

Keeping up-to-date

As members of the industry prepare to attend Hydrovision International in Denver, Colorado, we provide a roundup of some of the latest news from exhibitors attending the event

ABB

A transmission link which carries power from the Inga hydropower station on the Congo River in the Democratic Republic of the Congo (DRC) to the mining district of Katanga in the south-east of the country, while also exporting excess electricity to the Southern African Power Pool countries, is to get a partial upgrade following the award of a contract worth more than US\$30 million to ABB.

The Inga-Kolwezi high-voltage direct current (HVDC) power transmission link contract was awarded by Société nationale d'électricité (SNEL), the national electricity company of the DRC. The contract is part of the FRIPT project financed by Glencore and managed by Congo Energy, a subsidiary of Forrest Group International.

The retrofit will make it possible to increase transmission capacity from 520MW to 1000MW, securing power supplies to the mining region in Katanga and strengthening the power infrastructure in the DRC.

The 1700km link was built by ABB in 1982 and was, at the time, the world's longest transmission line. ABB upgraded the link in 2009, installing new thyristor valves, high-voltage apparatus and its MACHTM control and protection system. ABB's advanced MACH system, supports the company's ABB AbilityTM based digital offering and acts like the brain of the HVDC link – monitoring, controlling and protecting the technology in the stations, managing thousands of operations to ensure the reliability of power supply.

ABB has now been entrusted to carry out a refurbishment that will boost transmission capacity, enhance grid reliability, extend life span and help ensure the efficient transmission of hydroelectricity across the region. ABB's project scope includes system studies, supply of key equipment such as high voltage apparatus and commissioning.

The DRC is the 11th largest country in the world, with a land mass about one-fourth that of the US. It has a population of around 80 million, and one of the lowest rates of electrification in the world, with over 80% of the population still lacking access to electricity. The total installed generation capacity is estimated at around 2500MW, which is almost completely hydropower. Most of this is allocated to the mining sector, especially in the copper belt, where lack of adequate power is seen as a constraint to growth. Currently, the DRC utilizes just 2% of its estimated 100,000MW of hydroelectric potential, 40% of which is concentrated at Inga, where the government is boosting capacity.



Andritz Hydro is installing four Francis turbines at the Manolo Fortich plant in the Philippines.

Andritz Hydro

Andritz Hydro is half way through the installation of four Francis turbines at the 25.4MW Manolo Fortich Hydropower Plant 2 in the Philippines, developer Hedcor Bukidnon Inc has announced.

The AboitizPower subsidiary awarded Andritz a EUR 15 million contract for electromechanical works at Manolo Fortich 2, as well as the 43.4MW Manolo Fortich 1 plant. The latter plant will have a combination of Francis and Pelton turbines installed.

As well as equipment installation, Andritz will also ensure quality control of the entire hydro system such as analysis, target points and alignment, Hedcor explained. Commissioning of the project is expected by the end of this year.

Hedcor Bukidnon has also announced it has recorded 2.9 million man-hours with no lost time incident within the workplace, as of the time of writing.

Hedcor specializes in generating renewable energy from run-of-river hydropower system. It manages and operates 22 hydropower plants and supplies the Philippines with 185MW of clean and renewable energy.

ASI Group

This year, ASI Group Ltd. (ASI) is celebrating 30 years serving the industry. ASI's first successful innovative R&D project started in 1990 when, alongside Ontario Hydro, ASI developed and patented the first North American treatment program to combat zebra mussels within the Great Lakes. Since then, ASI has been recognized as

being the first company to provide sonar scanning capabilities for underwater assets, they developed the first Remotely Operated Vehicle (ROV) for long distance inspections (earning a spot in the Guinness Book of World Records) and was the first company in Canada to provide Commercial Diving services in radiated environments for the Nuclear Power Generation industry.

