

MAKING A SPLASH

ProSlide leverages
R&D for global
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TECHNOLOGY INC.

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Best practices when dismissing an employee
Seven steps for successful tech investment
Leveraging IIoT in the energy sector

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12 INNOVATION

ProSlide leverages R&D to make a big splash in the amusement ride market.



- 15 LAW** What you need to know when dismissing an employee.



- 17 QUALITY** ASQ survey links profitability to continuous improvement.



- 18 TRAINING** End the need for firefighting with continuous improvement teams.



- 18 EXPORTING** EDC portal streamlines access to insurance and support.

FEATURES

- 15 SAFETY STATS** WSIB Compass tracks injuries in the workplace.
- 19 OIL AND GAS** How IIoT leverages information to create value in the energy sector.
- 20 PURCHASING** Making a big technology investment? Seven steps will get you there.
- 21 STRATEGY** Canada Post's modernized machinery maintenance.
- 22 NON-DESTRUCTIVE TESTING** A new high energy CT scanning service for metalworkers.
- 23 LUBRICATION** Steam turbine systems and problems that require troubleshooting.
- 25 THINK LEAN** Inventory replenishment that keeps the process moving.
- 26 CCOHS SAFETY TIPS** What workers can do to relieve the ill effects of prolonged standing.

DEPARTMENTS

- 4 Editorial
- 6 News Bulletins
- 8 Careers
- 10 PLANT Online
- 11 PLANT Pulse
- 27 TECH CENTRE Feature: Bearing advances improve performance. Supply Lines
- 28 Leading Edge: Innovative ideas for plants
- 30 Products and Equipment
- 33 Plantware Events
- 34 Postscript

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Warning: US tax reform blowback

The glare from Justin Trudeau's halo must be interfering with his ability to see clearly. Bad enough that he has tried to push a progressive trade agenda on potential partners, which imposes labour and environmental standards, as well as protection for the vulnerable. The Prime Minister positions these efforts as sticking up for the poor and the exploited, while saving globalization from the nativism of the displaced. Good luck with that. But those on the other side of the table see the details as intrusive, complicating and, well...annoying.

Hardly an enticement to do business with Canada. Instead, he should work on the sunshine effects from inside solid trade and investment deals, although the progressive issues are beside the point.

Our man in Davos was pontificating again during his keynote address to global CEOs at the World Economic Forum, hectoring them to put workers before profits, elevate women and make the world a better place. Who can argue with the intent? Applause all around. But the CEOs were there to hear about why they should invest in Canada. And let's face it, that's a harder sell these days with the volatile dollar, high costs – especially for manufacturers – uncertainty about the status of NAFTA, plus the federal and many provincial governments that believe they can raise taxes and spend their way to economic growth while indulging in some social engineering.

Meanwhile, there were a couple of factory closures: a Dr. Oetker pizza plant in Grand Falls, NB and the 87-year-old Campbell Soup plant in Toronto. Both cited competitive pressures in the food and beverage segment.

The Camden, NJ soup maker is moving production to three plants in the US where it has excess capacity. It noted the Toronto plant couldn't be "economically changed" to meet future needs.

We can surmise the Trump administration's tax reform and attacks on regulation will appeal to US firms that have old plants in Canada. Bet on more companies looking south – where for some, labour and operating costs will be lower – to repatriate production.

Yet Trudeau made it clear in Davos his government will not be following the US. He needs to rethink that. One competitive advantage Canada had over the US was a low corporate tax rate that's about 26.5%. The Trump rate is now a flat 21%

The Bank of Canada noted NAFTA uncertainty and US tax reform will divert planned investments from Canada to the US, and shave 0.5% off its investment projection by the end of 2019. The implications and risks concern John Manley, a former Liberal finance minister and currently president of the Business Council of Canada, and Perrin Beatty, president of the Canadian Chamber of Commerce, a former Mulroney cabinet minister and the former head of Canadian Manufacturers & Exporters. Both feel all levels of government need to address how Canada can be more competitive and attract investors from here and abroad.

Tax expert and University of Calgary professor Jack Mintz recommends, among other things, that the federal government and provinces knock a few points off their rates to get closer to the Trump number and dial back some other "ill-advised" tax hikes.

Is that advice the Trudeau government is likely to take? Don't hold your breath. Justin and his crew are dreamily relying on an "educated workforce" and a tax rate that "is still competitive among G7 nations" to attract investment.

While the experts in the federal finance department take their time evaluating the potential impact of the Trump regime's tax reform reality, rest assured we'll soon experience it. US-based manufacturers operating in Canada are crunching the numbers and have a pretty good idea which direction the investment money will be flowing.

Joe Terrett, Editor

Comments? E-mail jterrett@plant.ca.

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BULLETINS

Calgary-based **NOVA Chemicals Corp.** is investing \$2 billion in two projects in Ontario's Sarnia-Lambton region. The investment includes the expansion of its Corunna, Ont. cracker and a new polyethylene plant.

Husky Energy Inc. in Calgary expects capital spending to be \$2.9 billion to \$3.1 billion this year. Capital spending for 2017, not including the acquisition of the Superior Refinery, was approximately \$2.3 billion.

Linamar Corp., the Guelph, Ont.-based auto parts manufacturer, is closing its \$1.2 billion acquisition of Winnipeg-based **MacDon Group of Companies** in Q1. Linamar continues to diversify beyond auto parts with this deal, which adds to its agricultural business. MacDon companies make agricultural equipment for global markets.

Montreal-based engineering firm **SNC-Lavalin** won a \$100 million services agreement from an unidentified plastics, chemical and refining company. The project's scope includes provision of all engineering support for the client's Gulf Coast facilities.

Xebec Adsorption Inc., a global provider of gas generation, purification and filtration solutions based in Montreal, is one of three Canadian Cleantech Export Stars named by Export Development Canada. The stars, including **Hydrogenics**, a provider of hydrogen generation and fuel cell products, and Vancouver-based **Ostara Nutrient Recovery Technologies** (which helps cities manage nutrients in wastewater), were selected from a field of 850 companies.

HPQ Silicon, a Montreal producer of solar cells, has entered into an international development agreement with solar silicon specialist **Apollon Solar SAS** to make high purity silicon metal high performance solar cells. Apollon, a French developer of renewable energies and processes, completed an audit of the PUREVAP process that **PyroGenesis Canada Inc.** in Montreal is developing for HPQ. The technology is expected to significantly lower the production cost of solar cells.

Cascade to update Mexican Airforce's C-130s

Will install advanced digital avionics suites from Rockwell Collins



A Hercules C-130 in flight.

PHOTO: HERNANDEZ

ABBOTSFORD, BC — Cascade Aerospace Inc. has been awarded a contract for the modernization of one Mexican Airforce C-130 Hercules aircraft.

The contract follows a recent delivery of two modernized C-130K Hercules aircraft fitted with advanced (Flight2) digital avionics suites from Rockwell Collins.

This program will be contracted through the Canadian Commercial Corp. (CCC) under an MOU between the Canadian and Mexican governments.

CCC is a federal Crown corporation that acts as Canada's international contracting and procurement agency.

The modernization program includes operational and technical training for Mexican Air Force personnel at the Cascade Aerospace headquarters in Abbotsford, BC.

The company is an operating unit of IMP Aerospace & Defence, a Canadian specialty aerospace contractor.

No financial details were provided.

First Magellan PCU delivered for deep space mission

TORONTO — Magellan Aerospace has delivered the first of three power control (PCU) units for a future deep space mission.

The manufacturer of aerospace systems and components based in Mississauga, Ont. was selected by the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado Boulder to provide satellite technology for a future space mission.

Magellan's Winnipeg plant is to deliver three of the PCUs and subsystems for three jointly developed control and data-handling units.

The end user customer and its program were not identified.

The unit provides spacecraft control processing, command decoding and processing, telemetry encoding, data handling and mass storage. Magellan's PCU provides power distribution and control, is scalable, and configures as either single string or dual string redundancy.

Magellan has operating units throughout North America, Europe, and India.

LASP is the world's only research institute to have sent instruments to all eight planets and Pluto.

\$100M in grants for Linamar

Supports Guelph auto parts maker's advanced manufacturing projects

OTTAWA — The federal and Ontario governments announced grants worth up to \$100 million combined to help automotive parts maker Linamar Corp. develop its advanced manufacturing technologies.

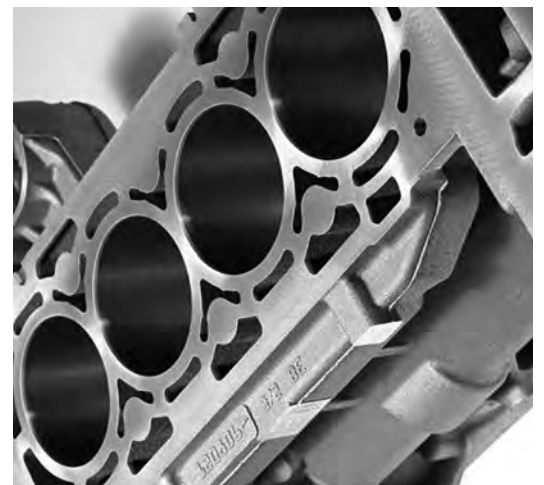
The Linamar investments are expected to create 1,500 jobs in Canada and help maintain more than 8,000 other positions.

The federal government is providing a grant of \$49 million to the company and Ontario will provide a conditional grant of up to \$50 million.

The project will be the first to receive cash through the federal strategic innovation fund. The Ontario government's grant will come from the jobs and prosperity fund as part of a project with overall eligible costs of up to \$500 million.

The release said the funding will help Linamar build next-generation transmissions and drive trains, high-efficiency engine parts and develop technologies for electric and connected vehicles. The grants will also support a Linamar

innovation centre focused on technologies such as artificial intelligence, machine learning and collaborative robotics.



Core precision metallic component used in Linamar automotive powertrains.

PHOTO: LINAMAR

US Navy tests Kraken SAS system

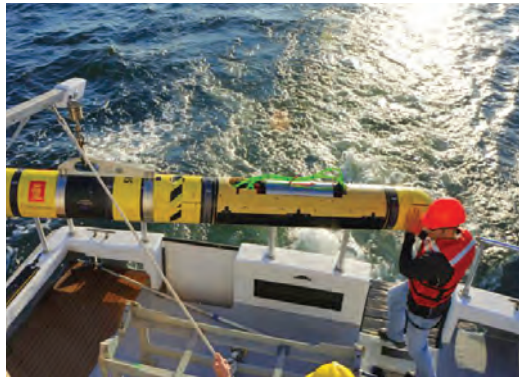
High technology sonar quickly locates and classifies mines

ST. JOHN'S, NL — Kraken Robotics Inc.'s wholly owned subsidiary, Kraken Robotic Systems Inc., has completed the development of a real-time synthetic aperture sonar (SAS) system.

The ultra high-resolution imaging system that provides 3D mapping of the seafloor was tested onboard a US Navy REMUS 600 autonomous underwater vehicle (AUV) operated by the Naval Undersea Warfare Center in Rhode Island.

