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COMPANY PROFILES

Matchmaking Trip |October 24, 2016 |MUNICH
Alle Informationen zum Matchmaking-Event am 24.10. in München finden Sie hier

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OIL&GAS / MEASUREMENT WHILE DRILLING

1. Evolution Engineering

Representative: Aaron Logan
Technology: Advanced telemetry, clean technologies
www.evolutioneng.com

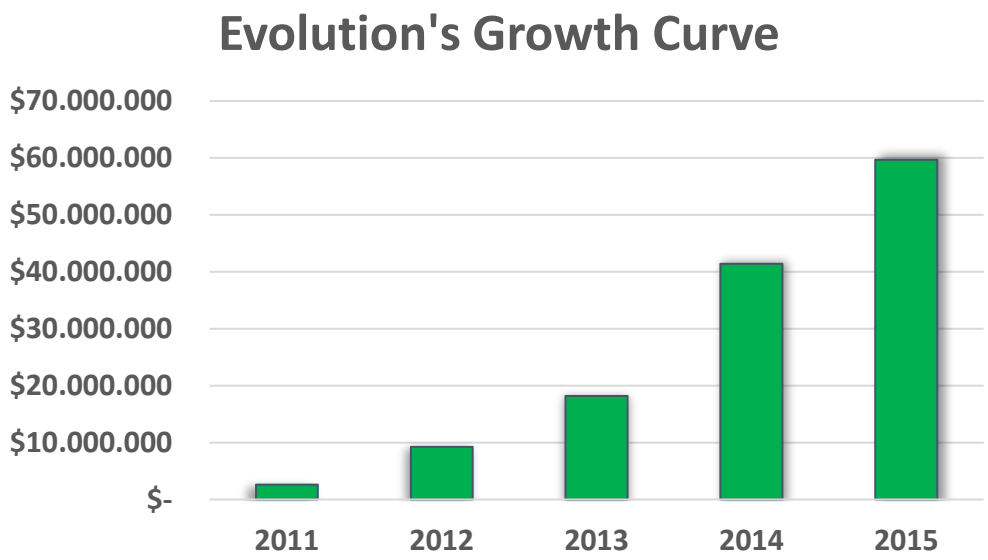
COMPANY

In 2011, Evolution Engineering™ (EVO™) was founded by a group of like-minded professionals with a history of developing and commercializing cutting-edge telemetry technology for the downhole market. EVO's founders had long been perplexed by the fact that the oil and gas (O&G) industry, easily the largest industry on earth, had been characterized by stagnancy in technological innovation in one fundamental area of its operation: data transmission. As in any other major industry, fast and reliable data has always been a driver for success, yet in this core capability, the oil and gas industry had been eclipsed by other industries like telecom and transportation. To illustrate the growing gap, O&G data transmission rates were 32,000 times slower than the first commercial computer models dating back to the mid-90s, not to mention data failure rates equivalent to a passenger plane crashing once every fifty flights between New York and Los Angeles. These low data transmission and high failure rates had been the reality in the industry for the last 20 years; EVO's founders decided it was time for a revolutionary change in the industry. What followed was the development and commercialization of EVO ONE™, the company's answer to an antiquated and saturated replica market and which quickly positioned Evolution Engineering as a leader and innovator in the downhole telemetry space. We felt it was time for an evolutionary change. With that foundation, Evolution Engineering started with the aim to be known as one of the most advanced, innovative, and rapid response engineering teams dedicated to building better telemetry and communication systems for the drilling industry. We adopted the mantra "Breaking Through Boundaries™" which is what our first technology release has accomplished.

Our focus at Evolution Engineering is to develop in house, from the ground up, next generation communication and sensor technology. We then deploy this innovative technology to the proper client base, resulting in positive and effective impacts on their businesses. Founded in August of 2011, our company has helped our clients rapidly gain market share by introducing revolutionary technology and novel processes into their workflow. Currently, Evolution holds 83 unique patents filed, each of which cover national entry in Canada, USA, Eurasia, the European Union, Iran, UAE, Saudi Arabia, Australia, Mexico, and China. We have an additional 36 drafted patents currently under review by the engineering team and are constantly striving to generate intellectual property central to Alberta. We have in house dedicated Intellectual Property resources supported by IP management software tailored to our business; we like to believe that we are a market leading small company, with big company IP generation. We place a huge value on promoting creativity in our entrepreneurial environment, as it is the key to driving innovation. Pushing boundaries, and staying on top of industry movements, helps identify and manage risks associated with development and commercialization of our technologies

We have grown in size to meet the ever-increasing demand for technology, as well as the need in the industry for reliability, low cost service, and exceptional quality. We strive to partner with like-minded companies in our application of technology while accommodating industry needs. Here are a few key points about our company:

- 65 full-time staff, including 37 full-time Engineers
    - Hardware, physics, mechanical, sensor, software, firmware
- History of developing next generation Measurement While Drilling (MWD) equipment
- Experience, our key people have developed 6 MWD tool platforms over past 10 years for:
    - Weatherford, Intrepid, Cathedral, Schlumberger (2 different platforms), XACT, EVO
- Evolution focuses on research, development, licencing, and knowledge transfer (80+ patent filings)
- Over $25 million spent on new product development since August 2011



TECHNOLOGY

The industry outlook can be broken down as follows:

Yesterday

- Market dominated by positive pulse "tensor" or "GE" style tools, poppet orifice, slow data rate, non-adaptable to changing drilling conditions, downward curve on reliability

Now

- Producers are being challenged to find cost reductions from efficiencies and reduced downtime associated with unreliable drilling services such as MWD, and look for more reliable EM or other telemetry options

Tomorrow

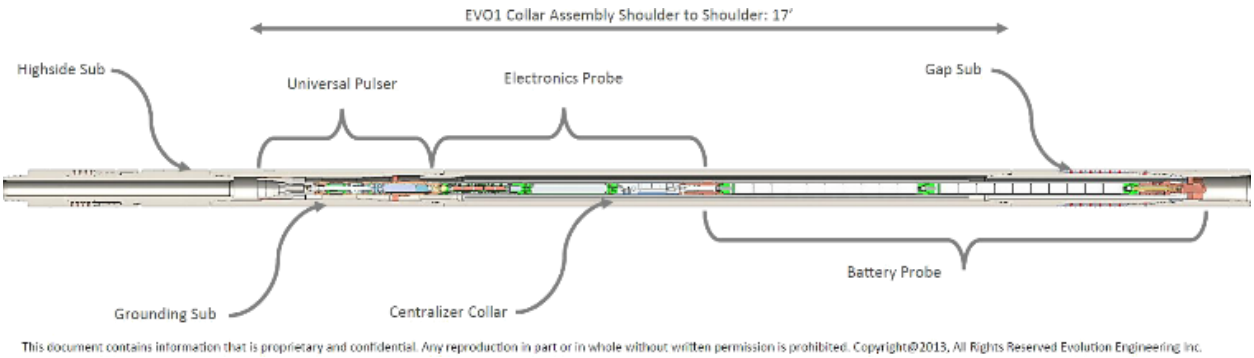
- Looking to enhance the drilling services by making use of automated and/or integrated services from surface to downhole, especially interested in higher data rates

Evolution Engineering has been working with Inpetro Energy (a technology partner) to develop a next generation Measurement While Drilling (MWD) tool for use in land based oil and gas (O&G) exploration.

