellite...(However,) flipping the switch didn't solve the problem, but (The arm) was used again later that year to retrieve the satellite so that it could be fixed'.

CONCLUSION

As previously stated, the pool at NBL is partitioned in two, and it is at the non-space station side where the HUET and water survival training courses are carried out. It is here that future and existing offshore personnel are trained on how to respond to different scenarios when traveling to a location via a helicopter simulator. It is worth noting that this side of the laboratory houses a work class ROV and an Orion scale model, both are staged behind the HUET training area, further demonstrating the laboratory's synthesis of these two disciplines.

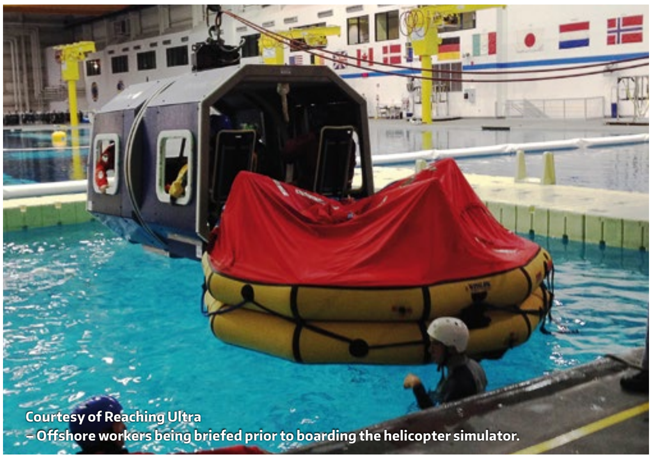

Courtesy of Reaching Ultra
– Topside cameras showing astronauts and divers working in the pool.


Courtesy of Reaching Ultra
– A fully outfitted Work Class ROV in staging area next to the offshore portion of facility.

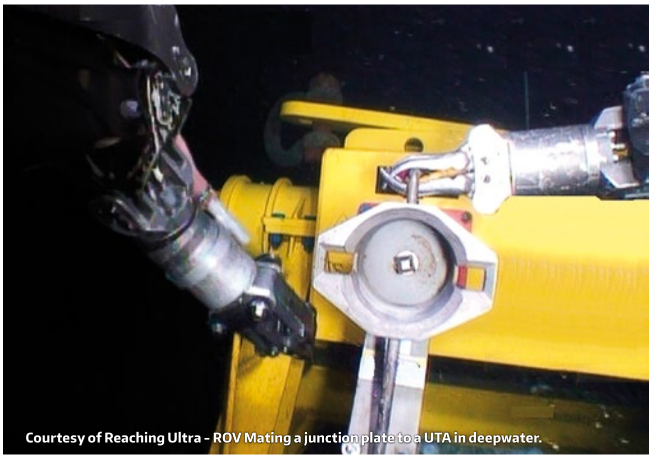
THE FUTURE AND NBL

It is our belief that NBL is a truly cutting edge facility that defies all technological boundaries, while providing a highly interactive arena where individuals are given the opportunity to experience and further their passion for the offshore and aerospace industry. For this reason, we highly recommend that any direct or outlying participants of the aforementioned industries experience NBL for themselves.

[1] Space Robotics Technologies for Deep Well Operations.
H. Nayar, K. Ali, A. Aubrey, T. Estlin, J. Hall, I. Nesnas, A. Parness, D. Wiberg.
Houston: Offshore Technology Conference, 2012.