The technology has been developed to quickly find and classify mines. High-resolution sonar data is processed onboard the AUV in real-time to create detailed acoustic images. These images are analysed on the fly by the vehicle's computers to enable the AUV to make enhanced decisions on the best way to continue the mission.

SAS's five centimetres of target pixel resolution covers ranges of over 250 metres, 10 times the range of side scan sonars.



Provides 3D mapping of the seafloor.

PHOTO: KRAKEN

Kraken identifies other potential underwater imaging applications as offshore energy, seabed surveying, marine archaeology, debris mapping and search and salvage.

Kraken Robotics, a developer of sensors and underwater robotic systems, is based in St. John's, NL.

Progress made reducing red tape

CFIB report card shows to best performers



Some governments are cutting red tape.

PHOTO: FOTOLIA

TORONTO — Red tape is the bane of any manufacturer, especially smaller ones, but some of Canada's governments are doing something about it, according to the Canadian Federation of Independent Business (CFIB).

Its 2018 Red Tape Report Card shows several governments are reducing excessive regulation, needless paperwork and redundant rules.

Grading is based on strong leadership, comprehensive measurement, and a commitment to control the growth of regulation.

This year three provinces received A grades: BC, where successive governments have reduced regulatory requirements by 48%; Quebec, which reduced its paper burden by approximately 22% since 2004 saving businesses \$303 million each year; and Manitoba, which showed the biggest improvement from the previous year moving up from a D+.

Manitoba's big jump comes from the introduction of new initiatives to measure, track, report and reduce red tape, including a two-for-one regulatory reduction law (one-for-one after 2021) and the creation of a Red Tape Reduction Task Force.

Alberta scored an F for the second consecutive year for failing to support any comprehensive red tape strategy.

Saskatchewan moved up from a B to an A-. Ontario dropped from a B- to a C+. Nova Scotia went from a B to A-. New Brunswick and PEI both slid from C+ to C-. Newfoundland Labrador declined from a C to C-. The Yukon earned a D while the North West Territories has back to back Fs. Canada went from B to B-.

View the complete report card at <http://CFIB.ca/redtape>.

\$21M for bio-chemicals from wood pilot

THUNDER BAY, Ont. — FPInnovations and Resolute Forest Products are investing in a TMP-Bio pilot project to develop new ways to produce and commercialize bio-chemicals derived from wood.

The \$21 million project is part of an initiative to renew and transform the forest products industry.

Resolute, a forest products company based in Montreal, is contributing \$3.5 million and hosting the pilot at its Thunder Bay pulp and paper mill.

TMP-Bio is a patented technology developed by FPInnovations that converts wood chips to sugar and hydrolysis lignin (H-Lignin) streams to create other products such as ethanol and a substitute for petroleum used in the production of consumer products.

The not-for-profit FPInnovations, based in Pointe-Claire, Que., carries out scientific research and technology transfer for the Canadian forest industry.

Mars brings Wrigley into its orbit

TORONTO — Mars Chocolate and Wrigley Canada are now operating as one business, known as Mars Wrigley Confectionery.

This segment is part of Mars Canada Inc., the legal parent company

for Mars segments in Canada.

Part of this business is the newly renovated, state-of-the-art manufacturing facility in Newmarket, Ont. The peanut-free facility is the first in North America to produce

Maltesers.

The family-run Mars Inc., based in McLean, Va., operates in more than 80 countries.

Mars Wrigley Confectionery includes M&Ms, Skittles, Excel, Snickers, Twix, Starburst and Juicy Fruit.

Major China biofuel deal for Enkern

BEIJING — Enkern Inc. has signed a \$125 million equity investment deal with a Chinese bio-industry conglomerate that will lead to the construction of more than 100 waste-to-biofuel facilities in the country by 2035.

Enkern, a Montreal-based producer of biofuels and chemicals from municipal waste, said the agreement with the Sino-bioway Group includes future licenses, equipment manufacturing and sales.

It also covers the creation of a major joint venture that will lead the construction of the state-of-the-art facilities.

The Sinobioway group primarily invests in the bio energy, environmental protection, medicine, agriculture, service, manufacturing and intelligence areas.

Enkern's technology converts non-recyclable, non-compostable municipal solid waste into methanol, ethanol and other widely used chemical intermediates. It operates a full-scale commercial facility in Alberta as well as an innovation centre in Quebec.

Enkern's facilities are built as prefabricated systems based on the company's modular manufacturing infrastructure.

CAREERS

Lyndon Flower joins Salina Vortex as its new business development manager. The Salina, Ka. manufacturer of bulk material handling products will be an added resource for the company's US and Canada division. Canadian offices are in Edmonton. Flower comes from A&J Mixing International where he held executive positions.



Lyndon Flower

Raven Telemetry, a provider of artificial intelligence for manufacturing in Ottawa, has a new chief strategy officer.

Rob Lander, former president and CEO of Stackpole (a global tier-one automotive parts manufacturer), has more than 30 years of experience in data-driven manufacturing.



Rob Lander

Tobias Kuehnle has been appointed managing director of TRUMPF Canada in Mississauga, Ont. He succeeds **Stefan Fickenscher** in April. Fickenscher was appointed sales director of the Machine Tool division at TRUMPF Inc. in the US. Kuehnle joined TRUMPF GmbH + Co KG in 2006, most recently handling product management and sales support services. TRUMPF makes fabricating machinery and industrial lasers.

Aurora Cannabis Inc. has appointed **Savior Joseph** new senior vice-president of global marketing. He was previously president of Colour, a digital creative marketing firm with offices in Toronto, New York and Halifax. Aurora Cannabis Enterprises Inc. is a licensed producer of medical cannabis.

Mario Gosselin is retiring as CEO of KP Tissue in Mississauga, Ont. and Kruger Products LP. **Dino Bianco** succeeds him in March. He was president of Kraft Canada where he led a business that tallied several billions of dollars in sales, had 23 brands, 11 facilities and more than 5,000 employees.

Aurora Cannabis investing in Micron's waste technologies

VANCOUVER — Aurora Cannabis Inc. is making a strategic investment in a Vancouver company that specializes in technology that treats organic waste.

Aurora, a licensed producer of medical marijuana, is collaborating with Micron Waste Technologies Inc., a developer of proprietary digesters. Micron's technology will treat waste generated by the cultivation and production of cannabis products.

Aerobic digestion converts waste into clean water that meets municipal effluent discharge standards. This diverts the waste from municipal landfills.

Micron will install its digester at an Aurora cultivation facility, where both companies will work on a viable design for the cannabis industry. If they are successful, Aurora will enter into a supply agreement for the purchase of digesters – at a preferred rate – for each of its cultivation facilities. Micron will also pay Aurora a 4% royalty based on gross revenues generated from digesters sold to other companies cultivating or processing cannabis, while retaining the system's intellectual property.

Aurora operates a 55,200 square-foot facility in Mountain View County, Alta. called Aurora Mountain, and the 40,000 square-foot Aurora Vie facility in Pointe-Claire, Que. Its 800,000 square-foot Aurora Sky facility is under construction at the Edmonton International Airport as a fourth facility is being completed in Lachute, Que.

Roofing manufacturer fined \$65,000 for worker injury

BRAMPTON, Ont. — A Brampton, Ont. manufacturer of roofing products has been fined \$65,000 as a result of a workplace accident that resulted in a worker sustaining critical injuries after being pulled into the rollers of a laminator machine.

I.G. Machine & Fibers Ltd. pleaded guilty in Brampton court to failing to ensure a guarding device was in place on the machine to prevent access to the pinch point.

The accident occurred on Aug. 8, 2016 at the company's Brampton plant. The worker was operating the laminator machine, which is designed to automatically heat-weld asphalt and fibreglass materials. The process involves feeding roofing material through large rollers to produce membranes for commercial roofing applications.

The worker's arms were pulled in while adjusting product that was being fed through the rollers. The machine had previously been guarded with an anti-nip bar, but it had been removed at the time of the incident.

The court also imposed a 25% victim fine surcharge in addition to the fine for the section. The surcharge is credited to a special provincial government fund to assist victims of crime.

LaserNett has a new home

MISSISSAUGA, Ont. — Metal fabricator LaserNett Inc. has moved to a new location in Mississauga, Ont. that provides it with room to grow. The new facility is 87,000 square feet, more than double the size of the previous building, with enough land for a 60,000 square-foot expansion.

CAE Healthcare debuts childbirth simulator

For practicing emergency labour, delivery tactics



Integrated mother-baby physiology. PHOTO: CAE

MONTREAL — CAE, an aerospace training and simulator manufacturer based in Montreal, has developed a device that simulates childbirth.

CAE Healthcare introduced the CAE LucinaAR with Microsoft HoloLens, described as the world's first augmented reality childbirth simulator with integrated mother-baby physiology, at the International Meeting on Simulation in Healthcare (IMSH) in Los Angeles.

CAE said clinical teams and learners would be able to practice emergency labour and delivery tactics on a high-fidelity manikin while guided by 3D holograms of the baby as it progresses down the birth canal.

There are approximately 12,500 CAE Healthcare simulators and audiovisual solutions in use worldwide.

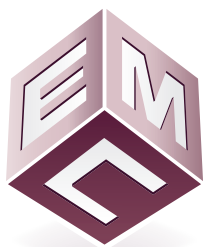
Trade Tech Industries expands its aluminum production

PORT HOPE, Ont. — Ontario is partnering with Trade Tech Industries on an expansion that is creating 10 new jobs in Port Hope.

The company, which employs 33 people, custom designs and manufactures structural steel, aluminum and stainless steel products for the construction industry.

It currently operates a single line for both steel and aluminum manufacturing.

With Ontario funding of \$173,900 added to its investment of almost \$1.2 million, Trade Tech will acquire a new production line and equipment for the aluminum side of the business as it looks to enter the US market.



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This project is funded by the Government of Canada Sectoral Initiatives Program

Mirabel produces its 5,000th helicopter

Part of Bell's 100 aircraft deal with China's Shaanxi



Mirabel employees gather around the 5,000th aircraft in the Bell Helicopter delivery centre.

PHOTO: BELL HELICOPTER

MIRABEL, Que. — Bell Helicopter completed its 5,000th aircraft in early December at its assembly plant in Mirabel, Que.

The Bell 407GXP was assembled for China's Shaanxi Helicopter Co. Ltd., which signed a purchase agreement for 100 of the aircraft in 2016.

The aircraft, launched in 2015, is an upgrade to the Bell 407 product line that provides an additional 22.5 kilograms of payload capability, with a new M250 Rolls-Royce

engine that improves performance and fuel efficiency. It's also equipped with new avionics features that lower maintenance costs.

Bell Helicopter is a Textron company, based in Providence, RI.

The Mirabel manufacturing operation was opened in 1986 and the facility is the final assembly and delivery site of the majority of Bell's commercial product lines. These include the Bell 505 Jet Ranger X, 429, 412EPI and 407GXP.