Founded in 1987, ASI has expanded its global footprint to provide necessary asset management solutions for governments and industries worldwide. To date, ASI has several locations across Canada, the US and globally including offices in St. Catharines, Sarnia, Vancouver, Orchard Park, New York, Chile and Singapore.

"ASI's success is a result of long-term and symbiotic relationships with valued clients. Our staff's experience and expertise along with the company's passion to develop and deliver visionary turnkey solutions is what has made the company successful on a global scale" says Carmen Sferazza, founder and President, ASI Group Ltd. "We plan to continue our company's success and grow even further through various R&D projects to ensure our clients have means to collect crucial data and gain a better understanding of their assets for condition assessment and overall operations management".

Atlantium Technologies

FirstLight Power Resources (FirstLight), a subsidiary of H₂O Power, has purchased and installed the Hydro-Optic (HOD) ultraviolet (UV) technology from Atlantium Technologies Ltd.,

to provide non-chemical biofouling control of invasive mussels in cooling water circuits in the Housatonic River Project hydroelectric system at the Shepaug Hydroelectric Station and Stevenson Hydroelectric Station.

Since their introduction in the 1980s, the extremely prolific dreissenid, zebra and quagga mussels have spread into waterways; attaching to and clogging virtually all types of submerged surfaces. Biofouling from these two mussel species and the operational impacts on the hydroelectric industry are profound. Flow restrictions or blockages due to mussel infestation are the foremost concern because of the threat to water delivery and power reliability. In addition, the associated costs from lost power production can be significant.

"FirstLight has evaluated the risk from mussel fouling, outlined the best management practices for coping with invasion, and identified the Hydro-Optic UV treatment solution as the best control option for raw water systems to prevent invasion and infestation," said Rebecca Allen, Engineer, FirstLight Power Resources. "The HOD system is an advanced UV treatment solution that achieves a 99% inhibition of settlement of quagga mussel veligers downstream of the system using a UV dose rate substantially lower than 100 mJ/cm². The HOD UV system will help FirstLight to minimize the risk from mussel fouling by preventing invasion and infestation."

Black & Veatch

Black & Veatch is to provide program management services to Denver Water on the Gross Reservoir Expansion - a project that will raise an existing dam, increase hydro output and improve water supply.

The project is a major component of the utility's comprehensive strategy to deliver safe, reliable water service and provide resilience to its. The expansion will more than double current reservoir capacity and improve water supply dependability for the 1.4 million people Denver Water serves in the metro area.

As Owner's Representative, Black & Veatch will assist Denver Water with project controls - including schedule, cost and document control, and eventually construction management - starting in May 2017 and extending through the first filling of the reservoir, expected in April 2026. Once permits are secured, dam construction is expected to occur in three phases over a total of four to five years.

"Black & Veatch is supporting Denver Water's vision of not only ensuring system resilience, but of providing clean, affordable and reliable water to customers for generations to come," said Greg Zamensky, project manager for Black & Veatch. "The Gross Reservoir Expansion Project builds on our deep experience in supporting utilities as they execute significant, long-term projects."

The project will raise the height of the existing 340ft-dam by 131ft, increasing reservoir capacity from 42,000 acre feet of water to 119,000 acre feet of water. The project will also increase the total

output of Gross Dam's hydroelectric power plant from 7.6MW to 8.1MW.

"Back in the 1950s, the existing Gross Dam was designed and built to accommodate subsequent raises like the one we're planning today," said Jeff Martin, program manager for the Gross Reservoir Expansion Project. "Just like the current dam is a strong foundation for our future work, Black & Veatch's resources and expertise will build on our existing project management team and will contribute significantly to delivering a successful project for Denver Water's customers."

CH2M

CH2M officially launched its new Flood Cloud service on June 6, allowing users of Flood Modeller and integrated software, TUFLOW, to seamlessly undertake flood risk modelling in the cloud for the first time.