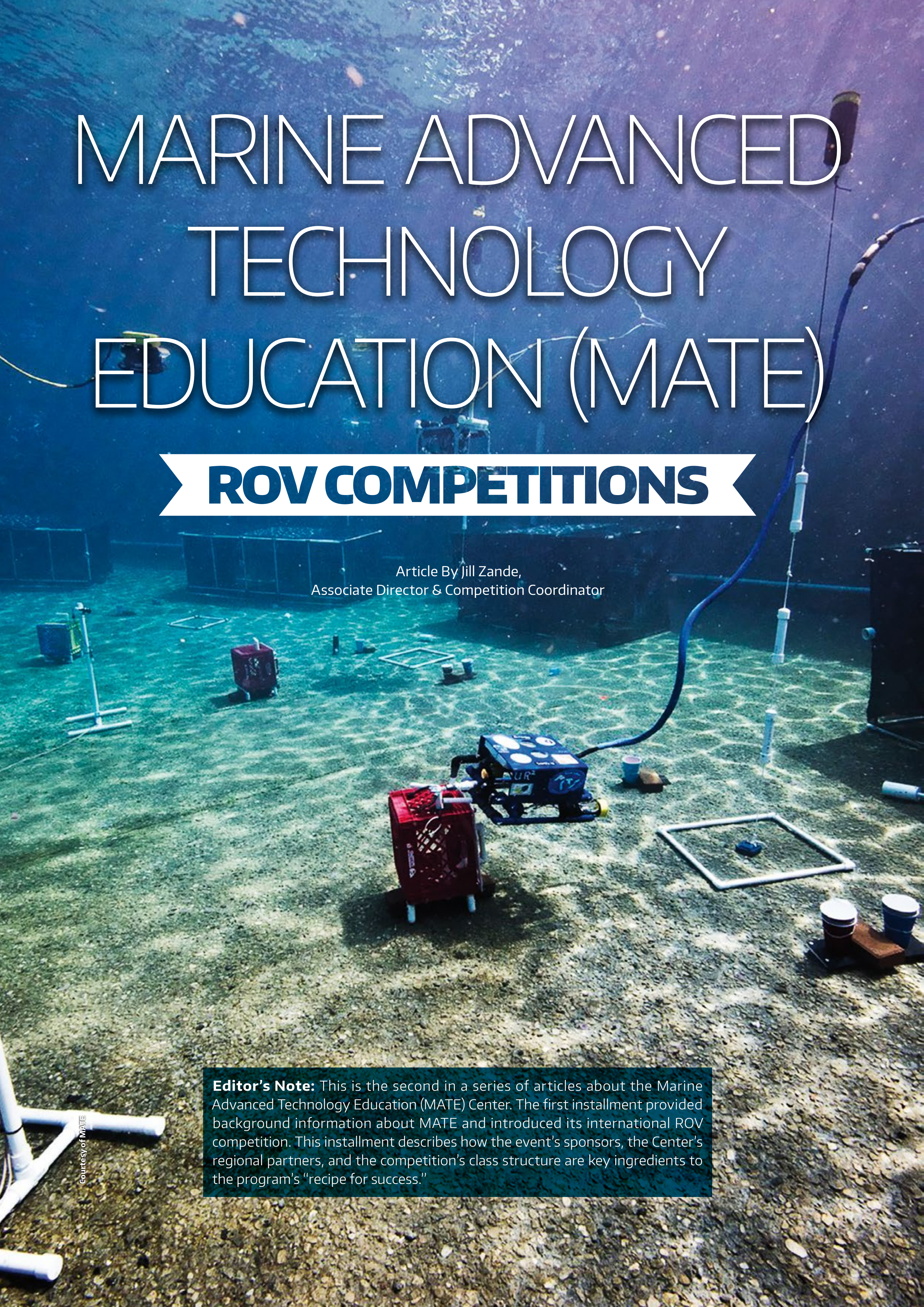


Courtesy of Reaching Ultra
– Offshore workers being briefed prior to boarding the helicopter simulator.



Courtesy of Reaching Ultra - ROV Mating a junction plate to a UTA in deepwater.

Courtesy of Reaching Ultra
– Technicians interfacing a class 1-4 ROV torque tool on a subsea asset at SIT.



Courtesy of MATE

MARINE ADVANCED TECHNOLOGY EDUCATION (MATE)

ROV COMPETITIONS

Article By Jill Zande,
Associate Director & Competition Coordinator

Editor's Note: This is the second in a series of articles about the Marine Advanced Technology Education (MATE) Center. The first installment provided background information about MATE and introduced its international ROV competition. This installment describes how the event's sponsors, the Center's regional partners, and the competition's class structure are key ingredients to the program's "recipe for success."

The MATE Center's international ROV competition is entering its 14th year. The program has come a long way since 2002; that first year there were 22 teams and ~150 students. In 2014, nearly 600 teams and more than 3,000 of students took part in the international event or one of the 20 regional contests that fed into it. 2015 looks to be even larger, with students from Cuba and Italy planning to field teams and a new event in Vladivostok, Russia joining the regional contest network.

MATE

A number of factors have contributed to the program's success. These include a structure that allows students to become involved at low cost and stay involved as they build upon their knowledge and skills to engineer increasingly more complex ROVs; like-minded partners that organize and carry out regional events; and the breadth and commitment of the organizations that sponsor the competition.


Courtesy of MATE


Courtesy of MATE


Courtesy of MATE

COST AND CLASS STRUCTURE

The competition structure consists of four levels, or "classes," of vehicle and mission complexity: SCOUT (entry-level); NAVIGATOR (beginner-intermediate); RANGER (intermediate); and EXPLORER (advanced). This progressive class structure complements the educational pipeline by providing students with the opportunity to build upon their skills – and the application of those skills – as they engineer increasingly more complex ROVs for increasingly more complex mission tasks. It also provides the opportunity for interactions among all grade and experience levels, which results organically in peer mentoring, sharing ideas and experiences, and motivating students to continue "next year."
Designing and building a competition ROV can be (but isn't always!) done inexpensively using readily-available and easily-accessible materials and resources. A visit to the local hardware store becomes an exercise in creativity as students and teachers begin to develop an eye for innovative uses for everyday materials. The innovation that goes into solving the problem of the competition mission tasks ignites students' interest and closely parallels real-world applications.
Further, the competition registration fee is set low to keep the program accessible to a diversity of students. For the 2014-2015 competition season, the EXPLORER class fee is $150; the cost to enter the RANGER class is $100. There is no fee to participate in either the NAVIGATOR or SCOUT class.