EVO ONE has broken several boundaries but at the heart of the development was creating a next generation industry leading MWD technology focused on high reliability. To change the industries current MWD market, we had to rely on innovations that are both simple and efficient in design, assembly, use, and service. The industry is very much restricted to legacy constrained technology, or the "wet noodle" syndrome that all current MWD probes seem to suffer from. When a company can start fresh, and is free of limitations in design – great leaps can be made as focus can be placed on how to address the issues from the ground up, rather than how to address the issues within the confinements of legacy based technology. With the mindset of "nothing is untouchable," we opened Pandora's box and made sweeping evolutionary changes. Drawing on the team's extensive industry experience, known service quality and reliability issues were identified; where leading offensive failures – including those that we experienced repeatedly in our past, were designed out of the system. We also identified and addressed the human factor related issues that arise with complex designs and products that do not take the end users' needs into consideration. As such, our first product offering, EVO ONE: Unified Telemetry, was born.

Operation of an MWD tool requires adaptation to multiple environments and changing drilling conditions. To do so, EVO ONE is fully automated to make real-time smart decisions both downhole and through a closed loop uphole/downhole EM communication with the surface system. Decisions are made in real-time based on changing drilling conditions so as to maximize signal to surface while maintaining data rates and decreasing battery

consumption, or by altering data rates to ensure signal is maintained – with two fully configurable telemetries downhole EVO ONE has the ability to adapt, and the smarts downhole and uphole to know when and why.



MATCHMAKING OBJECTIVES

Evolution hopes to find a partner to develop an injectable material with the following requirements, to be used in a downhole drilling application:

- Injectable
- Non-conductive
- Low water absorption
- High electrical resistance over time when submerged in fluid
- Resistance to chemical attack (see table below listing all common chemicals in drilling fluid)
- Resistance to hydrolysis (steam), and to have a high hydrolytic stability
- Resistance to salts and chlorides
- Injection needs to have good flow characteristics through dramatic changes in flow area mold restrictions/right angles/small cross section to large cross section to small cross section to large cross section injectibility
- Good flow during injection that results in good knitting of the injection
- Preferred to have heat deflection temperature around 200 Celsius
- Preferred to have a high tensile strength in excess of 25MPa at 200 Celsius
- Preferred to have a compressive strength in excess of 300MPa at 200 Celsius
- Must not become brittle from hydrolysis and chemical attack after being strained/stressed to crazing

The application of the injectable material during drilling is for structurally joining two metal components together to make an electrically isolated joint to allow for the creation of a dipole antenna, separating the drill string into two isolated portions of the antenna. This will allow for higher efficiency in drilling due to improved data transmission rate via new telemetry technology development enabled by this plastic; ensuring less wasted time, less drilling required to produce the same amount of oil (lower environmental impact on surface due to being able to geo-steer the wellbore using quicker information to make better decisions), and provide the ability to remove humans from a hazardous environment – and have them work out of an office as we automate the drilling process remotely. The benefit to the partner is that Evolution uses a sub-optimal material currently, and we use pallets of this material a month and we need an immediate replacement for this high volume, non-optimum, material we already use – the partner gets access to high-stress environments that will push the boundaries of plastic capabilities and caustic environmental impacts to the plastic.

Common Chemicals in Drilling Fluid

Water Based Mud	Oil Based Mud	Lost Circulation Material
• Caustic soda • Lime • Lignites and Humalites • Ferrochrome lignosulfonates • Calcium sulfate (gypsum) • Polyanionic cellulose • Xantham gum • Bentonite • Potassium based products (not used on regular basis) • Asphaltenes • Graphite • Gilsonite • Starches • PHPA (partially hydrated polyacrlamide)	• Calcium Chloride • Lime • Emulsifier packages (fatty acids, tall oils, forms of amides) • Gilsonite • Diesel • Organic clay • Dimer acids and organic acid compounds	• Mica, muscovite • Calcium carbonate • Cellulosic fiber • Nut plug • Graphitic carbon • Granulars • Cellophane and flake materials • Polymer compounds

PREFERENCES/REQUIREMENTS FOR POTENTIAL GERMAN PARTNER(S)

Expertise in the following areas would be preferred:

- Polymer design
- Thermoplastic design
- Development of high reliability/mission critical systems
- Quick to market projects
- Internal manufacturing capabilities, or proven third party manufacturing partners

BENEFITS FOR POTENTIAL GERMAN PARTNER(S)

Evolution Engineering would enable our German partner's entry into the downhole market with a technology that does not currently exist in its market space. Evolution Engineering and its clients have an immediate need for a renewable and rechargeable energy storage solution to replace the current utilization of a non-renewable resource. Our goal is to cut this utilization down to zero in our market by developing a new technology to replace the current one. Our close business relationships with both the operator and service provider sides of the industry give us immediate access to real life testing environments, and complete transparency for data related to super capacitor product improvements. Furthermore, Evolution Engineering and its technology partners have skill-sets in high temperature and high shock mechanical structure designs, and could therefore be able to provide great insight into these areas for development of a rechargeable cell design.

2. Inpetro Energy

Representative: Kurt West
Technology: Advanced telemetry and clean technologies
Website: www.inpetroenergy.com

COMPANY

Our focus at Inpetro Energy is to find and develop next generation technology. We then deploy this innovative technology to the proper client base, resulting in positive and effective impacts on their businesses. Founded in August of 2011, our company has helped our clients rapidly gain market share by introducing revolutionary

technology and novel processes into their workflow. Currently, Inpetro holds seven unique patents filed, each of which covers national entry in Canada, USA, Eurasia, the European Union, and China. We have an additional four drafted patents currently under review by the engineering team and are constantly striving to generate intellectual property central to Alberta. We have grown in size to meet the ever-increasing demand for technology, as well as the need in the industry for reliability, low cost service, and exceptional quality. We strive to partner with like-minded companies in our application of technology while accommodating industry needs.

TECHNOLOGY
Inpetro has been working with a technology partner to develop a next generation Measurement While Drilling (MWD) tool for use in land based oil and gas (O&G) exploration. This technology is currently commercially available exclusively through Inpetro and has quickly gained acceptance with some of the largest O&G operators across North America. Additionally, Inpetro offers value added services for the directional drilling partners and O&G operators. These services include fleet management, failure analysis, field support and training, process developments, and KPI tracking.

MATCHMAKING OBJECTIVES
Inpetro hopes to find a partner to develop a lifecycle management algorithm that would be used to determine service intervals and retirement criteria for downhole oil and gas tools. The O&G sector currently retires components purely on in-service hours; this practice is flawed as tools are retired early to avoid costly downhole failures. When a failure occurs, the investigation often finds the failed component exhibited warnings of impending failure. Using historic data, we feel that an algorithm could be developed to identify components that need further inspection before deployment. Additional, component service life could be determined by the tracking of similar tools, operating in similar environments, and identifying useful life.

PREFERENCES/REQUIREMENTS FOR POTENTIAL PARTNER(S)
Expertise in the following areas would be preferred:

- Predictive analysis algorithm development
- Machine learning experience – neural networks, fuzzy-logic, inductive logic
- Cloud based computing
- Development of high reliability/mission critical systems
- Quick to market projects

3. MWDPlanet and Lumen Corporation

Company representative: Mariya Kucherenko
Technology: Field of Science/Technology- Remote Sensing
Website: www.mwdplanet.ca

COMPANY
MWDPlanet and Lumen Corporation develops, manufactures, customizes and assembles Measuring While Drilling (MWD) tools for horizontal and directional drilling in the oil and gas industry. We have been growing steadily since our inception in 2013. Large capital projects in 2013 and 2014 have generated the cash flow necessary to support our current focus on R&D, technological innovation, and expansion to new international markets.