Seatbelt maker investing \$6.6M in modernization

GRANBY, Que. — Belt-Tech Products is getting some federal and provincial funding help for its \$6.6 million modernization project.

Quebec is providing the Granby, Que. manufacturer of seatbelt products for the automotive, industrial and aerospace sectors with a \$1.5 million interest-free loan through its ESSOR program, and the Canada Economic Development for Quebec Regions (CED) is kicking in a \$287,500 repayable contribution.

The project is expected to create approximately 30 jobs in the Montérégie region.

The company is acquiring specialized equipment such as a textile-dyeing machine and looms, and will integrate new technologies at its Granby plant.

Repayable CED funding of \$247,500 is also going to Elasto Proxy, a manufacturer of seals for the transportation, defence, electronics and renewable energy sectors in Boisbriand.

The company, which employs 42 people, will be applying the funding to the purchase of high-tech production equipment.



PLANT ONLINE

SOUNDING OFF

What readers have to say about breaking news

Have you checked out **PLANT's** daily news online? Here are some headlines that have inspired members of the Canadian manufacturing community to chime in. They're edited, but use the links to see the raw – and for some – longer versions of their remarks plus the stories that inspired their reactions.

Stay up-to-date on the developments – domestic and global – that affect Canada's industrial sectors by watching the news feed at www.plant.ca or reading **PLANT's** twice-weekly newsletter (hit Subscribe on the website).

Rising minimum wages could speed up automation, not relocations: labour leaders

www.plant.ca/8K3Oy

Sure, union leaders think this is great now, but just wait until they realize it's also going to result in a major overhaul of

the manufacturing sector [that will] increase automation even further and eliminate bottom level positions. This will result in fewer unionized employees and, therefore, less dues coming into their coffers. Then it will be a bad thing, and the unions will finally agree with small business owners (for the first time ever).

Stats demonstrate economic importance of Canada's automotive industry

www.plant.ca/Jydl1

Automotive and aerospace jobs are the middle-class jobs we should covet in Canada, yet our manufacturers are being sold to US-based VCs and PEs daily. We still lack the appropriate federal policies to attract major OEMs to invest in Canada, regardless of our competitive dollar. Why are VW and Mercedes setting up in North Carolina instead of Quebec or Ontario? I predict

Boeing will pull out of Canada [this] year.

Canada's move as US confirms hefty Bombardier trade duties

www.plant.ca/aHiVC

I am appalled at the hostile climate this US president is creating internationally and within his own borders. In protest, I have decided to refrain from flying on Boeing aircraft and will direct my spending to non-US goods and services.

Provinces have until the end of 2018 to submit carbon price plans: McKenna

www.plant.ca/4Ote1

The only reason for delaying this tax is to prevent the public from knowing exactly how much the Trudeau government has lied about the costs of his tax on the middle class before the next election. Without final numbers

Trudeau will try to skate around the fact his taxation does nothing to help the environment or the middle class. Canadians will be paying dearly for his taxation with nothing to show for it other than a large mess of corporate welfare to liberal friends...

Ontario won't meet 2020 electric vehicle target

www.plant.ca/QuLnq

It takes 30 minutes (approximately) to "rapid-charge" an electric vehicle. I can refuel my truck in about five. Also, I can run my fuel level to just barely above dead empty without worrying about damaging the fuel tank. Batteries aren't like that. If you fully discharge a deep-cycle battery, you have damaged it and reduced its service life. Also, if you run out of charge, you can't just walk to the nearest charging station and bring back a can of electricity...

Our labour market is strong: CIBC

It's in good shape to weather disruptions

Canada's job market is even better than it seems, finds a CIBC Capital Markets report.

Looking past the impressive 420,000 jobs created last year, average wages have grown and more higher-paying jobs were created than low-paying jobs.

The Canadian Labour Market – Even Better Than You Think examines three key vulnerabilities that could jeopardize the current expansion and durability of the recent improvement in wages and finds there's less slack in the labour market than policymakers perceive. Bottom line, the Bank of Canada (BoC) need not fret that underlying factors could threaten the current economic expansion.

Although youth unemployment has been a BoC concern for some time, the report notes it has been falling faster than the adult rate. Today, the youth-to-adult jobless rate is just over 2%, below its long-term average.

And the rate at which people become unemployed is currently at a record low, although they're staying unemployed longer. This is largely due to a mismatch in the labour market – way beyond the domain of monetary policy, says the report.

Wage inflation and absolute wage levels for those who have been working for awhile are not materially different from prime-age workers, suggesting a limited impact from a rising share of older workers.

Workers aged 55+ represent the fastest-growing segment of the labour market, but they're also slowly disengaging by working fewer hours each year. Last year, the 55+ factor reduced the total number of hours worked by 2%, the largest impact on record. This will only increase in time. Such a reduction is often taken as a sign the labour market isn't as strong as perceived, but the report observes it's also a demographically induced trend the Bank of Canada can't do anything to reverse.

Although Canada's labour market will be tested by challenges such as minimum wage hikes and ongoing NAFTA negotiations, CIBC says labour is well positioned to face what's coming.

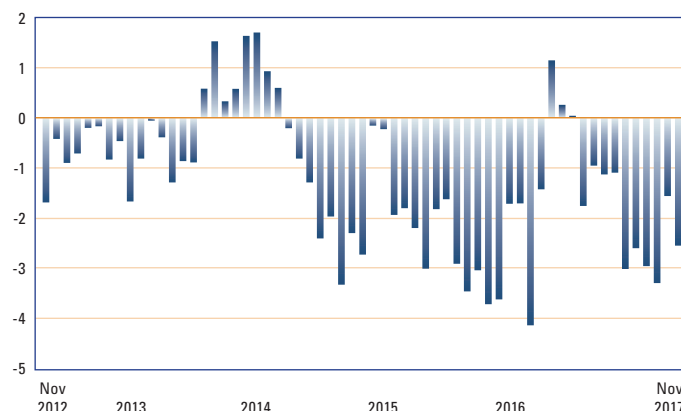
PLANT PULSE

ECONOMIC DEVELOPMENTS AND TRENDS

TRADE DEFICIT WIDENS IN NOVEMBER

Canada's merchandise trade deficit with the world widened in November from \$1.6 billion to \$2.5 billion. Statistics Canada reports imports were up 5.8% and exports 3.7%, both due largely to increased activity in the automotive industry. Meanwhile, a trade surplus with the US narrowed from \$3.5 billion in October to \$3.3 billion. Imports from the US rose 6.5% to \$31.9 billion while exports (led by vehicles) were up 5.4% to \$35.2 billion. The loonie lost one US cent relative to the US dollar month to month.

billions of current \$



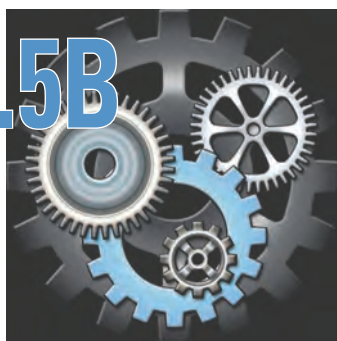
Note(s): Data are seasonally adjusted. Source: Statistics Canada, CANSIM



Robots shipped in North America as of the end of September, valued at \$1.496 billion, according to the Association for Advancing Automation. The hottest industries were metals (54%), automotive components (42%), and food and consumer goods (21%).

\$55.5B

November's manufacturing sales, up 3.4% from October, reports Statistics Canada. Twelve of 21 industries representing 81% of the sector posted increases.



44%

Percentage of senior manufacturing executives and managers who are optimistic about their prospects in 2018, according to the **PLANT**

Manufacturers' Outlook 2018 survey. But top issues of concern are protectionist policies in the US and elsewhere.



2.2 BILLION

The number of cigarettes produced by Canadian tobacco manufacturers in November, up 10.4% from October. Statistics Canada says cigarette production increased 0.2% from the same month a year earlier.



86,000

Job growth in the manufacturing sector in the 12 months to December, a 5.1% increase.

Statistics Canada reports natural resources saw a 4.6% increase to 15,000 jobs, following heavy losses recorded over the previous two years. There were 26,395 job vacancies in manufacturing and utilities during Q3 of 2017 versus 20,830 during the same period in 2016. Natural resources, agriculture and related production had 17,385 vacancies compared to 13,665 in Q3, 2016.



PROSLIDE MAKES A SPLASH

WATERSLIDE INNOVATOR TAKES ON THE WORLD

Investment in R&D pushes the envelope in amusement ride thrills.

BY JEFF BROWNLEE

Don't follow – lead. Be a tough competitor. Push the envelope. Most importantly, do it with passion. That's how Rick Hunter approached every tight turn and smooth-gliding steep grade of each downhill run as a member of Canada's alpine ski team in the early 1970s.

Thirty-plus years and approximately 3,000 waterslides later, the CEO of Ottawa's ProSlide has applied his skiing mantra to engineer fun for millions of thrill-seekers around the globe by offering them a similar experience.

And why not? There are a lot of synergies.

"The waterslide business has the thrill of skiing – putting people through G-forces, curves and sudden drops and riders don't need any skill," he says.

While riders may not require skill, pushing the limits of physics and marrying it with engineering, all in the name of manufacturing fun, does.

The company has approximately 120 employees at its global headquarters in Ottawa's west end and an additional 12 at a facility in Shanghai, China.

ProSlide is also constructing a larger R&D facility in the nation's capital while working with the city to create a leading-edge water park. That project is to break ground this year. ProSlide also owns Mont Cascades – a ski hill in the winter and water park (R&D) facility in the summer – about 20 minutes north of Ottawa

The industry has evolved substantially since its infancy three decades ago, explains David Alexander, senior vice-president of corporate affairs.

"When the company was founded in 1986, basically anyone who had a fibreglass plant and a hosepipe were making rides," he says. "It was a bit like the Wild West."

While the privately owned company was immediately a top gun from day one, ProSlide knew that to separate it from the competition, it would have to push the innovation envelope.

The first challenge came in

(Left) A Fibre Lamination employee in Hamilton uses a chopper gun to apply a layer of fibreglass and resin to a ProSlide part.

(Middle) Laminating a strengthening layer of woven roving into the second layer of a part.

(Right) Applying gelcoat putty to reduce the chances of air pockets between the fibreglass and gelcoat layers.

PHOTOS: STEPHEN URHANEY





David Alexander with models (L-R) TornadoWAVE 60 and a BehemothBOWL 60; Custom Complex with TORNADO 24/60 hybrid, CannonBOWL 40, PIPEline, 2x SuperLOOP with SkyBOX; and Custom Complex with TorandoWAVE 45, CannonBOWL 40, TORNADO 24/TORNADO 24 hybrid, TORNADO 18. PHOTO: ALEXI KINTERO

1990 when Hunter was approached by a company out of Colorado with the idea of developing a fibreglass raft ride for six people. Until that time, the industry standard was two people, boasting a maximum slide width up to 84 inches. This one required a width of 14 feet.

“Rick, with his entrepreneurial spirit, immediately said that we can do it,” says Alexander. “He came back to Ottawa and started tooling and fabricating the moulds for what would turn out to be a massive undertaking.”