CH2M's Flood Cloud is powered by Parallel Works and runs on Amazon Web Services to provide the on-demand computational resource required to deliver quicker results and improved flooding information. It helps to provide more scenarios to enable smarter flood management decisions and improved confidence in model results.

In line with the release of Flood Cloud, CH2M is offering a free, 45-minute webinar on June 6 to walk users through the basics of how to best use the new service to:

- Enhance flood models.
- Run more scenarios to enable better flood management decisions.
- Improve the understanding of confidence in model results.
- Access superior modelling power to help beat project deadlines.

"We're proud to provide our 25,000 users across the globe access to an on-demand, cloud-based resource that will deliver the step change needed for better information on flooding," said CH2M Technical Director for Flood Modeller Suite Dr. Jon Wicks.

Flood Cloud will enable users to run Flood Modeller Pro 1D, 2D and 1D-2D linked models, as well as Flood Modeller (1D)-TUFLOW (2D) linked models. It will also be able to run TUFLOW only models in the near future.

Dyrhoff

Dyrhoff has installed four rubber dams as part of the Donnacona hydropower plant in Quebec, located on the Jacques Cartier River near the towns of Donnacona and Cap Santé. The Donnacona rubber dam replaces the old wooden dam at the site, originally built in 1918, after it suffered major damage in May 2014. After careful consideration, owners Algonquin Power & Utilities Corp., working with consultants WSP, opted to install an air inflated rubber dam in its place.

The new Donnacona rubber dam comprises four spans, each measuring 1.95m high x 23m wide. The inflatable dam will provide water level management for the Donnacona dam and nearby hydropower

plant. The rubber dam will normally be operated in the fully inflated position for normal upstream water level control, and will start deflating once the headpond reaches a pre-determined upstream water level, allowing flood water to pass through and preventing flooding upstream. In addition, the dam will make it possible to pass the run-off from very large storms without flood danger, by deflating/opening one or more of the rubber bladders until the upstream reservoir water level has receded to an acceptable level. Dyrhoff has designed the dam for frequent and regular operation, and it is expected that each span will be deflated on average about 5 to 10 times a year, due to high upstream water levels. The inflatable dam has been designed to fully deflate or deflate in under 45 minutes. Following completion of the civil works by contractors Pomerleau, installation of the rubber dam took less than twenty days, under supervision of Dyrhoff. Initial commissioning tests took place in November and the dam is expected to enter operation in the New Year, with energy production at the 4.8MW plant resuming shortly thereafter.

The company's latest contract is design/supply of a 1.7m high, 43.1m wide air-inflated rubber dam on the Dora Riparia river in central Turin, Italy.

Emerson

Emerson Automation Solutions has launched the latest version of its reservoir management software suite - Roxar Tempest 8.0 - to bring reservoir engineers more tools to maximise the potential of their fields. The latest version features additional history-matching capabilities; enhanced field productivity thanks to greater simulation performance; and an integrated workflow from geosciences to production.

"Our reservoir management software has always had a simple goal - to help operators make better decisions and improve field economics when it comes to their development plans," said Kjetil Fagervik, vice president of product development and marketing of Roxar Software at Emerson Automation Solutions.

He continues: "We have now taken this goal a step further, adding even greater value throughout the reservoir lifecycle by providing a technology platform that combines engineering and geology and ensures that the very best uncertainty and risk analysis information is available for those vital field development decisions."

Roxar Tempest 8.0 provides several improvements:

- **Tempest ENABLE uncertainty management and history matching module:** new Ensemble Smoother-based history matching, a complementary technique to proxy-based history matching, which enables conditioning on all types of data - in particular spatial data, such as seismic - ensuring that all uncertainties are comprehensively accounted for. Users can now benefit from two cutting-edge history matching workflows.
- **Tempest MORE reservoir simulation**

module: increased software performance and reliability, and an improved user experience. New features include API tracking to efficiently model the flow of fluids with different properties, enhanced aquifer and pore volume specification, and control over relative permeability and capillary pressure at the completion level.