The keys to success in our industry are:

- Innovation and responsiveness to the market's demands
- Ability to rapidly develop and launch new technologies
- Flexibility to fully integrate the client's specifications into customized directional drilling kits
- Ability to offer continuous services for equipment, both in-house and at customer sites

We currently exhibit all of these keys to success. As an SME consisting of a team of 6 technically skilled innovators, we are committed to developing new, innovative and competitive technologies, as well as continuing to offer our world-class kit customization and consulting services. Our Research and Development Team is focused on developing and supporting the following projects:

- Hybrid E/M/Mud-Pulse Telemetry
- Remote and local Surface Real - Real Time Logging systems and Depth-Tracking systems for locations without an EDR
- Later-Log Directional Resistivity
- Wave-Propagation Multi Space and Multi Frequencies Resistivity Downhole data loggers
- Neutron Density Tool with MWD integration and real time logging
- Development of a Rotary Steerable System

While downtime in oil-field industries pushes Canadian companies to shut down their highly technological businesses or, at least, move them out of the country – our company works on how to keep technology and educated people in Canada. We know markets inside of our country and overseas and we know how to grow business in Canada and maintain an overseas client-base at the same time. The growing aggressiveness in cutting drilling costs of oil companies all around the world creates new market for more advanced and cost efficient drilling tools. Yesterday's very strict and conservative oil companies want to drill with new equipment today. This creates new possibilities for Alberta – to not lose technology, to use existing resources, and to integrate Alberta's companies into the international global market. MWDPlanet's project focuses on the new market and solves quite a few technological challenges for the oil and gas industry.

TECHNOLOGY

We are proposing to build a down-hole directional orientation module (sensor pack) to measure bore-hole orientation for MWD or any Directional Drilling applications. A novel sensor pack design consists of a newly developed rock-solid magnetometer and three accelerometers, for azimuth and inclination measurements respectively. At this time, we have developed and tested an in-house triple-axis magnetometer prototype. We have also sourced a third-party MEMS-based accelerometer. The next step is to combine these components into a three-dimensional, compact sensor pack.

As the main part of the project development, we will create a calibration tool, which is an additional commercial component that customers will use to calibrate the sensor on-site. The complete sensor pack with calibration station will then be pushed to commercialization. Sensor pack's new internal mathematics will eliminate industry's old problems of slow and not always repeatable measurements, while at the same time the newest integration section of the Sensor Pack will still keep the possibility to communicate with old MWD-systems. Any funding received will be used to complete the development of the sensor pack, as well as to design the production process necessary to manufacture the sensor pack.

Our primary innovation is combining the MEMS accelerometer technology with our in-house flux-gate magnetometer design. The combination of these technologies permits the following innovations, compared to directional modules currently available on the market:

- We can rate our combined sensor pack to a lower overall power consumption
- Our sensor pack will be smaller (more compact)
- Due to the higher shock and vibration ratings of the MEMS based accelerometers, our sensor pack will be more reliable
- Because we are using in-house components for the magnetometer, the overall cost of materials will be lower
- Resulted design will communicate with all existing MWD protocols on the market
- By offering Calibration System together with Sensor Pack

We will resolve all Directional Service company's problems that operate within harsh logistical parameters by providing them with a way to perform simple quality control of measured trajectory and/or possible repair and

recalibration even in remote exploration areas. Since our product in its infancy stage and has the strong interest of our current clients, we plan to focus on keeping them consistently updated on the progress of the project with direct outreach, print and video marketing materials. Patenting, successful field tests, and certifications will be the main selling points of our product. When it comes to innovative technology that is a part of a multi-million-dollar operation, data and statistics are necessary to assure our clients of the success of the development. Thus we will need multiple field-tests with carefully catalogued results. The data will be posted with the printed and video marketing material. Clients will be also invited to be present and participate at the actual field tests, so that we can directly demonstrate the efficacy of our product.

MATCHMAKING OBJECTIVES

We are looking for partners with technical R&D expertise, who can contribute to system integration. Additional goals for partnerships include undertaking technology adaptation of a proven innovative product to meet new requirements such as country-specific regulations and standards in the market being entered, technology validation of functionality, performance, quality and usability with early adopter customers in Europe and Asia, as well as validation of product value proposition (test, procedure/tools development, test results analysis and reporting).

CLEAN TECHNOLOGY

4. Campbell Scientific (Canada) Corp.

Company representative: Peter Urban
Technology: Environmental Intelligence (Monitoring) Technology
Website: www.campbellsci.ca

COMPANY

Campbell Scientific (Canada) (CSC) began operations in May 1978 in Edmonton, Alberta and was federally incorporated in June 1980. CSC's core purpose is "Always striving to make the best measurement possible" making the quality of the measurement a foundation of our business. Owners of scientific grade automatic weather systems (AWS) have a shared goal, high quality data. During its first 37 years of business, CSC has been a systems integrator that sold measurement and data acquisition systems (hardware and datalogger software only) for our client's needs. Currently, to achieve this requirement they purchase high quality measurement systems, then need to ensure they are successfully installed, maintained and calibrated over the lifetime of the equipment, often more than ten years. The owners must also retrieve the measurements from the stations, commonly in remote locations, via telecommunications or satellite. Once the data is collected, they must then perform quality assurance and quality control before the data is ready for decision makers who rely upon this information.

Campbell Scientific (Canada) Corp. (CSC) is an ISO 9001 certified, Canadian-Controlled Private Corporation providing quality data acquisition systems, sensors and measurement instruments. Our systems feature wide operating ranges and dependable, stand-alone operation. In addition, they have low power consumption from a variety of sources, many telecommunications options, and have the flexibility to support a variety of measurement and control applications. These systems are suitable for use in industrial applications such as vehicle testing, structural monitoring, geotechnical monitoring, and mining. Our automatic weather stations, meteorological, hydro-meteorological, and other sensors are used in environmental applications such as agriculture, air quality, fire weather, water quality, weather, and climate reporting. CSC is a leader in system design, service, support, integration, calibration, and training. Currently, CSC holds exclusive Canadian distributor rights for products manufactured by the following companies:

- Campbell Scientific, Inc. of Utah, USA
- R. M. Young Company of Michigan, USA
- Kipp & Zonen of The Netherlands
- Hach Company of Colorado, USA

- OTT Hydromet / Hydrolab
- UTC Aerospace Systems (formerly Goodrich Sensor Systems, formerly Rosemount Aerospace)
- Minnesota, USA
- Geonor of Norway

Our extensive product range addresses a broad spectrum of markets, from agricultural and hydrological research to environmental monitoring networks, with sophisticated communications and a wide range of industrial applications including vehicle testing (automotive, railway, mass transit), mining, oil and gas production, and engineering. As the expectations of scientists and engineers increase with advances in technology, CSC maintains a leadership role in the market and will continue to do so by taking advantage of the latest innovations.

CSC is a well-established business with annual revenues of 20M$ generated by a team of 75 employees. CSC was initially created as a distributor and integrator of products manufactured externally but has grown its own line of products and manufacturing capability over the last 10 years. A brand new local, Edmonton-based, manufacturing facility was inaugurated in 2013, where all our products are now designed and built. The CSC product lines are distributed globally by Campbell Scientific group companies or selected partners in specific regions of the world. These products have typically been focused on applications related to northern climates, so focus on snow and ice measurements or capacity to function in extreme climate conditions.

CSC has a complete engineering design team with a proven track record of developing innovative products for the market. Some examples of this include the recent release of our fourth generation, state-of-the-art CCFC, a remotely managed 5-Megapixel Digital Camera with 18x optical zoom, which is described as the best outdoor camera in the world and targets applications where remote, unattended monitoring is required. In a partnership with Hydro Quebec, CSC also manufactures the CS725 Snow Water Equivalent (SWE) Sensor. The CS725 is an innovative non-contact alternative to traditional snow pillows commonly used today. In 2013, we introduced the CS230 Temperature Profiler, a completely sealed probe assembly with external probes for temperature profile measurement in roadbeds, soils, and water (snow & ice).