Award winner

Part of that undertaking meant going back to Hunter’s roots as a skier, which fuelled the ride’s innovation. Aptly named Mammoth, it features the ProSlide compound curve, which is the moniker that translates into creating curves of varying radii enabling a faster, smoother ride with stronger G-forces

The company assembled the slide at Quebec’s Mont Blanc ski hill, pumped water from the hill’s snow making pond and flipped the proverbial switch with Hunter taking the initial plunge. The result was a game changer.



Mammoth took home top honours from the World Water Park Association's 1991 Award for Best New Water Park Ride. In total, it has been installed in more than 109 water parks around the world.

"It was absolutely revolutionary for its time," Alexander says. "It was an instant success and was a defining moment in ProSlide's history because that was the first time we set ourselves apart from the competition."

But definitely not the last. The company boasts that no other waterslide manufacturer globally invests more in R&D than it does and has now adopted innovation in motion as part of its marketing collateral.

Those investments have led to the development of industry-leading technologies such as the linear induction motor technology borrowed from trains. It enables up-hill travel and has prompted a new industry term – water coaster. ProSlide has also created water-propulsion technology using multiple sequential water jets. 3D printing creates to scale models of water

"MAINTAINING CONTROL OVER OUR TECHNOLOGY AS WE MANAGE OUR GROWTH IS VERY IMPORTANT TO US AND THAT'S WHY WE'RE PRODUCING IN CANADA..."

parks boosting research and development. It's also embracing computational fluid dynamics, which uses numerical analysis and data structures to solve flow problems.

"When we came out with the Mammoth, it was iconic and it was different – a home run for us. But we didn't stop innovating," says Alexander.

And it's working. ProSlide has earned more than 80 awards – the most among its peers – and has a global footprint on every continent except Antarctica and Africa.

Coming up with the next greatest water thrill ride starts with a passion-fuelled vision to create the ultimate experience. Technology then transforms



A hybrid MAMMOTH-TORNADO slide at Caribbean Bay in Yongin, South Korea.

PHOTO: PROSLIDE

that idea into a virtual concept courtesy of CAD modelling and 3D rendering.

ProSlide uses a proprietary modular design for all waterslides, a competitive advantage that Alexander compares to Lego building blocks.

"We look at the elevation, the length and the sequence of parts and curves. With different radius curves the challenge is how to build those LEGO-type pieces or building blocks in a sequence

fibreglass plug. Durable production moulds are then created.

"The key to the process is creating a solid fibreglass mould," Alexander adds.

Solid fibreglass moulds

ProSlide uses an open-moulding composite lay-up technique that includes a gel coat spray added early in the process, followed by a series of resin chops – spraying short strands of fibreglass out of a spray gun. The result is a fibreglass thickness between 6.5 to 9 mm.

While other manufacturers have opted to use the closed-moulding or RTM resin transfer, Alexander says ProSlide's experience with that process has resulted in too many inconsistencies.

The company used to do half of the fibreglass production at its Rigaud, Que. facility, but now it outsources to four suppliers in Quebec and Ontario, which trimmed production costs.

Keeping made-in-Canada part of the business strategy is a source of company pride.

"We are proud that products made in Ontario and Quebec are utilized all over the globe," he adds. "That's not something you see a lot of these days."

Considering that the company had about 35 employees 10 years ago, it's been on a steep growth trajectory that has posed a few growing pains.

"Maintaining control over our

technology as we manage our growth is very important to us and that's why we're producing in Canada and shipping all around the world," Alexander adds.

Operating a global business out of Canada's capital has been achieved solely on private funding and doesn't pose many challenges, especially when you have a product that's in demand.

"We are a proud Canadian company and we're blessed to operate in a world class city, with a highly educated and culturally diverse workforce," adds Alexander. "When you have a superior product that people want to buy, where you are located in this global economy becomes less important."

Looking forward, the company doesn't think it has made its last splash in the innovation pool just yet.

"We have a culture that is very open to change. We will continue to push the envelope and move things forward," he says. "There's a saying in skiing: When you get out of bed in the morning and lean forward, you start moving forward. We've done that from day one."

Jeff Brownlee is an Ottawa-based communications specialist and business writer. E-mail jeff@rainmakermedias.ca.

Comments?

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LAW

What you need to know before dismissing an employee.

BY LISA BOLTON
AND SAMIA HUSSEIN

As every business owner and human resource professional knows, despite the best efforts of management, some underperforming employees simply cannot or will not improve. In those cases, ending the employment relationship may be an employer's only option.

While each employment relationship is unique, and generalizations should be avoided, at the very least employers provincially regulated in Ontario should consider the following issues and best practice tips.

Contrary to what many employers believe, in the absence of an employment agreement limiting the circumstances in which employment may be terminated, an employer may terminate employment at any time and for any reason, so long as the decision does not breach the employer's human rights obligations or constitute a reprisal under health and safety or other legislation. For example, it's not illegal to terminate employment because the employer "doesn't like" the employee. However, it is illegal to terminate employ-



Employment can be terminated at any time and for any reason.

PHOTO: FOTOLIA

You're FIRED!

TERMINATION ISSUES AND PRACTICES TO CONSIDER

ment if the reason (in whole or in part) is because, for example, he or she is of a certain colour or sexual orientation.

Termination is either with or without notice. A dismissal without notice is permitted if the employer has "just cause", meaning the employee's con-

duct is so bad it has effectively destroyed the employment relationship. Absent just cause, an employee is entitled to notice of termination, which can take the form of working notice, or pay in lieu of notice.

Sometimes it's difficult for an employer to know whether an

employee's conduct or poor performance is sufficient to merit dismissal for just cause. Get it right and an unsatisfactory employee can be removed from the workplace without financial cost to the employer. Get it wrong and the risk to an employer could include liability for wrongful dismissal damages, not to mention negative publicity both inside and outside the workplace.

Just cause

Before making a decision to terminate employment for just cause, consider – objectively – the extent and quality of the misconduct. Is it bad enough that it has irreparably harmed the trust that underpins the employment relationship? Serious misconduct such as theft, workplace violence or insubordination are often (but not always) sufficient to meet the just cause threshold.

Just cause is more difficult to establish in the case of a chronic underperformer. Thorough documentation is required to demonstrate the employee was aware of the performance requirements, given sufficient time and assistance to improve, and failed to do so. For these reasons some employers decide, on a business basis, it's less onerous and expensive to simply give the employee notice, or pay in lieu of notice, than to allege cause and risk the additional cost and risk in responding to a wrongful lawsuit.

If there is a valid employment contract that sets out the

SAFETY STATS

Let Compass guide your H&S plans

WSIB tool provides provincial injury and benefits statistics

Ontario's Workplace Safety & Insurance Board (WSIB) has launched a new online tool that will find and compare health and safety statistics for businesses across the province.

Compass shows the number and types of injuries in any workplace. You'll see how many people were off work past the day of an accident and how many people are still receiving benefits a year later, and compare statistics for up to five different businesses at one time.

The first phase lets you see how your workplace compares to other businesses in your sector or rate group. This provides a sense of where you fall on lost time injury rates, leading part of body injured statistics and lost time claims

receiving wage loss benefits at one year. You'll also see injury claims and benefit payments by registration year.

Any business receiving coverage from 2012 to 2016 will be included. If your business had no claims or illnesses, you'll appear on Compass but without any statistics.

The tool also identifies what's driving sector statistics. For example, in 2016, manufacturing accounted for 15% of all allowed lost time claims, or 6,383 claims, over the last few years with little change.

More information will be provided in future phases to help you make decisions about health and safety in your workplace.

Visit www.wsib.on.ca/compass.

amount of notice to be provided upon termination, that will be sufficient so long as the notice period in the agreement meets or exceeds any statutory notice requirement. In Ontario, for instance, the minimum statutory notice period is limited to between one to eight weeks depending on the length of employment. An additional amount for statutory severance is also required in some circumstances.

If the employment relationship is not governed by a valid employment agreement, the employee may be entitled to "reasonable notice" determined in accordance with the common law – judge-made law developed by courts. Reasonable notice is intended to reflect the period of time the employee would reasonably take to find alternative, comparable employment and takes into consideration a

number of factors such as the employee's age, length of service and position.

Although there is no formal cap to reasonable notice, informally the cap is roughly 24 months generally (though not exclusively) reserved for an older, senior level employee with many years of service.

A well-drafted employment contract reduces the risk an employer will be exposed to liability for a long common law notice period, and in many cases limits termination entitlements to the minimum amounts established by employment standards legislation. A contract also reduces uncertainty for an employer, as the amount of reasonable notice is already determined.

The best time to introduce an employment contract is at the time of hire, prior to the employee commencing work. In that case the offer of employment is the "consideration" (compensation) in exchange for which the employee accepts the terms of the employment contract. However, all is not lost if an employment contract is not entered into prior to the employee starting work. There are opportunities during the employment relationship when an employment contract may be introduced. However, in those cases, expert legal advice is a must.

In any event, it's important to appreciate that most employment contracts will be interpreted strictly against the employer and in favour of the employee. Thus, to obtain the maximum protection possible for an employer, any employment contract should be drafted or reviewed by experienced employment counsel. Employment contracts should also be reviewed periodically to ensure the language used continues to be enforceable.

Employment-related disputes can be expensive. A properly drafted release gives an employer comfort that, once the matter is concluded, no other claims will be successfully made by

the employee arising out of the employment, including under human rights or employment-related legislation. To ensure your organization receives the full and intended value of a release, remember to follow these guidelines:

Exceed minimum statutory requirements. When terminating without cause, ensure the payment exceeds the minimum requirement under the applicable employment legislation.

Time to review. Provide the departing employee time to review the settlement documentation and seek legal advice if he/she elects to do so. An employee who wants to sign the release during the termination meeting should be advised you can't accept it and to take it away to review.

Do not provide legal advice. Be careful not to make any representation to the employee about his/her legal rights under the release. If there are questions, encourage the employee to seek his/her own legal advice.

Do not withhold minimum entitlements. When terminating without cause, do not threaten to withhold minimum statutory entitlements (such as termination and/or severance pay) unless the employee signs a release. Not only is it unlawful to do so, this may create an opening for a court or tribunal to conclude the release was signed under economic duress or that the employer acted in bad faith.

When dismissing an employee, an ounce of prevention really is worth a pound of cure, and prior consultation with expert employment law counsel is very often the best medicine.

Lisa Bolton and Samia Hussein are lawyers with Sherrard Kuzz LLP, an employment and labour law firm representing management. Call (416) 603-0700 (Main) or (416) 420-0738 (24 hour). Visit www.sherrard-kuzz.com.

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QUALITY

Achieve success by infusing quality thinking across the enterprise.

BY ELIZABETH BURNS

Globalized value chains have moved low-end productivity jobs offshore but the future looks bright for high-tech, advanced manufacturing. That translates into more growth for manufacturers who know how to make the most of this shifting landscape.