- **Tempest VIEW module:** users are given the ability to load and display in the pre- and post-processing interface Tempest VIEW simulation results from METTE™, Emerson's production modeling and management tool, allowing for a better understanding of the flow behavior due to new navigation, filtering and display options.
- Further integration from geosciences to production as a result of the Big Loop solution, offering reservoir engineers an automated workflow that tightly integrates static and dynamic domains throughout the field's lifetime, incorporates the stochastic property of geological inputs, and ensures optimal consistency of the reservoir properties with the underlying geology. Reservoir engineers can also utilise the Roxar App Connector to run additional third-party programmes or in-house applications, leading to improved uncertainty analysis through the closer integration of geology and engineering. Roxar Tempest, which runs on Windows and Linux and operates alongside Emerson's reservoir modeling solution, Roxar RMS, is an integrated software suite that provides a single, consistent interface and is used in hundreds of installations worldwide. Tempest modules include fluid analysis and an economic evaluation tool that provides cash flow analysis derived from simulation results. All modules can be deployed as an integrated suite with a common interface, or separately within 3rd party simulation workflows.

Gannett Fleming

Gannett Fleming's Tempe Town Lake Dam Replacement project was selected as the 2017 American Society of Civil Engineers (ASCE) Phoenix Branch Project of the Year in the "Greater than \$10 million" category. Gannett Fleming was the design engineer of record for the \$45 million dam located in Tempe, Arizona, and provided design and construction management services. The award is shared in partnership with the owner, the City of Tempe, and the prime contractor, PCL Construction, Inc.

Arizona's second-most visited public attraction, Tempe Town Lake draws more than 2.4 million visitors each year to enjoy swimming, boating, kayaking, and fishing. One of the lake's original rubber bladders failed in 2010, causing more than 750 million gallons of water from Tempe Town Lake to rush downstream.

"The new Tempe Town Lake Dam is the largest hydraulically controlled steel gate dam

of its kind in the United States, and it ensures the lake's continued success as a recreational venue and a powerful economic development engine," said Stewart Vaghti, PE, CFM, ENV SP, a senior project manager for Gannett Fleming.

"Gannett Fleming is excited to be a part of an historic project, and we take great pride in the positive impact our work has on the communities we serve," noted John Derr, PE, executive vice president and Gannett Fleming's West Region director.

The replacement dam consists of eight hydraulically operated steel gates, each 106ft long, 17ft tall, and more than 260,000 pounds. The use of steel gates improves the durability and reliability of the dam, while the implementation of a

hydraulically operated system offers a heightened level of safety and flow flexibility. The dam's concrete piers and spillway slab were constructed over a roller-compacted concrete (RCC) foundation, one of several solutions employed during the project to help reduce the construction schedule. A time-lapsed video of the construction is available online - construction began in June 2014 and was completed in May 2016.

"PCL is pleased to have been a part of this momentous project," said Mike McKinney, PCL district manager. "We look forward to continuing to provide complex solutions to communities' growing water needs."

The ASCE Phoenix Project of the Year Award is presented annually to a civil engineering

Hydropower Systems Inspection, Repair or Replacement

Canyon Hydro has the expertise and machinery to inspect, repair, rebuild or replace your existing hydropower components, large or small.

At Canyon, our Senior hydro specialists are available to examine the runner and flow control devices (nozzles, wicket gates, etc.) to quickly identify areas of concern. Non-destructive tests, including x-ray and ultrasonic, can detect surface imperfections, hairline cracks and other sources of performance degradation.

All major turbine components can be repaired or replaced by Canyon, including runners, nozzles, wicket gates and wearing rings. Replacement runners are redesigned using Canyon's advanced technology modeling and machining, resulting in higher efficiency and output than the original design.