PARTNERS WITH A COMMON VISION

The regional competition network has primarily been a grassroots effort. The growth in the number of regional events from one in 2001 to 24 in 2015 can be attributed to partnerships with like-minded organizations as well as to the generosity and commitment of STEM professionals who volunteer their time and technical expertise.
MATE regional partners include the National Oceanic and Atmospheric Administration's (NOAA) National Marine Sanctuary Program; the Thunder Bay and Gray's Reef National Marine Sanctuaries are the lead coordinators of two regional events. Community colleges and universities, such as Long Beach City College in California, Bristol Community College in Massachusetts, Robert Gordon University in Scotland, and Memorial University of Newfoundland, established and carry out events each year. In addition, sections of the Marine Technology Society (MTS) in Puget Sound, Washington, New England, and Texas coordinate the contest programs in their area. Research institutions, such as the Dauphin Island Sea Lab in Alabama, are also regional partners, as are non-profit organizations such as the John G. Shedd Aquarium in Illinois. These organizations, their personnel, and their pool of committed volunteers share MATE's vision to engage students in science, technology, engineering, and math, increase their knowledge of marine-related issues, and help to prepare them for future careers.

INVESTING IN THEIR FUTURE WORKFORCE

In addition to its regional coordinators, MATE's industry partners played a key role in the development, growth, and sustainability of the competition. Over time, the competition has garnered the financial and technical support of more than 1,000 working professionals and 100 ocean and STEM-related organizations, including the MTS and its ROV Committee. The MTS ROV Committee generated the spark that set the program in motion; in 2000, the Committee reached out to the MATE Center to work together to raise awareness of the industry and its wealth of job opportunities. The Institute for Electrical and Electronics Engineers Oceanic Engineering Society is also an annual financial sponsor; other professional societies, such as the Society of Naval Architects and Marine Engineers, support individual college and university teams.

Businesses and corporations, such as Oceaneering International, contribute funds, facilities, equipment, and/or time and technical expertise. Each year Oceaneering sends engineers and technicians to serve as judges and safety officers as well as recruiters to scope out potential new hires. Government agencies – in both U.S. and abroad – as well as research institutions, such as the Monterey Bay Aquarium Research Institute (MBARI), also support the program with facilities, equipment, and award prizes. NASA hosts the Texas regional event each year; its in-kind facilities contribution is worth more than $175,000. It will take the continued support of all of these organizations – as well as the support of new organizations and individuals – to sustain the competition program as it continues to engage more students and expand to new regions.

RETURN ON INVESTMENTS

The competitions' longevity, expansion, and total numbers of participants and organizations involved are evidence of its success. However, the true measure of success is the return on investment (ROI): students who have followed a pathway to post-secondary STEM education and, from there, have entered the ocean workforce. Based on post-event surveys and personal communication with current and former competitors, the program has experienced a positive ROI.

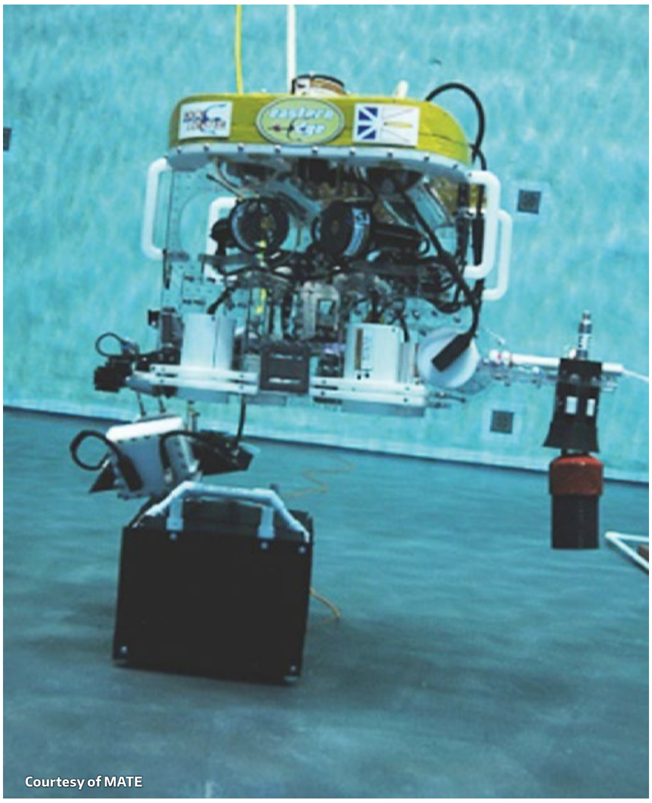
Inspired by their learning experience and exposure to the relevance of STEM, high school students have gone on to pursue engineering or technical degrees at institutions such as the Massachusetts Institute of Technology, Purdue University, the University of California Los Angeles, the University of North Carolina-Charlotte, and the US. Naval Academy, among others. A number of these students have shared that they included the competition within their college application and essays and, as a result, were accepted into the college and major of their choice when other students with higher grade point averages (GPAs) were not.