While some companies are harnessing the potential of quality to advance their business goals, others struggle to use innovation to implement continuous improvement programs, according to a new report by Forbes Insights and ASQ, a global community of quality professionals. They surveyed 1,869 senior executives and quality professionals who see a direct connection between the success of their quality initiatives and their organizations.

Forty-seven per cent of respondents attribute profitability growth to their continuous improvement efforts and 36% regard themselves as “established” quality organizations. Another 39% are still developing their quality efforts but lack a cohesive focus, while 25% say their initiatives are siloed, or non-existent.

More than half of the organizations with established quality programs say their initiatives already encompass a range of key corporate functions, including operations, customer service, production, partner/vendor relations, research and development, training, and sales and marketing. These organizations realize quality doesn’t happen spontaneously or within one single department, but that it needs to be deeply embedded in work styles and employee culture.

In a plant assembly line driven by quality, employees know they can stop production if they see an anomaly, even if it’s not in their area of responsibility. And



Growing your BUSINESS

AN ASQ SURVEY LINKS YOUR PROFITABILITY TO CONTINUOUS IMPROVEMENT

managers know they’re empowered to call on any resources needed to provide superior customer experience.

Quality challenge

An ongoing challenge for most senior executives is providing the appropriate level of training, skills and support to see quality initiatives through. Most corporate leaders (54%) cite employee competence for future needs as their most vexing, yet-to-be-resolved quality challenge, followed by outdated, rigid or slow processes (53%) and the need for greater data quality (52%).

A foundry in Ontario is overcoming this issue by using the Organization Knowledge requirement of ISO 9001:2015 to identify current levels of employee competence and future requirements. During this project, the management team identified future competency needs. The final step is to identify how the current and

future needs will be met.

Ideas such as technical conferences and training (including electronic methods) have been investigated, and the management team has committed to providing training on various topics each quarter.

Not surprisingly, senior leaders and quality professionals in this study see things a bit differently when it comes to how quality success is defined. Top executives see continuous improvement closely aligned with innovation, shared development and information systems performance. Quality professionals are more focused on the management of specific programs and implementation of tools.

Despite their differences, both groups agree there are steps to succeed with quality initiatives that include the following:

1. **Create a business case for performance excellence.** Mission and

Quality initiatives are key to efficient production.

PHOTO: FOTOLIA

vision statements, policies and measurable objectives aid in understanding criteria for performance excellence.

2. **Motivate your team to deliver quality success.**

Provide the results of measurables assigned to each key business process. A number shows employees will know how close they are to success.

3. **Promote an open and collaborative environment.**

Be honest and open about how your organization is doing, especially from your customer’s point of view. Employees will feel they are part of the business and have a real opportunity to make things better.

4. **You can’t manage what you can’t measure.** Each

of your key business processes should have a measurable objective with a target. Communicate results to employees (at all levels) so they know where improvements are required. They also gain a sense of success when a target is met.

5. **Innovate for the future.**

There will always be competitors who work faster and cheaper. Urge all employees to innovate daily, keeping in mind measurable objectives and targets.

Canada has been celebrating 150 years of Confederation and past glories fuelled by innovation. Quality thinking will ensure success carries into the future.

Download the Forbes Insights/ASQ report at economic-sofquality.org.

Elizabeth Burns is the owner of E. Burns Consulting in Guelph, Ont., which helps manufacturers and other organizations implement ISO 9001 and related business management systems. E-mail eburns@sentex.net.

Comments?

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TRAINING

There's no need for heroes when you tap into the knowledge on the plant floor.

BY HUGH ALLEY

A company had several hundred employees and dozens of people with lean belts of several colours. One of the newer employees was a supervisor. He wondered why, despite all the experts, the supervisors were still completely occupied with firefighting.

The result wasn't surprising. The plant had been trained to "let the experts handle it." The lean gurus – green, yellow and black belts – were called in when there were issues. The problem got put on a list. And sometime later, one or more of the experts would show up to save the day.

The company was breeding – and relying on – heroes who would swoop in and solve the problems. Unfortunately, problems soon resurfaced.

It seems faster and easier to involve the experts, but nothing happens when they aren't there. Because the workers aren't very involved in the improvement effort, they don't know whether the changes are making a difference or not, and they stop volunteering information that could make a difference.

It doesn't have to be that way.

Halfway through the company's 12-week project, people on the team were showing they could critically appraise the data generated during trials. They were also showing more restraint interpreting the data. When team members were excited by early results, one of their colleagues cautioned, "Hold on. We're not ready to draw a conclusion yet. We don't have enough data." That kind of insight is what you'd expect from an experienced black belt, not from someone who has been working through an improvement routine for six weeks.



Involving plant floor workers in problem solving eliminates the need for fire-fighting.

PHOTO: FOTOLIA

End the FIRE-FIGHTING

BUILD CONTINUOUS IMPROVEMENT TEAMS

It happened because the workers on the floor were deeply involved in developing not just what would be tried out, but how it was to be done. They didn't have carte blanche. Someone

who had seen similar challenges in other places guided them.

Daily work

Mike Rother from University of Michigan argues that if the only

time you have improvement is when there's an event and an expert is on hand, you are training people to do business as usual, not continuous improvement.

He says the improvement routine needs to be part of the daily work of every manager or supervisor. Then it becomes "continuous." You can see more of his work at www-personal.umich.edu/~mrother/Homepage.html.

If you are struggling with improvement that only happens when the experts are there, consider looking for a different model.

Bring your managers and supervisors to a point where they're working daily to make improvements.

Hugh Alley is an industrial engineer based in the Vancouver area who helps organizations achieve significant performance gains in delivery, quality and cost over a short timeframe. Call (604) 866-1502 or e-mail hughralley@gmail.com.

Comments?

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EXPORTING

EDC portal speeds export sales

Streamlines access to insurance and support

Export Development Canada (EDC) is making it faster and easier for manufacturers to sell abroad and protect themselves against the risk of foreign buyers not paying for a product or service.

Companies can apply for insurance coverage, pay premiums, report overdue payments, submit claims and speak directly with a dedicated sup-



Greater flexibility for accessing world markets. PHOTO: FOTOLIA

port team on EDC's new online Portfolio Credit Insurance portal.

The real-time service, available 24/7, is part of the Ottawa-based Crown agency's broader effort to give exporters greater flexibility and the ability to rapidly respond to shifting market demands.

EDC's research shows there are approximately 140,000 Canadian companies currently engaged in trade or planning to export. About 76% of the companies are considered to be "micro" in size (under \$1 million in annual volume).

Access the portal at www.edc.ca/en/solutions/insurance/credit-insurance/portfolio-credit-insurance.html.

OIL & GAS

How connected devices in the oil and gas industry create value.

BY MICHAEL MARTIN

The idea that any device with an on-off switch can be connected to the internet is capturing the world's imagination. While this capability provides some personal utility, its greatest value comes from connecting and applying intelligence and analytics to the larger, more technical systems we rely on.

The Industrial Internet of Things (IIoT) connects big, specialized equipment and complex systems to cognitive and analytical intelligence so they can run better, safer, cleaner and more efficiently. The transformation of operating models to integrate IIoT is becoming more prevalent, notably in the natural resources sector. The global economic impact of this kind of connected technology for oil and gas, and mining alone, over the next decade is more than \$1 trillion.

What can IIoT mean for the oil and gas industry in Canada?

IIoT gives a never-before-seen level of access to information through thousands of connected devices, with a real-time visibility into how systems are performing, any breakdown of equipment, and even worker safety.

For example, before the IIoT, if a pumpjack in an oil field had a technical issue, there was no way to remotely determine the nature of the problem. It could be that torque and loads were off, or perhaps rod stresses were detected, or the pump was overheating. Without IIoT, diagnosing the situation would require man-hours, incurring the costs of a truck roll, and putting a worker into a potentially dangerous situation.

Through a network of sophisticated operational analytics software, oil companies monitor their systems at a granular



IIoT gives the oil and gas industry real-time visibility in how systems are performing.

PHOTO: SUNCOR

Energy connects with the IIoT

LEVERAGING THE POWER OF INFORMATION

level. Crews observe dozens of processes at once, locating, identifying and fixing issues in a fraction of the time, with far less cost and risk.

Safer option

IIoT also uses this same kind of intelligence and connectivity with pipelines. We already know it's safer for people and the environment to transport oil by pipeline rather than by truck or train; but connecting every metre of that pipeline to the IIoT makes it an even safer option. Sensors along every link in the pipeline continuously report on its status. Even the smallest fluctuation provides information before there is a problem.

IIoT is present – or will be present – in multiple aspects of the oil and gas industry in ways we may have never even considered. These are just three examples:

Automation. Manual process-

es can be slow and cumbersome. Conveyor belts or wellheads, for example, may be unmonitored and so inspections would be human-managed. If inspections only occur on a weekly basis, the device could have been defective for up to seven days, bringing productivity of that system to a standstill.

Worker safety. Wearable technology allows real-time monitoring of employees in dangerous situations. An emission detector on a worker in a processing plant can sound an alarm for dangerous gases, such as methane. Wearable devices even sense if a worker is too exhausted at the end of a long shift to work within safety regulations.

Geo-location. In emergency situations such as an explosion or a fire, geo-location sensors pinpoint workers within three metres of where they are located.

By placing sensors and embed-

ding devices in the machinery used to extract resources, companies enhance safety, improve efficiency, boost profitability and greatly improve the processes required for the extraction and movement of the oil and gas.

Further, gathering data from multiple sources provides information that enables teams to scale up or down very quickly while assessing and managing various situations. Crews download weather information, pull data from drill sites and evaluate a broad scope of conditions ranging from noise and vibration, to slurry ponds and leach residues from mine tailings, as well as vegetation and terrain data captured by drones flying over the property.

Analyzing this data – from any source – will enable companies to leverage it in some way.

IIoT has excited the imagination of many, with estimates of 50 billion devices being connected to the internet by 2020. IIoT may command less attention, but it's already generating substantial benefits by connecting our big systems and capital equipment to cognitive and analytic platforms.

Michael Martin is the Internet of Things lead executive for Network Services at IBM Canada.

Comments?

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PURCHASING

How to avoid buying a system that doesn't fully address your needs.

BY JONATHAN PASTRIKOS

Manufacturers planning big technology purchases expect to improve productivity and competitiveness, but there's potential for major headaches that include a painful implementation process, hidden expenses or features that don't work as expected.

Minimizing those headaches begins with a proper search for the right system and vendor.

Follow these steps for a successful technology purchase:

1. Examine your business needs. A tech purchase often starts from a chronic problem or gap, usually related to the flow of information. Maybe your records are all on paper but you need them on a computer. You might want to automate some processes or reduce errors. Or you might be trying to make different systems in your company talk to each other. Appoint a senior person who has a good sense of the organization to spearhead the search for solutions. Review your current business and where you want to go in the next few years. You want to avoid buying to suit immediate needs, which leads to scrapping the solution later or bolting it to other systems that don't work well together.