For larger systems, Canyon has the ability to scan the interior of existing spiral cases and draft tubes, using the information to create a digital 3D model of the entire system. This makes it possible to perform a fully integrated CFD analysis and further optimize the efficiency of replacement runners and wicket gates.

Canyon Hydro maintains an impressive array of high capacity precision machinery, including extensive CNC capabilities.



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project in Gila, Maricopa, or Pinal counties that demonstrates significant excellence in delivering infrastructure that improves communities and the quality of life. The Tempe Town Lake Dam Replacement also garnered a Best Project award in the Water/Environment category of the Engineering News-Record Regional Best Projects 2016 Awards – Southwest, and the American Concrete Institute and International Concrete Repair Institute Arizona Chapter's Best in Concrete award for the around-the-clock placement of 18,000 cubic yards of RCC.

Knight Piésold

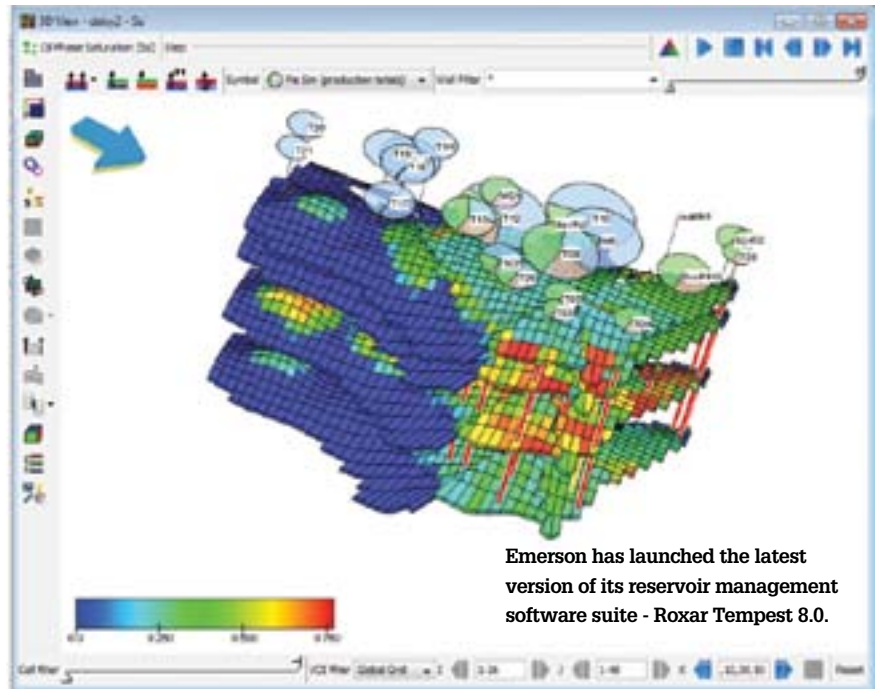
Knight Piésold received an Award of Merit in the Energy and Industry category, for its work on the Box Canyon Hydroelectric Project, at the 28th Awards for Engineering Excellence. The Association of Consulting Engineering Companies British Columbia (ACEC-BC) recognized the innovation and technical excellence of member firms at the awards gala, held on April 8, 2017, at the Westin Bayshore Hotel in Vancouver.

ACEC-BC honoured projects under five categories with 17 awards for engineering excellence. "The winning projects are some of the most impressive work we have seen from BC's consulting engineers, who have been showcased on this stage for nearly three decades," said Keith Sashaw, President and CEO, ACEC-BC.

The Box Canyon Hydroelectric Project is a 16MW facility located in the McNab Creek watershed in Howe Sound, BC. Knight Piésold assisted the owner, Box Canyon Hydro Corp. (a subsidiary of Elemental Energy Inc.), with concept development, optimization studies, environmental assessment, and permitting, that continued through to detailed design and operational monitoring.