TECHNOLOGY

Under the Sensor Lync product group, Campbell Scientific Canada is developing a set of technologies and solutions that in their entirety will allow a much greater and a significantly diversified set of customers to receive and utilize real-time environmental intelligence. Traditionally quality measurements of the environment are made based on equipment that the customer or their consultants install and service in the field and as a result, the management of the quality and consistency of resulting data is often challenging. Beyond those “on-the ground” obstacles the correct and effective interpretation of such data into actionable answers – or as we call it intelligence – are a significant roadblock for “non-scientific” users and businesses in their quest to optimize (business-) processes based on environmental influences.

The stack of new technologies that we are currently developing into a cohesive system significantly lowers initial investment as well as the operational cost by implementing true plug and play measurement solutions (ease of installation and maintenance), by providing real-time connections to cloud-based management and storage systems (reduced on-site activity). For the first time public and private sector organizations will be able to integrate measurement data and intelligence into their business solutions, applications and processes in real-time.

Finally, our new approach to quality measurements (advanced smart sensors), on-site data collection and commination (Sensor Lync Data Accumulator) and a scalable cloud-based data management and application platform lowers the cost of implementing and managing environmental measurement networks (collection of stations) so significantly, that much higher densities data points will be possible, which in turn will enable a whole new host of applications in new markets (i.e. tens or hundreds of data points through major cities instead of a two or three).

The technology we are developing is based on cutting edge advancements in embedded systems development, satellite and cellular network based communication as well as advancements in the realms of Big Data, high performance cloud processing solutions and Machine Learning. The key to our value proposition is to bring those technologies together and integrate them into a turn-key solution that everyday business people and individuals can use and benefit from reliably, without in-depth knowledge or experience in the science and engineering behind it. The current development status of the Sensor Lync technology stack ranges form ready for advanced testing in the field (hardware) to advanced prototype development (software) and will go through several iterations additions with the aim of enabling our strategic goals over the next 4-6 years.

MATCHMAKING OBJECTIVES
Intensify our relationships with existing / potential partners for hardware and software development as well as OP partnerships to supply components integrate into our systems.
Identify new potential partners with the same goals as above in the areas of:

- Big Data management technologies
- In-memory database and data management technologies
- Machine learning technologies with the goal of data analytics and interpretation, predictive outcomes and forecasting
- Cloud infrastructure & application technologies
- Web-based application development and management
- Radio frequency-based data communication technologies
- Embedded systems development (microcomputer and linux-based)
- GSM and Satellite-based data communication technologies
- Non-mechanical precipitation measurement technology (i.e. Radar)
- Non-mechanical wind speed and direction measurement technology (i.e. Ultrasonic)
- Solid-State LIDAR sensor technology
- High-end sensor technologies for environmental monitoring (Air, Water, Temp, Pressure, Humidity etc.)

5. EXEN Pro Ltd.

Representative: Armin Hayatbakhsh
Technology: Clean technologies, oil & gas, energy recovery and efficiency
Website: www.exenpro.com

COMPANY
EXEN Pro, as an APEGA permit holder, is a consulting, engineering, procurement, and construction management (EPCM) firm, uniquely served by an R&D team, based in Calgary, Canada. We provide services for the oil and gas, environment, and energy sectors. Our highly motivated and experienced management team has served industries for over 20 years. We target to provide high-quality and cost-effective sustainable solutions. Our business development team facilitates business development platforms and represents technology and industrial portfolios for technology providers and suppliers for the Canadian and international market in the oil, gas, mining, energy, and environment sectors. Our vision is to be the most transparent, compatible and trusted partner for our customers by sharing relevant information, targeting mutual interest concerning the business, and consistently delivering excellence by applying the knowledge, expertise, and skills of our team. The core business mission of EXEN is to continually seek new customers and expand our relationships with our existing clients. We want to consistently develop and strengthen our services in niche market areas in order to increase our business utilization gradually.

Research and Development (R&D)
EXEN's engineering mission is to have a research and development team that closely collaborates with government and academic institutions in order to utilize state-of-the-art technologies and solutions for sustainable industrial applications. Our areas of interest include process development, process modeling, process simulation, and product development. The focus of our R&D team is on oil and gas, efficient energy generation and conversion

systems, environment protection technologies, water conservation technologies, water and wastewater treatment, steam generation, and solid waste management. EXEN has been a nominated firm to participate in the Industrial Research & Development Fellowship program from the Natural Science and Engineering Research Council of Canada (NSERC). Recently, we have developed a few analysis resources and software, tailored to our business, in the area of water recycling and treatment modeling for heavy oil extraction plants; and vacuum degasification, lime softening, and multi-media filtration process units. All those resources have been successfully validated and used for several industrial projects. Our R&D services include Technology Screening and Selection, Technology Demonstration, Technology Analytical Modeling, Process Simulation and Optimization, Project Regulatory Requirements, Pilot Start up, Operation, Testing and Performance Evaluation Support.

In addition, we provide Advanced Scientific and Engineering Services including Plant Integrated Water and Energy Modeling, Water Recycling Solutions, Exergy and Energy Recovery (Pinch) Analysis, Flow Assurance Analysis, Multiphase Flow Analysis, Computational Fluids Dynamic (CFD) Modeling, Finite Element Modeling, Hydraulic Transient Analysis, Renewable Energy Studies, and Waste-to-value Energy Studies.

TECHNOLOGY

Based on our interest area in R&D and business, we have identified the following research and development project, which will provide technical and economic benefits to both Canadian and German businesses; and eventually make revenue for both countries.

Project – Boiler Flue Gas Heat Recovery, Boiler Blow Down Treatment and Reuse, and Greenhouse Gas (GHG) Emission Reduction

About 95% of the Canadian oil reserves are in the form of oil sands, which can be produced using either surface mining for shallow deposits or Steam-Assisted Gravity Drainage (SAGD) for deep deposits. Additionally, this oil extraction technology is being applied in other parts of the world, such as South and Latin America, as well as in the Middle East. Boiler as a steam generator plays a major role, in terms of required steam production and contribution to GHG emission, in the above-mentioned oil extraction technologies. Therefore, there are many existing boiler installations and also will be many other boiler installations in future plants.

EXEN has been involved in several thermal heavy oil recovery projects in Alberta and Saskatchewan by developing integrated water and steam plant models, providing water and energy reuse solutions, and water treatment technologies through previous R&D projects. Based on our past experience, we have explored a few opportunities for water recycling, energy recovery and GHG emission for heavy oil recovery projects. For the GCCIR project, EXEN is targeting new technologies platform based on heat recovery of boiler flue gas, carbon dioxide partial separation from boiler flue gas, carbon dioxide recovery and use; and boiler blowdown treating solely (silica, chloride and organics removal) or combining with another slip stream (rich in carbonate hardness) of the plant and recycling. We intend to develop and adapt a fit-for-purpose technological solution, analytical model and possibly experimental pilot, consisting of several modules, for Canadian heavy oil recovery and any boiler installation projects. Each module, which will cover each individual technology, can be applied solely or jointly for every new and retrofitting project depending on the project requirement, conditions and budget; and governing regulations of the project. All above project's objectives will provide efficient energy use, water conservation, less GHG emission; and also less capital and operational costs comparing with the existing technologies. At the concept phase of the project, several candidates, as technology providers, and corresponding technologies are being considered. Additionally, we may plan for other R&D projects, depending on the market demand, in the area of water and wastewater treatment, energy recovery, turbomachinery, waste-to-value/energy (waste including cooking oil, coffee ground, brewery solid waste recycling, zero-emission biochar technology) and biofuel in the near future.

MATCHMAKING OBJECTIVES

A principle objective of the matchmaking trip will be to explore and set up relationships with the related technology providers, focusing on:

- The abovementioned technologies and the impact of each technology module on others, as well as the balance of a facility; as well as which technology would be the most fit-for-purpose solution for Canadian applications;
- Identifying any risk of the available technologies for the Canadian project application; and major technology modifications or developments required;
- The capabilities of the potential partners for adapting and piloting their technology for the Canadian application and corresponding regulations;
- The most appropriate technology and analytical methodologies to target for joint development between EXEN and other partners; and
- Path forward for the technology licensing, commercialization, and future business collaboration after the technology development.