2. Perform a functional requirements analysis. With the input of employees, map out your key business processes and prepare a detailed list of tech needs to support each process and area of the business. The idea is to identify how data flows through your business and locate any problem areas. It's not uncommon to have several hundred different requirements. Make a note of whether each need is critical or a nice-to-have. Also



Focus on current and future needs.

PHOTO: FOTOLIA

Buying advanced TECHNOLOGY

SEVEN STEPS TO A SUCCESSFUL INVESTMENT

list problem areas, opportunities for improvement and future needs. You may want an inventory management system to track product attributes such as lot, serial number or location but add barcode-scanning capabilities later to create efficiencies in warehouse management. Clearly document your requirements in writing.

3. Create a request for proposal (RFP). Use your requirements list to prepare an RFP. It should ask vendors to explain their solution, how it will meet each need and any required customization. Also ask about their implementation plan, including training, configuration and support. Request a list of all costs, including add-on features, professional services and licensing. And ask for a list of similar businesses they've worked with.

4. Develop a vendor list, distribute the RFP. Include a mix of larger and smaller suppliers. Ask vendors to submit a detailed written response.

5. Seek clarification. Vendors are sometimes vague about hidden costs or functions their system doesn't perform well. If the vendor is proposing customized software, find out who would own the source code and how customization would affect the ability to make upgrades. If you're exploring cloud solutions, ask whether the vendor would own your data, where it would be stored and how difficult it would be to extract data if you wanted to switch providers.

6. Rate the vendors. Understand the vendor's implementation plan, and flag any proposed customization. It's usually best to minimize customization or get a system out of the box. A customized system may break when you need to upgrade or cause problems if you switch vendors. Determine the total cost of each solution. Don't be fooled by a low bid. Some vendors offer an attractive base price, but pack a hodgepodge of hidden costs into the implementation process.

7. Select the vendor. Make a short list of two to three vendors and invite them to do a proof-of-concept demonstration. Ask to see specific processes that would solve your critical needs. Compare the user-friendliness of each solution. Also get a sense of the vendor's cultural fit with your business, knowledge of your industry and the skill level of its people. Do reference checks, then choose the winning vendor. If needed, ask for an updated proposal and carefully review all contract terms and conditions. Negotiate any vague or unfavourable clauses. Review a large contract with a legal advisor.

Doing a proper search for the right system and vendor is the best way to get technology that will meet your needs at a price you expected.

Jonathan Pastrikos is a business consultant at the Business Development Bank of Canada (BDC), a federal Crown corporation. Visit www.bdc.ca.

Comments?
E-mail jterrett@plant.ca.

Listen to the MACHINES

CANADA POST MODERNIZES ITS MAINTENANCE

Optimizing triggers for sorting machines improved performance.

Canada Post has found the right mix for better performance by modernizing its approach to the maintenance of its letter sorting equipment. How it did so was the subject of a case history presentation by Dan Gilbert, the national director of maintenance performance and planning.

Gilbert has extensive experience with Maximo software, continuous improvement, and root cause analysis.

Canada Post has 1,000 employees across the country looking after plant maintenance, regional engineering, national design and program management, as well as fleet management. There are 156 Toshiba multiline sorting machines, capable of sorting 41,000 letters per hour. This equipment is located at various centres to meet service standards based on geography, not capacity.

Gilbert said a mostly time-based program where there is high variability in utilization is inefficient. That's why Canada Post decided to rebalance the mix. It moved away from reliance on time-based triggers to let the machine tell what it needs through condition monitoring while using available staff skills for more technical activities.

To implement this – as part of a \$2 billion Postal Transformation Initiative – new state-of-the-

art letter sorting machines were deployed in 2010 at mail processing plants across the country to optimize the blend of triggers.

In the process, Canada Post soon discovered this new approach created many challenges. Answers were needed to several questions. Where to start? What are the machine limits? What is the employee skill set? What are the expectations for change management? What methods and methodologies to apply?

New approach

A multiyear, step-by-step approach was adopted consisting of the following:

- selecting a single machine with a sibling as a test unit;
- building a new strategy for the test machine, applying RCM tools and methodology;
- leveraging lessons learned from the test machine on all other similar machines across the country by measuring performance;
- building a roll-out package, including training for use of diagnostic tools, using decision tree analysis to determine potential root causes for failures, and creating orders for extra work to be scheduled for execution later; and
- developing a condition-based program across the entire fleet.

Along the way, there were some valuable lessons learned.

"We were doing a lot of tasks that had no positive impact on equipment performance," Gilbert said. "With the right information



Canada Post anti-graffiti mailbox.

PHOTO: RAYSONHO

and training, our technicians were excited to be more in tune with machine performance and diagnostics."

Canada Post also found out that implementing change takes longer than expected; that open communication with stakeholders is key; and that changing people's approach to their jobs is the hardest part. Technician's attitudes are crucial and engaged

employees equal sustainable performance.

Source: MainTrain maintenance, reliability and asset management conference, presented by the Plant Engineering and Maintenance Association of Canada (PEMAC).

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High-energy CT

A NEW INSPECTION SERVICE FOR METALWORKING

It qualifies and validates parts that previously couldn't be processed.

Manufacturers now have a high-energy option for non-destructive testing and inspection of parts.

The Jesse Garant Metrology Center has launched a high-energy industrial CT scanning service for mid-size part validation and high-volume part inspection.

The lab's system is the first of its kind that pairs a 3 MeV cone-beam x-ray source with a large format 2k x 2k flat panel digital detector that accommodates rapid inspection of mid-size parts, up to 44.5 inches in diameter and 63 inches in height. This allows the internal inspection of castings made from ferrous and non-ferrous materials, which is good news for metalworkers.

The inspection company, with sites in Windsor, Ont. and

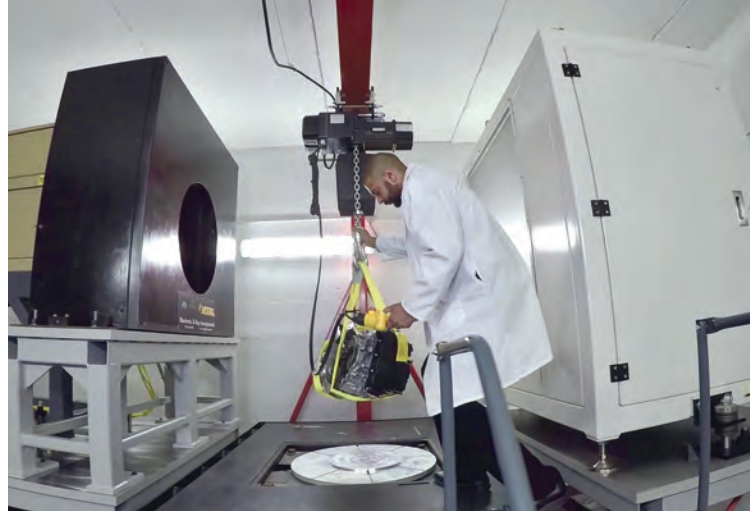
Dearborn, Mich., says the typical four to 16 hours for a CT scan has been reduced to less than an hour. The service also suits the inspection of complex parts and assemblies, allowing for cleaner separation of internal components, and inspection of higher density materials not possible with lower energy micro CT systems.

Metalworkers will benefit from useful analyses that include identification of defects like porosity, inclusions, wall thickness

variations, first article inspection, and actual to nominal comparisons for out of tolerance features.

The Jesse Garant Metrology Center, founded in 2009, has invested \$15 million in imaging technology over five years, most recently \$4.5 million and three years of planning, design, development and construction for its new capability.

Comments?
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A technician prepares a part for scanning.

PHOTO: JESSE GARANT METROLOGY CENTER



CARTS



WORKSTATIONS



FLOW RACKS



AGVs

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LUBRICATION

Steam turbine manufacturer Dresser-Rand Canada explains how the lubrication systems work and highlights problems that would require troubleshooting.

Steam turbines extract thermal energy from pressurized steam to do mechanical work on a rotating output shaft. These complex machines – found in a range of industrial markets including oil and gas, paper, steel and energy – have many parts. Correct lubrication ensures they operate efficiently and minimize friction while carrying heat away from thrust and journal bearings, and from gear meshes.

There are three types – ring oil lubrication, saddle pump and force-feed pressurized systems.

Ring oil lubrication carries oil from the sump to the turbine bearings. Typically one oil ring is used per journal bearing, providing lubrication during start-up, normal operation and coasting down. The oil level in the sump is critical to proper operation. Ring oil lube systems may use fin type coolers submerged in the oil sump or a water jacket around the sump. Sump temperature must not exceed 82 degrees C. The use of ring oil lubrication is limited by speed (maximum 5,000 rpm) and temperature.

A saddle pump lube type is a supplementary system in which an oil pump is used to circulate oil through the bearing housings. This type is typically used on small, single-stage turbines where oil temperatures exceed 82 degrees C. The saddle pump is usually mounted on the coupling end bearing cap and is shaft-driven through spur gears. Standpipes or equalizer pipes are used to maintain proper oil levels in bearing housings. When sump cooling is not adequate, an external oil cooler may be installed. The system pressure is



A modern Siemens steam turbine.

PHOTO: SIEMENS/CHRISTIAN KUHN

The 101 on steam TURBINES

WHAT YOU NEED TO KNOW ABOUT LUBE SYSTEMS

typically 3 to 5 psig.

In force-feed pressurized systems, an oil pump sends pressurized oil directly to the turbine bearings. This type is used when operating speed, horsepower or temperature exceed the practical limits of ring oil or saddle pump systems.

System components

Lube oil system components include a pump, tank, cooler, filter and control valves.

Pressurized oil is circulated throughout the lube oil systems that may contain main, auxiliary and emergency oil pumps. The most common types are positive displacement gear and centrifugal oil pumps, driven by the steam turbine, AC or DC electric motors, or shaft-driven. Shaft-driven oil pumps are

direct-drive or driven through a gear reducer or increaser. If the main oil pump is shaft-driven, oil rings or an auxiliary oil pump are used during start-up and run-down. Main and auxiliary oil pumps have identical output ratings. Emergency oil pumps are typically driven by DC motors and are used only for lubrication during run-down operation.

A positive displacement gear type oil pump causes lubrication fluid to move by trapping a fixed amount of it and then forcing that trapped volume into the discharge pipe. Gear pumps use two meshed gears rotating in a closely fitted casing. The fluid is pumped around the outer periphery and trapped in the tooth spaces. The pump output is given as flow rate in gallons,

or litres, per minute at a given pressure.

In centrifugal oil pumps the rotation of the pump impeller delivers kinetic energy to the lubrication fluid through centrifugal force. The impeller slings the liquid out of the volute, forcing it to discharge from the pump by converting velocity to pressure.

Lube oil tanks can be located in the equipment base plate, the machine casing or at a separate place. Capacity is based on return time. A vent or vapour extractor eliminates air in the system. Tanks must also have a level indicator, drains, cleanout access, a fill opening, baffles and a degassing tray.

Shell-and-tube oil coolers will remove heat from the lubrication oil. Two fluids of different starting temperatures flow through a heat exchanger. One flows through the tubes and the other flows outside the tubes but inside the shell. Heat is transferred from one fluid to the other through the tube walls.