The project may have the most hydraulically complex design of any run-of-river hydroelectric project in North America, if not the world, with nine intake structures on different creeks and tributaries, all feeding into a single, high-pressure penstock to direct water to the powerhouse containing a 6-jet vertical axis Pelton turbine generating unit. It has multiple intake structures that address the unique hydrology, river morphology, and fish species distribution along McNab Creek and its tributaries. It has an 8.6km-long water conveyance system of interconnecting pipelines and high-pressure penstocks that handles varying intake elevations and flow contributions, requiring the addition and design of surge facilities and check valves. The project design also took into account the complex hydraulic transient pressures (water hammer), and provided unique ecological flow releases at each of the diversion weirs.

Through an alliance contracting model, Knight Piésold worked closely with the owner, project manager, and contractor to successfully complete this complex design. Commissioned in early 2016, the project generates 46 GWh/year of renewable



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energy, enough to power approximately 4,500 homes in the Sunshine Coast and the Lower Mainland.

Kuenz

A brand new Künz Trash Rack Cleaning Machine type H500 has been delivered and assembled in April/May 2017 at Lavey (Switzerland). Custom made according to the client's requirements, it is perfectly adapted to the 100m radius of the rail track and features a rotating rake to better unload debris into the hopper. The hydropower station is operated by Services Industriels de Lausanne.

Mavel

A new 24MW hydropower plant is providing electricity for the Republic of Belarus, equipment supplier Mavel has announced.

The recently commissioned Polotskaya hydropower project, which is operated by RUP Vitebskenergo, is located on the West Dvina River. The project utilizes five Mavel Kaplan PIT type KP3000K4 turbines, with the firm also having supplied generators, hydraulic units, gearboxes, control systems as well as assembly and commissioning technical services.

Polotskaya is the second project in the Republic of Belarus to utilize Mavel's KP3000K4 Kaplan PIT turbine. Each of the turbines has a runner diameter of 3000 mm, four runner blades, and was designed and manufactured at Mavel's Benesov, Czech Republic manufacturing facility and headquarters. In 2012, Mavel commissioned RUP Grodnoenergo's 18 MW Grodnenskaya hydroelectric power project on the Neman River. This plant utilizes five similar KP3000K4 turbines.

Natel Energy

Natel has developed and built a new hydroEngine model, the Linear Pelton, the first-ever

implementation of a linear free jet single stage impulse turbine. The technology utilizes the highly efficient fluid mechanics of a Pelton-style bucket on a linear powertrain, and removes the need for a draft tube, stators, wicket gates, or stay vanes. The Linear Pelton operates efficiently in the net head range 3-20 m (9-65 ft) and up to 1MW.

Reel Coh Inc

To enhance customer service, Reel Group has decided to operate as a business unit by application markets.

This organizational logic is coupled with a strong presence in North America since 2015, following the acquisition of Reel Alesa and the creation of Reel USA. REEL Alesa is a material handling solution provider primarily in the aluminum industry. Reel USA provides material handling services and solutions tailored to the aeronautics, nuclear and hydropower industries.

To ensure consistent brand identity and create a clearer link with Reel Group, COH Inc. became Reel COH Inc.

Reivax North America

In May 2017, Reivax North America announced it has delivered three more static excitation systems to Tacoma Power for a total of 10 units so far. The Reivax RTX Power excitation systems rated at a maximum continuous current of 979ADC were delivered to the Mayfield hydro station. These Mayfield units are part of the large contract that Reivax North America received in 2014 to supply a total of 11 static excitation systems. Reivax North America has also delivered static excitation systems to Tacoma Power's Wynoochee, LaGrande, Alder and Cushman 2 hydro stations.

In February 2017, FortisBC awarded Reivax North America a contract to supply four static excitation systems for its Upper Bonnington

hydro station in South Slokan, BC. Reivax North America will deliver one of its RTX Power excitation systems each year for the next four years. Each system is equipped with a redundant regulator that function with a single bridge with redundant fans. FortisBC appreciated this configuration since it was cost effective but also allowed for a smaller cabinet footprint while still providing high reliability with a Mean Time Between Failure of 20 years.