This will be explored through discussions at one of the matchmaking cities, as well as during a planned site visit by EXEN to the potential partners.

A second important objective is to look for product or technology developers who need a research and development team to collaborate with. These would be an entity that already has a product concept with a well-defined business case and are seeking a collaborator, such as EXEN, with the demonstrated capabilities to support them to develop their product from concept into commercialization. This collaboration can be based on a business partnership, product licensing, research and development subcontractor, or product's Canadian representative agreement depending on the project conditions. In addition, recently we have applied to the Germany-Alberta Collaboration Fund for Product Development and Commercialization under "High Temperature Oil, Solids and Water Separation Technology as a De-oiling Process for Oil Extraction Application" project in collaboration with our German partner.

EXEN, by performing the research and development projects, will bring several benefits to the Program:

- It defines the market demands, opportunities and challenges, in the area of our expertise, as the research and development project subject.
- It screens and selects the appropriate technology concept based on the market criteria and a net benefit to the whole facility utilizing the technology.
- It brings collaboratively the required resources to develop the technology, solution or product that will meet the project requirements.
- It creates joint intellectual property opportunity.
- It helps to demonstrate new technology to the Canadian market by collaborating or facilitating pilot project in an operating facility in Canada.
- It provides societal benefits such as positive environmental impacts, talented resource and innovation connectivity, and market share increase.

PREFERENCES/REQUIREMENTS FOR POTENTIAL PARTNER(S)

Based on our capabilities, business areas, Canadian market needs and research and development projects, we prefer to meet potential partners in the area of:

- Technologies in water and wastewater treatment:
    1. Non-chemical technology for separation, removal and reuse of soluble iron and manganese from water (electromagnetic or pulse spark discharge or electrical field)
    2. Boiler blowdown (organics and silica content water) treatment and zero liquid discharge process by non-evaporative technology (i.e membrane, absorption or hybrid)
- Waste heat recovery and energy production:
    1. Organic Rankin Cycle (ORC) and heat/power energy production (commercial/industrial)
    2. Hybrid Technologies
- Pressure Let-down energy recovery from liquid, vapor and gas:
    1. Turbo expander
    2. Others
- Biofuel

6. Questor Technology Inc.

Representative: Audrey Mascarenhas
Technology: Clean Technology – Waste gas incinerators & waste heat to power
Website: www.questortech.com

COMPANY
Questor Technology Inc. is a public, international environmental cleantech company focused on emissions, founded in late 1994 and headquartered in Calgary, Alberta with field offices located in: Grande Prairie, Alberta; Brighton, Colorado; and Brooksville, Florida. The Company is active in Canada, the United States, Europe and Asia and is focused on clean air technologies that safely and cost effectively improve air quality, support energy efficiency and greenhouse gas emission reductions.

Questor designs, manufactures and services high efficiency waste gas combustion systems. The Company also provides power generation systems and water treatment solutions utilizing waste heat generated from clean combustion or other processes. Its proprietary combustion technology is utilized worldwide in the effective management of methane, hydrogen sulphide gas, volatile organic hydrocarbons, hazardous air pollutants and BTEX gases ensuring sustainable development, community acceptance and regulatory compliance. Questor and its subsidiary ClearPower Systems are providing solutions for landfill biogas, syngas, waste engine exhaust, geothermal and solar, cement plant waste heat in addition to a wide variety of oil and gas projects in Canada, throughout the United States, the Caribbean, Western Europe, Russia, Thailand, Indonesia and China.
With a focus on solid engineering design, Questor products enable its clients to operate cost effectively in an environmentally responsible and sustainable manner. Questor trades on the TSX Venture Exchange under the symbol “QST”.

TECHNOLOGY
Questor’s patented combustion technology guarantees the destruction of waste gases and harmful pollutants at 99.99% combustion efficiency. Our equipment is reliable, safe and Questor has been deemed a ‘best practice’ by a number of major midstream companies in the United States as the patented combustion design offers the ability to combust high water-content waste streams thereby eliminating the requirement for any equipment associated with condensing, any operating expenses required to cool and dispose of the waste water. In addition to providing regulatory-compliant technology, this design provides significant capital and operating costs savings.
The Company provides combustion solutions for a variety of applications including truck and railcar loading facilities, gas dehydration, acid gas, low heat content waste gas and waste vaporization This technology creates an opportunity to utilize the heat generated from efficient combustion that can be used for water vaporization, process heat and power generation.

There are several benefits the Company attaches to its combustion technology including:

- safe and effective disposal of waste gas streams
- regulatory compliance
- significant operational savings
- opportunity for heat recovery

In 2014, Questor acquired US-based, ClearPower Systems whose proprietary single-scroll Organic Rankine Cycle (ORS) system provides an efficient and cost effective means of converting heat energy into electrical power. The ClearPower system delivers power from 65kW to 2MW from waste heat. One market segment of major interest to Questor is the bio gas and bio mass to electric power application. There is a significant number of existing bio gas digesters in Germany producing bio gas which in turn fuels internal combustion engine drive generators. These engines are generally one megawatt and fit the heat profile that we need very well. By retrofitting a waste heat unit on the engine, using its exhaust and jacket water for the heat source the overall electrical efficiency can increase by as much as 10%. In addition, the revenue added by the increased electrical production offers a very

attractive return on investment. The power is produced with no fuel and has zero emissions so the net result has a positive effect on reducing GHG emissions.

Product Details:
Methane Combustion:

- Methane combustion >99.99%; Releases only CO2 and water. 9-fold reduction in GHG emissions
- no smoke; no odor; no visible flame
- exceeds EPA regulations; Quad O certified
- solution for completions and flow backs; green completions and closed loop completions
- 100% destruction of Benzene, hazardous air pollutants and volatile organic compounds
- Refinery and Petrochemical emissions

MATCHMAKING OBJECTIVES
Questor is ready to commercialize its waste heat to power technology and sees Germany as a key market for this technology. Questor believes there is a significant opportunity to collaborate on the R&D (in particular on QTI water treatment with waste heat and waste heat to power technology. We would like to apply for Alberta-Germany Collaboration Fund and have a project that would be applicable demonstrating the clean combustion of landfill gas with the conversion to power.

MEMS / PHOTONICS

7. Boreal Laser Inc.

Representative: John Tulip
Technology: Clean Technologies
Website: www.boreal-laser.com

COMPANY
History: Boreal Laser was founded as a defense contractor in the early 1990's. The company has manufactured and sold trace gas sensors for industrial and environmental applications since 2000.
Products: Boreal Laser provides laser gas detection solutions for environmental, process monitoring, and safety applications. The company's systems remotely monitor optical absorption of trace gases present in the laser beam and use this absorption to determine the concentration of these gases. One application for Boreal Laser systems is fugitive emission measurements. Laser systems are combined with beam scanners and stationed downwind of emitting sources such as leaky gas processing facilities or agricultural sites. Fugitive emissions are found by combining data from the laser systems, atmospheric data, and a dispersion algorithm. Another application is line-of-sight safety perimeter monitoring of toxic and explosive facilities within refineries, chemical plants, and petrochemical processing facilities. Boreal Laser also supplies in situ cross-stack and cross-duct monitoring for emissions and process measurements and helicopter based airborne pipeline leak detection systems. The company exports most of its production and has currently sold gas sensing systems to 49 countries.

INNOVATION/TECHNOLOGY
Boreal Laser is developing mid-infrared laser trace gas sensing systems. MidIR sensors have the potential for non-contact detection of most molecular gas species with high sensitivity. We are, for example, currently developing Acrolein fenceline atmospheric emissions monitoring systems for a major US chemical manufacturer. Boreal Laser is also developing miniature MidIR sensors for airborne gas detection application.