Oil coolers are designed to maintain lube oils at approximately 48 degrees C. Water is on the tube side and oil is on the shell side. To prevent contamination, the operating pressure on the oil side is higher than the

water pressure.

Fouling must be avoided or kept in check. It occurs when a fluid goes through the heat exchanger and impurities precipitate onto the surface of the tubes. This reduces the cross-sectional area and interferes with the heat transfer across the exchanger. Applying an anticipated fouling factor ensures the cooler operates as designed.

Some designs allow removal of tube sheets for cleaning. An oil bypass line around the cooler with a temperature control valve regulates oil supply temperature.

Filters typically use replaceable paper elements to remove fine contamination from lube oil. Strainers use a reusable stainless steel mesh screen to remove coarse contamination. Most steam turbine lube oil systems use either a single filter system with an unfiltered by-

pass or a duplex system with a transfer valve and two oil filters in parallel.

The pressure differential between the filter's inlet and outlet is monitored and may have an alarm point to indicate the need for a filter element change. In some cases additional filters with low micron elements are used to protect sensitive control system components.

Control valves regulate fluid pressure and temperature during operation. An oil pressure regulating valve is normally open. A downstream sensing line pipes the oil to the spring-loaded (open position) regulator diaphragm. When the oil pressure from the sensing line overcomes the spring setting the valve begins to close, reducing the oil pressure downstream of the regulator.

A normally closed backpressure regulating valve has an upstream sensing line. The outlet

Watch for these symptoms of trouble

- **Abnormal noise, or knocking.** Caused by cavitation, inlet restrictions, such as clogged strainers or too small pipe diameters, and aeration (pump inlet air leaks or improperly sized reservoirs).
- **High fluid temperature.** Caused by improper flow (restrictions to bearings, low system pressure) or improper cooling (oil cooler fouling, inadequate tank size). Temperature exceeding 82 degrees C damages seals, reduces fluid life through oxidation, and increases wear on bearings and other system components.
- **Low pressure.** Caused by flow restriction, incorrect regulator or control valve set point, or incorrect pump sizing.
- **High pressure.** Attributed to incorrect set points of regulator/control valve, and stuck valves. Other culprits are incorrect pump and piping sizes.
- **Water contamination.** Identified by brown or milky appearance of the lubricating oil. Water increases the oil level. The formation of emulsion clogs filters and strainers, causes deposits on bearings and accelerates valve failure. Remedial measures include improving mechanical or brush seals, diligent regular steam seal maintenance, and improved air purge baffles in tanks.
- **Debris contamination.** Results from rust, slag, dirt and leaves clogging filters and strainers, lines and passages, and it accelerates valve failure.

is piped to the oil tank.

Three-way thermostatic valves maintain a constant oil supply temperature after the oil cooler. They send the oil through the cooler, bypass the cooler, or do both. A temperature element and a spring open and close the valve.

Properly refined and highly filtered mineral oils must have high oxidation stability to prevent the formation of rust on metal parts. They must also be free of acid and alkali, and capable of separating rapidly from water; have a high viscosity index and minimum tendencies to oxidize or form a sludge when agitated at operating temperatures; or to emulsify or foam when agitated with water and/or air.

These include thicker horizontal flanges and improved bolting for better sealing, elimination of vertical flanges and improved materials better suited for repair, such as stainless steel. The benefits of case upgrades are the ability to properly maintain existing equipment, footprint, piping connections and spare parts.

Control upgrades (programmable logic controllers), instrumentation upgrades (probes,

accelerometers, monitors) and seal upgrades also improve steam turbine operation. For instance, brush seals reduce leakage from stage to stage and enhance the function of conventional labyrinth seals. Reducing leakage results in more power from the available steam. It's not uncommon to see a 0.2% to 0.5% improvement in efficiency.

Upgrading sleeve journal bearings to tilt pad reduces instability caused by oil whirl, allows uniform distribution of oil flow and provides adaptability to shaft movements. In many cases re-machining is not required.

The information featured in this condensed version of a technical paper is the property of Dresser-Rand Co., published here with permission from the presenters at a lubrication education day seminar hosted by the Society of Tribologists and Lubrication Engineers (STLE) in Hamilton. Dresser-Rand, a Siemens company, makes steam turbines for the oil and gas, paper mills, steel, energy and other industrial markets.

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THINK LEAN

There are several methodologies for a range of applications.

BY RICHARD KUNST

The underpinning of any process is the replenishment of inventory, whether it's physical property or information.

Let's begin with some baselines. PFEP (Plan For Every Part) is built in an Excel database and should cover every explicit part detail such as: part number; units per pack; packs per case; dimensions and weight; supplier; supplier's location.

Cadence is the manner the inventory will be replaced or moved. This links to your engineered timed delivery routes (TDR) and is fundamental to how inventory will be moved and replenished. It will help define which of the following replenishment methodologies is most suitable:

Direct link. The upstream and downstream work centres are physically connected by a conveyor, or are adjacent. In either situation, the downstream work centre works on whatever product emerges from the upstream.

Broadcast. It's used when major subassemblies are on a final assembly line. The subassembly and main assemblies are often custom-made and not interchangeable. In this system, a master schedule is prepared that determines the sequence and timing of final assembly. A message will be broadcast to feeder departments or suppliers so the arrival of the component is synchronized just-in-time to the final assembly when needed.

Two bin system. Use it for lower cost items (fasteners). When the items are consumed from one bin you switch to the second while the first bin acts as a trigger for replenishment.

Re-order point (ROP). They maintain a stock of each item that may be required at the



Stay on top of your INVENTORY REPLENISHMENT THAT KEEPS THE PROCESS MOVING

downstream work centre, which pulls stock as required. When stock levels fall to a designated minimum or re-order quantity, a purchase order or other signal is sent to the upstream work centre for replenishment to the maximum quantity. While some features of ROP resemble kanban, it normally works with larger lot sizes and much longer lead times. Moreover, the replenishment signal is initiated when the stock is at the lowest allowable point, not when it's withdrawn.

Probability carts or racks. They're used where a minimum number of options and the randomness of the mix does not justify a full stocking location for the SKUs. If replenishment cadence were hourly, the cart or rack would hold 1.5 hours of the mixed components. When the refresh time approaches, the holes in the cart or rack are replenished.

MRP/ERP. A vast amount of data concerning process, work times, inventory at every stage, suppliers, lead times, sales forecasts and sales orders can be

used to schedule almost every production situation. Practice, however, presents a multitude of problems. Generally, the most complex systems have the broadest application. Broadcast and Direct Link, for example are only feasible under certain conditions whereas modern MRP systems can be used in nearly every situation. But the simpler systems, properly applied, work better in many ways. Kanban is about midway in terms of simplicity and range of application.

Kanban. Literally translated, it means visual authorization to replenish, withdraw or schedule. Kanban, often confused with a two-bin system, can have several triggers active within the supply chain. But in very simple terms kanban uses a small stock of product located between the upstream and downstream work centres. A signalling system informs the upstream work centre as each withdrawal is made. This allows the work centre to schedule replenishment along with any other items it must produce.

Parent-child relationships

Pay attention to cadence, which is fundamental to how inventory is moved.

PHOTO: FOTOLIA

avoid the use of supermarkets. In this strategy the child replenishes from the parent while the supplier or feeder department replenishes the parent.

Kanban requires rules, procedures and the discipline to carry them out: no production without a kanban signal; and do not arbitrarily change authorized stock levels. More complex systems using containers or cards may have some additional rules.

All replenishment methodologies need to focus on increasing the velocity of inventory flowing through your process while minimizing investment and labour management, making the type of methodology important. It's hard to justify using an ERP/MRP system to manage fasteners that cost a fraction of a cent.

It's important to first decide on your refresh rate to establish the cadence and apply the appropriate methodology. This can range from something simple to something very complex, and involve when to add your supplier's preferred lot size; how to optimize the inbound freight system according to weight; and optimization of the trailer.

Keep in mind, managing inventory is about finding the right balance based on supply and demand, and keeping it moving efficiently to eliminate waste. It's imperative that you constantly look at how to reduce batch sizes to improve agility and velocity.

Richard Kunst is president and CEO of Cambridge, Ont.-based Kunst Solutions Corp., which helps companies become more agile, develop evolutionary management and implement lean solutions. Visit www.kunstsolutions.com. E-mail rkunst@kunstartofsolutions.com.

Comments?

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CCOHS SAFETY TIPS

A variety of positions reduce the ill effects of prolonged standing.

Do workers in your plant stand in one position for hours on end? Any prolonged position can hurt the body. Machine operators and assembly line workers will attest to the physical discomforts they experience. These include: sore feet, swelling of the legs, muscular fatigue, low back pain, and stiffness in the neck and shoulders.

Prolonged and frequent standing causes a variety of health problems. Without some relief by walking, blood may pool in the legs and feet, causing inflammation of the veins. This may progress to painful varicose veins. Excessive standing also causes the joints in the spine, hips, knees and feet to become temporarily immobilized or locked. Such immobility can later lead to rheumatic diseases from degenerative damage to the tendons and ligaments. But there are ways to reduce the ill effects on their posture.

Workstation set up. A stand-up workstation should be



Workers often sit or stand for long periods of time.

PHOTO: FOTOLIA

Stand-up JOBS

HOW TO RELIEVE THE FATIGUE

adjusted using elbow height as the guide. For example, precision work, such as electronic assembly, requires a work surface that's five centimetres above elbow height to provide support.

Light work, such as assembly line or mechanical jobs, requires a work surface that is five to 10 centimetres below elbow height. Heavy work, demanding downward forces, requires a surface that is 20 to 40 centimetres below elbow height.

Proper position. Those working in a standing position should always face the job, keeping the body close. Adjust the workspace so there's enough space to change working position. A foot rail or portable footrest shifts body weight from both legs to one or the other. Use a seat whenever possible, or at least during rest breaks. Avoid over-reaching behind or above the shoulder line, or beyond the point of comfort. Instead of reaching, shift feet to face the object. Workers should take frequent rest breaks and find ways to change position as much as possible.

Comfortable footwear. If a worker's feet aren't comfortable, neither are the legs, hips and back. Comfort depends largely

on footwear. Choose CSA-approved footwear with the proper ratings for the hazards. Shoes should be as wide as the worker's feet, leaving room to move the toes. Arch supports prevent flattening of the feet, and a heel with a firm grip prevents slipping. Lace-up shoes are best because they tighten the instep and keep the foot from slipping inside the shoe or boot. Heels should be no higher than five centimetres. Padding under the tongue softens the pressure over the bones at the top of the foot. Shock-absorbing insoles are recommended for metal or cement floors.

Proper standing surface. Wooden, cork or rubber-covered floors are preferable to concrete or metal. Mats with slanted edges help prevent tripping on hard floors, but not too cushioned. Too much causes fatigue and increases the hazard of tripping.

Remember, an ideal position is one that changes frequently.