Rotork

The innovative Rotork CK range of modular electric valve actuators is designed to meet diverse actuation applications in the power and water industry, says the company.

The modular CK design provides flexibility and configurability, enabling quick selection from stock to meet customer specification with short lead times, it adds.

The torque range facilitates reliable operation of valve types and sizes typically found in industries such as power generation and water treatment. In combination with secondary gearboxes, the CK range maximum multi-turn output torque is 10,800 Nm (8,000 lbf.ft) and part-turn torque is 205,600 Nm (151,600 lbf.ft). A direct-drive part-turn CK range is also available.

The modular construction presents a wide range of options and features. These range

from a standard CK actuator, requiring separate motor controls, to sophisticated Centronik versions equipped with an integral state-of-the-art intelligent digital control unit. The Centronik module can be mounted up to 100 metres from the actuator to provide local operation, configuration and commissioning for valves in inaccessible locations.

All CK versions can provide mechanical valve position indication. Standard features also include oil bath lubrication for extended life, mounting in any orientation, a safe motor-independent handwheel operation available at all times, and IP68 environmental double-sealing.

Increased valve protection is provided by independent torque and position sensing. Plug-and-socket connections facilitate fast and efficient commissioning and maintenance. All actuator sizes can utilise separable thrust or non-thrust bases, enabling actuators to be removed from the valve without affecting valve position.

The Centronik digital control unit provides intelligent control with datalogging for diagnostics and asset management, offering cost-effective integration with centralised and distributed control systems. Compatibility with hardwired, analogue or digital control protocols includes Rotork Pakscan, Profibus, Modbus, DeviceNet and HART.

Rapid and secure commissioning and configuration is performed using the actuator selector switches. A handheld Rotork Setting Tool, using infrared or Bluetooth interfaces, is optionally available for these functions. The actuator display window provides position indication, status and alarms plus user-friendly menu-driven configuration screens.

Saab Seaeye

Dominion Diving made big cost savings by customising it's Saab Seaeye Cougar XT light work electric robotic vehicle and boosting its performance.

The resulting Cougar XT custom version could handle a tooling package normally possible only on a much larger hydraulic system – and take on three demanding tasks in one hit.

Founded 50 years ago, Dominion Diving, based on Canada's Atlantic coast, provide subsea services and have a reputation for finding imaginative ways to fulfil demanding tasks.

Matthew Lohnes, president of Dominion, explains how the Cougar XT's power and design flexibility allowed them to readily enhance and boost the system.

"We effectively turned the Cougar into a work class system that could undertake tasks typically needing 100hp hydraulic tooling and perform three roles in one tooling package."

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He explains how the subsea intervention was to profile a manifold site using multibeam sonar; then operate a trash pump to excavate and clear sand and debris from the valve row, before engaging a torque tool to isolate the manifold and then operate a manipulator to turn paddle valves.

"In building the package we added extra channels to control different survey equipment, and built an enlarged skid to accommodate the tooling which included a Kraft Predator seven-function force feedback manipulator and a torque tool."

Faced with a new one-ton payload, they added an additional thruster to the Cougar XT's six-strong thruster pack.

The result was a very compact system that undertook all three tasks whilst operating successfully in currents of 2.5 knots and working with exceptional manoeuvrability in a confined space.

The Cougar XT is a proven compact 2000 metre rated electric vehicle that is able to handle a variety of task-specific skids with different tooling options that can be easily bolted on and changed as needed.

Matthew Lohnes concluded by stating that the flexibility and performance of the customised Cougar XT meant the job was completed on time and to budget.

Schnabel Engineering

Schnabel Engineering and SWS Global have formed a strategic alliance to provide tunnel and underground solutions for complex infrastructure challenges in North America.