MATCHMAKING OBJECTIVES
Our objective is to find a partner interested in collaborating synergistically with Boreal Laser to either develop

midIR laser gas sensors or develop new industrial applications for MidIR sensors. A project could, for example, be the development of a system to detect trace levels of toxic molecular gases in stacks, along fence lines, and in chemical processes. An effective partnership would enhance the technical capabilities of both parties. We are also interested in partners with UAV technology, partners with knowledge in atmospheric physics and technology (in particular for green gas emissions monitoring) and atmospheric polluting technology.

PREFERENCES/REQUIREMENTS FOR POTENTIAL GERMAN PARTNER(S)
Boreal Laser would prefer a partner familiar with of optical gas sensing. We would also prefer a partner interested in either industrial gas sensing or emission monitoring.

8. Luxmux

Company representative: TBD
Technology: Spectrometer / Photonics
Website: http://www.luxmux.com/

COMPANY
Luxmux is a company based in Calgary, AB Canada and has been in business since 2011. The company is shaping the future of Photonics with its revolutionary and proprietary" best in class" ultra-wide photonic solutions. Luxmux has pioneered photonic advancements that serve existing industry applications in a much more cost-effective and efficient manner. Current photonic solutions require the user to compromise resolution, power and/or bandwidth for a specific application. Our suite of technology products possess the power of a laser with 1,000 times the bandwidth.
Whether you are looking for a photonic light source, tunable laser, or spectrometer, Luxmux offers the only technology solution that simultaneously maximizes resolution, power and bandwidth.
We are currently focused on the "test and measurement", "gas composition measurements", "aerial monitoring of fugitive emissions" and "oil and gas" industries. However, our enabling technology is applicable to wide variety of additional industries.

TECHNOLOGY
The BeST-SLED® family, which stands for Broad Spectrum Tunable Super luminescent Diode light source. The family of fiber coupled solutions which provide a high power broad band light sources from 1250nm-1750nm which can be tuned for various spectral ranges or provide continuous spectral coverage over the entire range with 100mW of power.

The UWT family, which stands for Ultra-Wide Tunable and includes:

- **Ultra-Wide Tunable SLED** Source – A fiber coupled tunable super luminescent source from 1250nm-1750nm with an average of 1nm linewidth Full Width Half maximum (FWHM) with an average of 200uW/nm power.
- **Ultra-Wide Tunable Narrow Linewidth Laser** – A fiber coupled tunable laser covering 1250nm-1750nm with an average of 0.3nm linewidth FWHM and over 10mW of power at each wavelength.
- **Ultra-Wide Tunable Single Frequency Laser** – A fiber coupled tunable single frequency laser covering 1250nm-1750nm with a 100 Khz linewidth average over the entire tuning spectral range and over 10mW of power at each wavelength.

The Spectrometer Family of Solutions can use any of the above referenced optical sources. Luxmux provides a high dynamic range (60dB) spectrometer solution with reference channel capability and software, optional industrial inputs for pressure and temperature sensing and optional Bluetooth capability for a complete spectroscopy solution.

Sample Accessories - Various sample accessories such as, half parabolic collimators with reference channel outputs, gas cells, flow cells and single mode reflectance probes with wide collection angles are available to be used for the Luxmux family of products.

MATCHMAKING OBJECTIVES

Luxmux has three main objectives; Exposure of technology capability, integration into new applications for increased abilities/efficiencies and partnerships to ensure our technologies remain cutting edge in the future.

- Exposure: Our technology stands out for the wide tuning range capability of our butterfly packaged diodes and lasers, from 1250nm-1750nm. We make an affordable and portable device. Luxmux would like to expose our technology end customers of tunable diode and tunable laser products.
- Integration: Currently our technology is integrated into the industrial process control industry for applications like steam quality, oil in water, gas composition and more. With these integrations, we have revolutionized their processes. At Luxmux we know we can have this same effect on many industries as an integrator. We are looking forward to discovering what other industries can benefit from our technology. It would be beneficial to create a partnership that can benefit both sides through integration in markets/applications outside of the oil and gas and industrial process control. Such markets as telecommunications, Lidar, Optical coherence Tomography, Test and measurement labs such as photonics labs.
- Partnerships: Our partnerships have been as important to our growth as our technology. Germany has a large laser market; we are looking forward to partnering with intelligent minds to help shape new products and direction. Our partnerships will prove to be a guiding force for the future of our company. We are happy to have the opportunity to develop these partnerships outside of North America.

PREFERENCES/REQUIREMENTS FOR POTENTIAL PARTNER(S)

Manufactures, suppliers, distributors, integrators and users of Tunable lasers, Tunable Diodes, SLED's or spectrometers.

9. NORCADA

Company representative: Graham Mckinnon
Technology: Medical Devices
Website: www.norcada.com

COMPANY

Norcada is a MEMS and photonic product company specialized in the development and manufacturing of MEMS devices and mid-IR DFB lasers for a wide range of industrial and scientific applications. Founded in 2001, Norcada has access to a state-of-the-art MEMS and photonics fabrication facility in Edmonton, Alberta, home to a major nanotechnology cluster in Canada. Norcada MEMS products include thin film devices, MEMS heating chips and liquid cells for electron and X-ray microscopy, silicon nitride X-ray windows, X-ray tomography chips, silicon nitride holey membranes for TEM and X-ray analyses, and nanopore devices for bioanalysis. Norcada also develops and manufactures single mode semiconductor distributed feedback (DFB) lasers in the 1.3 - 3.6um wavelength range for industrial sensing, environmental monitoring, and TDLAS applications.

TECHNOLOGY

Norcada's product focus involves the following two main technology areas.

MEMS and Nanotechnology: Our MEMS and nanotechnology product focus involves the development and manufacturing of ultrathin membrane products for electron and X-ray microscopy applications. There are three key application areas we are seeking collaborations for:

- MEMS chips for in-situ TEM and X-Ray Microscopy applications - the MEMS chips we have developed include heating chips, liquid cells, and e-biasing chips. All products can be configured for electron microscopy as well as X-Ray microscopy.
- Ultra-thin X-ray windows - the ultra-thin X-ray windows have high transmission rates for X-rays (and electron beams), and yet are capable of holding at least one bar pressure differential. These thin membrane products are well suited as vacuum windows for electron and X-ray sources and detectors.
- Nanopore technology for DNA sequencing – Norcada has developed a wafer-scale nanopore fabrication technology using our ultra-thin membrane platform. We are currently able to produce nanopores down to 50nm on wafer scale using standard nanofabrication technology, and nanoproes as small as 10nm using ion milling methods. Our nanopore devices are basic enabling building blocks for a wide range of bio-analysis and DNA sequencing applications.

Semiconductor infrared laser technology: Norcada's mid-IR laser technology allows the fabrication of semiconductor DFB lasers with single mode operation with narrow linewidth and wavelength tunability. Our technology can cover the 1300-3600nm wavelength region. These wavelengths and performance characteristics make Norcada lasers well suited for laser spectroscopy and trace-level gas sensing applications (TDLAS).

MATCHMAKING OBJECTIVES
Our main objective is to find compatible collaborators in Germany to develop new products and applications for Norcada's MEMS and nanotechnology product platform technologies. Specifically, we are looking for early adaptors for our MEMS chips for in-situ microscopy, ultra-thin windows for electron beam and X-ray, or nanopore devices for bio-analysis and DNA sequencing. For our semiconductor infrared laser technology, we are looking for potential partners who have needs of lasers for gas sensing and spectroscopy applications, the collaboration may entail development of custom wavelengths, or special packaging platform to best suite their specific applications.