Students have reported that they have been awarded scholarships or internships as a result of their participation in the ROV competition. One student was offered an internship with a robotics company while still in high school; the company specifically called out the student's involvement with the competition and the project management, teamwork, and critical and creative thinking skills that he developed through his participation as the key reason he was offered the position.

Students who are now employed as professionals in ocean STEM fields have shared their compelling stories of how the competition influenced their education and career path. Exposed to the myriad of ocean careers and armed with the skills needed to succeed in them, students have gone on to work at research facilities like the Woods Hole Oceanographic Institution, MBARI, and Bob Ballard's Institute For Exploration. Former competitors have also been hired by companies like Oceaneering, Schilling Robotics, SeaTrepid, VideoRay, and more. There are also stories of students who have taken the entrepreneurial spirit of the competition to a new level and gone on to form their own ocean technology companies; OpenROV is one example.

Perhaps the ultimate ROI for the MATE Center are the students who are now employed in the ocean workforce who return to the competitions to volunteer as judges and technical support. The feedback and insight that they provide about their competition experience and the working world is invaluable. Their information is used to improve and enhance the competition program so that it continues its relevance to the workplace and its goal of meeting workforce needs.

In the next issue, learn more about this year's competition theme and mission tasks. And mark your calendars for June 25-27, 2015 – the dates of the 14th annual MATE international ROV competition, which is taking place in St. John's, Newfoundland and Labrador, Canada.



Courtesy of MATE

ROV PLANET

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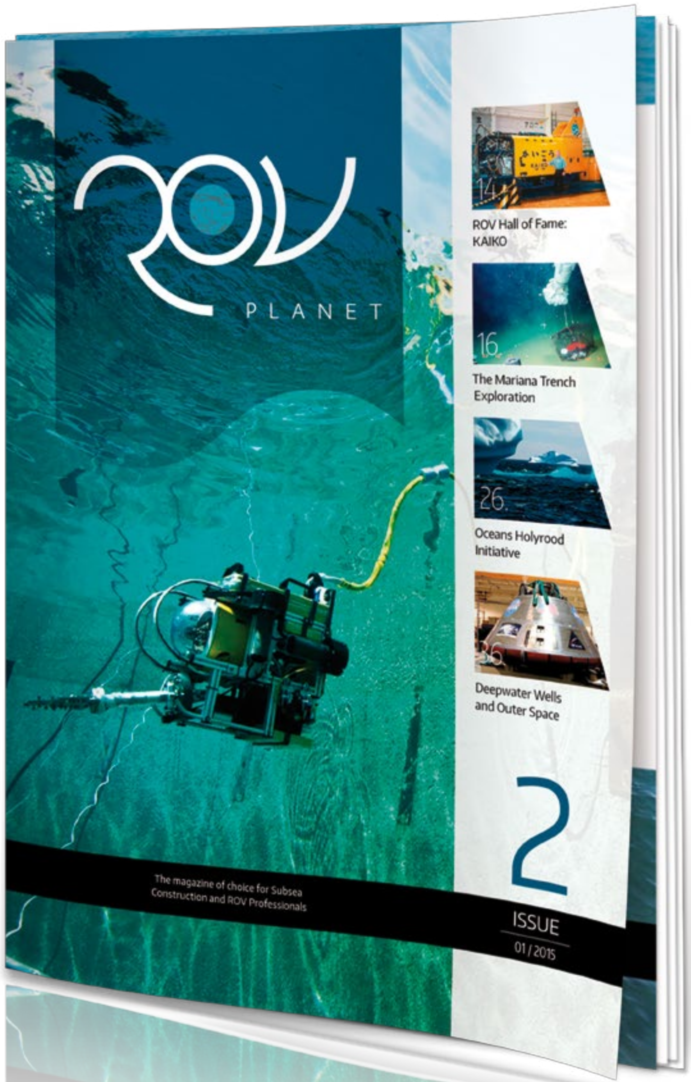

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