Services offered will include:

- **Tunnel Design:** Analysis of construction methods and support systems appropriate for given ground conditions; mechanized and conventional tunneling methods; NATM/SEM; rock bolt, shotcrete, lattice girder, liner plate,

and rib and board initial support; cast-in-place and precast concrete segmental linings.

- **Shaft Design:** Initial support and final lining design for shafts in soil or rock, including steel sheet piling, soldier piles, steel ribs and lagging or liner plate; diaphragm walls, with tiebacks if required; tangent or secant pile shafts; ground improvement methods; rock bolts, shotcrete, wire mesh, and lattice girders.
- **Cavern Design:** Ground support design for large underground openings such as transit platforms and escalators, tunnel intersections, and underground powerhouse facilities.
- **Geostructural Design:** Soil and rock cut slopes for tunnels, underground openings, rail, highways, cofferdams, bulkheads, bridges, support of excavation and leaders in micropile and soil nail wall design.
- **Structural Geology Evaluation:** Analysis of rock mass data to identify critical joint set orientations and their intersections, and kinematic analysis to identify critical wedge failure patterns and required ground support systems.
- **Numerical Methods for Design:** Finite element and finite difference methods for determination of stress and deformation around underground openings, and for evaluation of excavation sequencing and phasing impacts on ground response and structural support.
- **Inspection and Rehabilitation:** Inspection of vehicular, rail, hydroelectric and pedestrian tunnels and underground chambers for fitness-for-service and/or rehabilitation.
- **Risk Management:** Systematic identification and evaluation of risk issues that can affect project cost, schedule, and safety; development and tracking of risk mitigation measures to effectively manage and reduce the likelihood and impact of risk events.

Seamor Marine

An innovative product has been launched by Seamor Marine Ltd. An in-house designed and produced Auxiliary Camera has been developed to expand the capabilities of a underwater remotely-operated vehicles (ROV).

Seamor, producer of the Chinook and Steelhead ROVs, has found a solution to the need for additional quality cameras that can easily be installed and used with a variety of ROVs. An easily-installed and repositionable full standard definition colour or black and white camera opens up a world of new possibilities for ROV pilots. Being able to view a different angle, behind the ROV, or close-up on a manipulator will provide even more reliable information for pilots to operate and maneuver their vehicles.

"We are excited about offering a high quality camera that is so adaptable, and very competitively priced" says Mr. Robin Li, Seamor Marine Ltd. President. "Like all our products, we have ensured that it can be used in a variety of applications. Its a great add-on for any ROV and an affordable tool to expand the capabilities for underwater work."

The Auxiliary Camera produced by Seamor Marine features a top-of-the-line full resolution NTSC or PAL camera. This camera has been designed with integrated neutral-white LED lighting, which further enhances the camera's fine sensitivity. seamor-marine-auxiliary-camera-spotlight-on-side-mount

Seamor's Engineering department designed this camera to operate with low power, and wide voltage range. This light weight camera (175 grams in the air, 80 grams in water) is equipped with industry sub-sea standard connectors that make it compatible with any Seamor ROV, or as a stand alone camera. These cameras can also be used with other ROVs, or mounted onto a divers' helmet if needed.

Vaptech

Vaptech has announced that the Tikvesh hydropower plant in Macedonia, for which it supplied the turnkey solution, has been successfully commissioned.

The project is operating under a net head of 117.3m using a flow of 1.1m³/sec. Vaptech' scope of supply on this project included a horizontal Francis turbine at rated speed 1000 rpm, butterfly valve DN600PN16, generator, electrical equipment, automation system and supervision of installation works.

The Western Balkan region has the largest remaining unexploited hydropower potential in Europe. Among the markets with great potential are Macedonia, Serbia, Bosnia and Herzegovina, Albania, Montenegro, Bulgaria.

In the first three quarters of 2016, Vaptech established its position in Macedonia with three new projects and the commissioning of HPP Konyarka 235. An additional three projects are expected to be put into operation in Macedonia this year. ■