PREFERENCES/REQUIREMENTS FOR POTENTIAL PARTNER(S)
For MEMS and nanotechnology: we are looking for companies that have a need to develop the following products and/or applications:
- Heating chips and liquid cells for scanning/transmission electron microscopy, or X-ray microscopy
- Companies that develop x-ray detectors and need ultrathin X-ray vacuum windows
- Companies that are developing nanopore based next generation genetic (DNA, RNA, Protein) sequencing technologies

For semiconductor infrared laser technology: we are looking for companies that are developing Tunable Diode Laser Absorption Spectroscopy (TDLAS) based instruments for gas sensing applications.

10. Preciseley Microtechnology Corp.

Representative: Tiansheng Zhou
Technology: MEMS Technology Optical Mirror and Mirror Array for Laser Modulation
Website: www.Preciseley.com

COMPANY
Preciseley Microtechnology Corp. is an independent fabless MEMS product company that specializes in micro-optical systems, MEMS Near Infra Red (NIR) Spectrometer and MEMS Microphone and Micro speakers. Existing products include miniature electronically controllable MEMS mirror components used for laser beam steering, switching, and manipulation. These controllable MEMS micro-optics replace large motors and mirrors in scanned or switched optical systems. Advantages in cost, reliability, and size have made MEMS micro-mirror technology commonplace in the fiber optical telecommunications industry with increasing adoption in sensing and optical instrumentation applications. Preciseley's pioneering micro-optical technology enables the miniaturization of large and cumbersome optical detection and display systems. With these active laser scanning and steering

components, large optical systems (such as laser displays, gas sensing spectrometers, and laser ranging mappers) can be miniaturized for widespread integration into the everyday world of cars, phones, and watches.

TECHNOLOGY

Off the shelf and custom MEMS micromirror and micromirror array chip products

- For LIDAR applications
- For HUD applications
- For Fiber optical switches
- For Tuneable Laser
- 9 awarded patents

All single crystal Silicon structure MEMS microphone/microspeaker

- No dialectical materials
- Comb drive sensing and actuation structures
- Smaller chips size (0.8x0.8mm) with higher sensitivities
- Simpler process; low cost for mass production
- Could be used as ultrasonic sensors
- 3 awarded patents

MEMS Near-Infra-Red (NIR) Spectrometer

- Smaller size (could be 5x5x5mm); can be integrated into smart phones, or portable/hand held devices
- Wider detection range (800-2600nm) with about 10 nm of resolutions
- Smart phone compatible
- Battery operation
- 1 awarded patent

MATCHMAKING OBJECTIVES

- For the materials sensor (NIR spectrometer) R&D-project:
  - Expertise in miniature broadband (800-2600 nm), 0.5-1.0 watt, less than 10x10x10 mm light sources
  - Expertise in Packaging technology for miniature opto-electronics module
- For the Microphone and Ultrasound project:
  - Expertise in ASIC chip design and fabrication for a MEMS capacitive sensor at 3-10 pF of capacitance with 3-6% capacitance variations

Additionally Preciseley seeks to engage with partners requiring active micro-optical components for light manipulation. Of particular interest are companies pursuing the creation or miniaturization of:

1) portable miniature spectrometers for material sensing for IOT
2) projection display systems especially laser projection systems
3) laser ranging and tracking systems

These partners could possess:

1) Optical integration and packaging for miniature optical systems
2) Optoelectronics firmware and software

Preciseley also looks for systems integrators who will needs MEMS innovative comb-drive microphone/microspeaker and ultrasonic sensors.

HEALTH- / BIO-TECHNOLOGY

11. [n/e]

12. Elsius Biomedical Inc.

Company representative: Alessandro Biglioli
Technology: Medical Devices (cardiovascular and respiratory support), ECMO
Website: www.elsius.com

COMPANY
Elsius Biomedical Inc. is an Alberta corporation dedicated to the development, production and commercialization of ECMO (Extra Corporeal Membrane Oxygenation) systems. It has developed an integrated pump oxygenator called pCAS and a biocompatible coating called EBS, both combined with its proprietary console make for the most advanced system on the market today. The company has a very experienced management team headed by Mr. Alessandro Biglioli, who is in his 14th start-up venture. Elsius has the possibility of becoming a world market leader in this niche of the respiratory/cardiovascular support field.

TECHNOLOGY
Extracorporeal life support systems (ECLS), including extracorporeal membrane oxygenation (ECMO), are increasingly utilized to support patients for whom other therapeutic options are limited. ECMO in particular is being used for longer durations reflecting the on-going short supply of donor organs, as well as their expanded uses in other therapies. Elsius' pCAS system is comprised of a series of cohesively designed components, specifically a compact integrated blood pump-oxygenator device, a small touch-screen based control console, and other ancillary componentry. pCAS is intended for use as an improved cardiopulmonary bypass system for acute and chronic uses, such as Extracorporeal Membrane Oxygenation (ECMO). While it demonstrates marked improvements over what's currently on the market in terms of pumping ability, gas exchange capability and ease of use, the cornerstone of pCAS is an engineered bioactive surface (EBS) designed specifically for the pCAS application. EBS incorporates technical innovations in the areas of bioactivity (several-fold higher than currently available coatings), stability, reduced inflammatory response and a significantly lower cost of application. It is anticipated that these unique features will allow lower levels of systemic anticoagulation and inflammatory response and thus result in fewer post-procedural complications such as thrombosis, inflammation and bleeding. Other features of the pCAS system include a lightweight and compact control console that facilitates transport and rapid deployment, an intuitive user interface, and integrated high-density batteries for portable operation. Elsius has certified the EBS coating for safe human use and did extensive animal and lab tests on the pCAS system resulting in a product that is in a pre-design freeze status. Once that is achieved it will be available for clinical trials and clinical regulatory approvals.

MATCHMAKING OBJECTIVES
Elsius is pursuing multiple objectives with this trip. We are looking for a technical partner to finish the development part of the device, both a medical device manufacturer with RD capabilities on blood contacting cardiovascular devices and a developer/manufacturer of electronic medical control systems (for our console). We are also looking for a partner(s) to help design and manage the clinical trials of the system in Europe, usually those kind of organizations are called CRO (Clinical Research Organizations), we are open to innovative ones that want to develop a system to manage the trials and clinical data in an innovative digital form. We are planning to apply to the German collaboration program.

PREFERENCES/REQUIREMENTS FOR POTENTIAL PARTNER(S)

We would like an experienced CRO that is fully capable of designing with us the best clinical trials to certify CE the product and bring it to the market in Europe. Critical will be the ability to create and maintain high quality clinical data documentation so to be able to use them in other regulatory jurisdictions (like the US, Canada and/or Japan). We would like also to find a partner that can handle the clinical data generated in a digital way that allows us to do sophisticated data analysis and can be ported to the normal sales operations. We would like also a technical partner with experience in medical devices manufacturing and design, in particular someone with experience in designing and producing accessories (connectors, cannulae, heat exchangers, bubble traps, etc.) for blood contacting cardiovascular devices. Finally, we would like someone with experience in designing and producing medical devices electronics controllers, experience in controllers for cardiovascular and respiratory support applications would be preferred.

13. [n/e]

ADVANCED MATERIALS

14. AdvEn Industries, Inc.

Representative: Kyle Wang
Technology: Clean Tech and Electrochemical Materials
Website: www.adven-industries.com

COMPANY

AdvEn Industries, Inc. is a material science and technology development company founded in October 2011. Over the years, the company has steadily built a "Material Technology Platform" based on our innovations of our proprietary "activated carbon" codenamed "ASACs" (AdvEn Super Activated Carbon series). ASACs is a high performance and low cost basic material that can be scaled to suit various levels of performances and costs required by industrial and commercial users. ASACs can be applied in multiple industries where activated carbon has been or will be playing an important role, such as in energy storage, industrial catalysts, oil/gas recovery, certain high-value added water treatment segments and military applications. We primarily focus on high-end and high value-added market segments where high performance activated carbons are in large demand.

We are in the process of producing prototype ASACs products in our new prototype plant commissioned in March 2016, for sample distribution and limited quantity sales of ASACs to North American national labs and corporate and academic labs. Based on the high performance of ASACs, we are developing various applications using ASACs, such as super capacitor electrode coating technology, high-energy capacitors (HEC), lithium sulfur battery systems, applications of ASACs in efficient bitumen extraction process, etc. AdvEn is a shareholder owned company funded by founders, private investors and government grants since its inception.

TECHNOLOGY

Our proprietary activated carbon (ACs) making technology produces various grades of ACs with low costs relative to its performance. Our ASACs has a record breaking BET surface area compared with the best commercially available ones in the market today. This offers a vast potential in high-end market space that uses ACs to store energy and to perform adsorption functions. The purity of our products is at the top level in their respective categories. The proprietary methods and ingredients we use in producing our ASACs are least corrosive to equipment hence bringing good prospect for commercial adoption. Our ASACs production is in its prototyping and sample production stage, aiming for full commercial scale production in 2018. Our super capacitor electrode coating technology is in its R&D stage aiming for filing patents by end of 2016 and assembly and production by end of 2017. Our high energy capacitor (HEC) R&D is in process, aiming to complete prototypes in 2018. Our R&D in lithium sulfur battery systems is a long term effort, aiming to launch a commercializable (i.e. non-academic, non-

theoretical) prototype before 2020. Other than producing and marketing ASACs on our own, we will work with application partners to conduct joint field demos for various applications that use ASACs.

MATCHMAKING OBJECTIVES
We hope to find German partners who are in the downstream of what we do – i.e. companies that develop applications that use our ASACs as a core ingredient, such as new breed super capacitors, new breed lithium batteries, novel applications in water treatment (both industrial and municipal), new oil/gas recovery applications, catalysts for chemical industries, specialty chemical companies that apply "high-performance" activated carbons, etc.

Should we find the right partner(s), we will be interested in applying for the collaboration fund.

PREFERENCES/REQUIREMENTS FOR POTENTIAL PARTNER(S)
We like to seek both technologies and capabilities in partners in Germany and France as follows:

- Companies that have Super Capacitor or advanced battery assembly lines with consistent volume fabrication capabilities
- Electrolyte technology in supercap and batteries (high voltage and low resistance)
- Anode technology and prelithiation
- Application technologies that use high performance carbon materials for environment (water, air, soil cleaning), catalysts used in chemical processing or thermal power generation pollution control (taking mercury out), medical, food/beverage, military, etc.

15. Camber Technology Corporation

Company representative: Mike Hazelton
Technology: Corrosion, material science, polymer science, chemical inhibitors, interfacial science, analytics
Website: www.camberltd.com

COMPANY
Camber Resource Services Ltd (Camber), based out of Calgary, Alberta, Canada, has wholly owned subsidiaries, Sterling Chemicals Ltd. (Sterling) and Camber Technology Corporation (CTC). Sterling is a specialty services and chemicals supplier, supporting flow assurance and asset integrity in the Canadian oil and gas and power generation sectors. CTC is a new and growing technology company that provides product development and expertise, analytical services, and research capacity to Sterling and other customers, including water treatment, pulp and paper and agriculture. Over the last year CTC has grown steadily because of their association with Sterling and the market access afforded by this relationship.

At its core, CTC supports the Canadian oil and gas industry, and employs technologists, engineers and research scientists with strong backgrounds in various oilfield services, polymer science, surfactants, materials and corrosion, and analytical chemistry. CTC has developed a suite of inhibitor chemistries that address common concerns, including phase separation, corrosion, organic and inorganic foulants, water treatment and biocides. Alongside product development, CTC provides much of the necessary analytical facility to support management of a chemical treatment strategy. Here, services range from routine oil, water and gas analysis, to in-depth failure analysis of materials, to specialized monitoring techniques such as electrochemical corrosion monitoring, particle size analysis and advanced analysis of inorganic and organic foulants. A strong focus on analytical interfacial science, microfluidics, and polymer synthesis has emerged.

Going beyond day-to-day chemical services to the oil and gas sector, CTC has initiated and/or participated (participates) in a number of collaborative research and development projects. Involvement has included short-term specialized analytical work, chemical synthesis, ongoing partnerships and project leads. Short-term projects have included analysis of complex polymer fouling on heat exchangers, as well as mineral scales from pulp and paper processing. A number of ongoing projects include micro and millimeter scale fluidic devices for online

particle size analysis and mineral scale inhibition, electrochemical corrosion monitoring and anti-fouling inhibitors and coatings. An example of a larger project, in which CTC is project initiator and lead, is the development and application of hyper-branched, low toxicity polymers for separating emulsified water and crude oil and for wastewater treatment.

TECHNOLOGY

Project 1: Theoretical investigation of Asphaltene/Wax precipitation and deposition from crude oil: Study involving Nucleation kinetics and Bulk/Interfacial properties

This was a short-term (4 month) project, supported by the Canadian government and an oil producer in Western Canada. The customer was having issues with paraffin wax deposition. Experiments were performed to measure the interfacial bulk and wetting properties such as contact angle, interfacial and surface tension, of the foulant and a number of newly developed inhibitors. This project has entered a second phase and CTC would benefit from a company with expertise in interfacial rheology and measurement techniques.

Project 2: New Efficient and Green Demulsifier Based on Hyperbranched Polymers

Lab scale synthesis and proof of concept has been demonstrated. New applications for the devised polymers are being explored. CTC would benefit from collaboration with a company that has a strong background in water treatment chemistry, including emulsion breakers, clarifiers and flocculants.

Project 3: Evaluation of QCM Technology as a Tool for Evaluating Anti-Fouling Surfaces and Chemical Inhibitors

Proof of concept has been demonstrated by the client company, who approached CTC for support in the design and evaluation of the final device. This portion of the project is in its initial stage. The technology is being designed for online monitoring of mineral scale fouling propensity of various industrial systems, but specifically pulp and paper. CTC would benefit from a company with expertise in analytical instrumentation and packaging for microfluidic systems. This project is specific to aqueous systems and an important design concept is the integration of systems that can measure common chemical properties of process waters (pH, conductivity, dissolved oxygen, chlorides, phosphates, etc.).

Project 4: Handheld Devices Using Microfluidic Technology for the Evaluation of Process Stream Fouling/Corrosion Propensity and Inhibitor Screening

The global objective of this project is to design and develop handheld device(s) for on-site monitoring of foulant precursor material, fouling rates and the effectiveness of inhibitor chemistry in industrial systems. A number of microfluid/milli-fluidic test chips have been designed and are intended for monitoring corrosion electrochemically, organic fouling (wax/asphaltene) from crude oils, and mineral scales from aqueous systems. In the current stages of these projects, CTC would benefit from a company with expertise in optics for flow visualization and particle size analysis. Also, instrumentation and measuring interfacial and surface properties.

This project is a key focus for CTC in the Alberta-Germany matchmaking program.

MATCHMAKING OBJECTIVES

Our objective is to find an international industrial partner with a strong background in interfacial/surface chemistry, microfluidics and measuring instrumentation. As a small company, CTC relies heavily on cooperation with like-minded companies with an interest in innovation.

We are in need of expertise related to

- Fouling precursor measurement – this is done by spectrometry and we are detecting dissolved minerals such as Calcium, Barium, Phosphorous, and ions such as sulfates and ions contributing to alkalinity. We are working on measurements of the raw stream and slip streams because some of the analysis requires pre-processing.
- Suspended material – turbidity, changes in fluid conductivity, changes in fluid pH, particle size analysis of slip stream samples
- Deposited material – measured by heat conductivity, quartz oscillators

We are also open and excited about other opportunities.