This article was contributed by the Hamilton-based Canadian Centre for Occupational Health and Safety (CCOHS). It provides information, training, education, management systems and solutions that support health and safety programs and the prevention of injury and illness in the workplace. Visit www.ccohs.ca.

Comments?
E-mail jterrett@plant.ca.

Manage asbestos risks

You're not likely to find asbestos in new products and buildings but it's still out there and presents a potential health hazard to workers who come into contact with it.

The Canadian Centre for Occupational Health and Safety (CCOHS) has launched an e-course to help manage asbestos-related risks in the workplace.

This mineral, no longer mined, was used in a range of manufactured products because of its heat-resistant and insulating properties. Before 1990, it was used mainly for insulating buildings and homes, and for fireproofing.

But when asbestos is dry, it can be crumbled, pulverized or powdered, releasing small fibres and clumps of fibres into the air as dust. Inhaling them can lead to respiratory illnesses such as lung cancer and mesothelioma, with symptoms taking between 20 to 40 years, or longer to develop.

Risk of exposure is minimized or eliminated if the materials containing asbestos in a building are: tightly bound in the original product (and in good condition); sealed behind walls and floorboards; isolated in the attic; and left undisturbed.

The e-course, Asbestos in the Workplace, provides an understanding of the hazards, how to manage them and what action to take.

Visit www.ccohs.ca/products/courses/asbestos/.

POWER TRANSMISSION



Contamination reduces a bearing's lifespan.

PHOTO: NSK

BEARINGS: They're still ROLLING

...BUT ADVANCES ADD TO LIFESPAN AND PERFORMANCE

Test improvements to ensure your applications will benefit.

BY JIM ELEKONICH

Bearings play a critical role in the efficiency of applications across a range of industries, and while the design of this centuries-old device hasn't changed radically, the technology and research into extending bearing life and performance continues to evolve.

Manufacturers who demand

high-performing, long-lasting bearings that withstand higher speeds, heavy loads and often marginal lubrication can take advantage of these advances through testing and development, to prove their applications will be improved.

Tech advances. The life of today's standard off-the-shelf bearing is above and beyond what was available 20 years ago. Every bearing manufacturer works to create unique, patented products and processes to best serve increasing consumer demands that include optimized

design and materials.

For example, EQTF (Extra Quality Tough, developed by NSK) bearings, are made of special steel that provides better wear protection. The surface is case-hardened by adding hard silicon nitride particles within the steel. The ball surface is not only harder, but also smoother. This helps with lubrication, maintaining the oil film longer and therefore improving bearing life and durability.

EQTF angular contact ball bearings are primarily deployed in machine tool main spindle applications such as lathes and milling machines, but could be used in other applications such as those with heavily loaded bearings and grease lubrication such as pump or motor applications.

Demand for high speeds. For machine tool bearings, the biggest advancements in tech and improvements have been realized with high-speed applications. Extensive research has gone into the internal design of the bearing and opti-

SUPPLY LINES



Michel Lacombe, assistant general manager at Rousseau Metal accepting the Visionary Company of the Year award. PHOTO: CCIO

VISIONARY STORAGE

The Chaudières-Appalaches and Capitale-Nationale regions of Quebec have recognized Rousseau Metal Inc.'s innovative company culture and its contribution to the local economy.

The manufacturer of automotive and industrial storage products was declared "Visionary Company of the Year" at the 2017 Vision Trophy Awards Nov. 29.

The honour goes to a company that distinguishes itself in product R&D; integration; employee training and engagement; boosting the local economy; and sustainable development.

The award is organized jointly by the region's Comptables professionnels agréés and the Chambre de Commerce de Québec.

EXTENDED REACH

Armstrong Fluid Technology has acquired the circulator pump business unit of HALM Motors + Systems GmbH.

The German company supplies high efficiency circulator pumps for heating, solar, geothermal and domestic hot water applications.

Armstrong, a Toronto-based manufacturer of fluid flow equipment, said the acquisition extends its global reach.

The circular pumps unit will be integrated into Armstrong's building business.

Armstrong has more than 1,100 employees operating in seven manufacturing facilities on three continents.

mizing various features, including cage design and material as well as optimized internal bearing specifications such as contact angles and raceway curvatures.

What bearing users can do to capitalize on new technology. OEMs will best maximize these advances in bearings technology by contacting bearing suppliers early in the design process for new or improved products, and asking what new products or technologies are available to them. End-users can maximize the performance of new bearings by ensuring the operating environments are properly maintained.

Do not underestimate the impact of contamination condition. It leads to the decreased performance by interfering with the lubrication oil film between the balls and the raceways. Even minute amounts of contamination will accelerate wear and decrease life. It is important to pay attention to cleanliness, not only in the application's environment, but also in handling. It's also important to take a look at your lubrication. Grease manufacturers are developing advanced products that could improve their performance.

And rather than settling on the bearings you've always used, look at advances in technology that better suit your application needs. It's worth taking the time to test and prove these improvements.

This is an edited version of an article contributed by NSK Canada Inc. (a supplier of NSK bearings) in Mississauga, Ont. Jim Elekonik is a senior applications engineer specializing in machine tool spindle bearings and linear motion products. Visit www.nskamericas.com.

Comments?

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Monitors two power supplies.

PHOTO: EMERSON

PROTECT AGAINST POWER FAILURES

For hazardous and harsh environments

Sometimes power interruptions that cause downtime (among other problems) are unavoidable but Emerson, the industrial tech company based in St. Louis, Mo., offers a preventive measure.

Its SolaHD SDN2X power supply redundancy modules protect against critical power failures in hazardous and harsh industrial environments.

They continuously monitor two power supplies connected in parallel. If one fails, the SDN2X automatically changes over to the second power supply. Because the power supplies are decoupled via the module, the operating supply doesn't feed into the failed supply.

Their compact size saves panel space and there's less heat generated than diode-based modules thanks to the MOSFET design. That translates into longer life of the components housed in the same enclosure as the power supply.

Diagnostics are provided via three bi-colour LEDs, while a relay output provides power output status information to a PLC or other control equipment.

Three sizes of modules are available, each module supporting redundancy between two 12 VDC or two 24 VDC power supplies. www.emerson.com

OPEN GATE WARNING

EdgeAlert is loud and visual

An open gate on an elevated mezzanine level is a potential hazard for plant personnel. Wildek Inc.'s patented EdgeAlert signals an open gate condition with a highly visible flashing light and a loud alarm.

It installs on new or existing swing, slide, tilt and scissor gates and includes a 120 VAC plug-in power supply but it can also be powered by four long life alkaline D cell batteries. And it includes a single-pole, single-throw 30 V, 2 A, 60 W relay output for connection to other alarms or safety controls.

The dual-channel processor system is self-monitoring and will display a "fault" signal if a sensor or wiring problem is detected.

Amber-coloured LED lights are located on the front and back of the alarm enclosure. When a gate is being used, workers may choose to silence the alarm for 120 seconds by pressing the "Snooze/Acknowledge" button. However, light continues to flash. When the open gate is closed and secured, the EdgeAlert is reset by pressing the "Snooze/Acknowledge" button again, or simply opt for the Automatic Reset mode.

Wildeck, based in Waukesha, Wis., manufactures material lift, warehouse mezzanine, industrial safety gates.

www.wildeck.com



Simulator training in action.

VIRTUAL TRAINING IMPROVES FORKLIFT SAFETY

Operator uses a real truck in simulated scenarios

A leading factor contributing to forklift truck accidents is a lack of training or improper training of operators. Raymond Corp. is helping to ensure users of its lift trucks know what they're doing.

The forklift manufacturer based in Greene, NY offers a virtual reality simulator that supplements the training of new drivers and helps to keep the



Installs on swing, slide, tilt and scissor gates.

PHOTO: WILDECK



PHOTO: RAYMOND

veterans sharp, while eliminating the need to purchase or store purpose-built training trucks.

It puts the operator in a virtual warehousing environment using an existing Raymond forklift truck plugged into the Simulation Port. Preloaded lesson modules cover reach, orderpicker and stand-up counterbalanced lift trucks. Each model's lessons increase in complexity and build on principles learned in earlier lessons, to reinforce desired behaviours.

An instructor's panel provides

a clear view of what the operator sees through three vantage points for real-time feedback. A report follows that documents the operator's progress and highlights areas that need work.

Training uses include supplementary instruction between the classroom and hands-on operation, refresher instruction and experiential learning in alternative scenarios. But the simulator is also useful for pre-screening incoming forklift operator applicants.

www.raymondcorp.com

VISUALIZE, ANALYZE ACROSS MULTIPLE SITES

Cloud service delivers instant business intel

Keeping an eye on what's happening in multiple plant locations is a challenge but Honeywell Process Solutions is up to the task.

The industrial automation, instrumentation and services company (offices across Canada, headquarters in Morristown, NJ) has a new software-as-a-service cloud hosting solution that provides enterprise-wide visualization and analysis.

Its Honeywell Connected Plant Uniformance Cloud Historian fuses the real-time process data analysis of a traditional enterprise historian with a data lake, integrating production, ERP and other business data with analytics tools to deliver instant business intelligence. All this using tools and functions already in use at sites and plants to leverage insights found at one

plant across all plants.

Uniformance collects, stores and replays historical and continuous plant and production site process data, making it visible in the cloud in near real time. The historian combines a time series data store, which empowers plant and enterprise staff to execute and make decisions with a big data lake. Data scientists use this to uncover previously unknown correlations between process data and other enterprise business data.

A major benefit is time saved. Projects that took weeks or months are achieved in hours.

Additionally, Honeywell estimates the scale and performance delivered through native cloud technology reduces enterprise information technology costs by up to 25%.

www.uniformance.com



Leverage insights across all plants.

PHOTO: HONEYWELL

NEW CHARGER FOR EVS

Delta-Q's ICL900 serves any electric machine

Delta-Q Technologies has introduced a new ICL900 lithium battery charger for electric vehicles and use in other machines.

The Vancouver manufacturer says the 900-watt ICL900 charges from nine to 15 in-series cells for use in any electric machine including scooters, floor care machines, lift trucks, sports and utility vehicles.

With a maximum output of 57 V, the charger applies custom lithium algorithms to optimize performance and life to meet tough application requirements. It uses CAN-bus communications and carries a comprehensive set of global regulatory approvals, including touch-safe requirements for the European electric vehicle market.

<https://delta-q.com/>



Delta-Q's ICL900 charger. PHOTO: DELTA-Q

PRODUCTS AND EQUIPMENT

AUTOMATION

PANELS COMMUNICATE CRITICAL HM DATA



Built in ports.

AutomationDirect's two new C-more Micro panels display text, graphics and bitmaps to effectively communicate critical HMI data to the operator.

The EA3-S3ML micro touch panel has a 3.1-in. STN LCD monochrome 128 x 64 pixel display and 12 selectable LED-driven backlight colours.

The panel displays up to 10 lines by 32 characters of static text and up to 10 lines by 21 characters of dynamic text with

embedded variables and phrases mixed with graphics.

The EA3-T4CL has a 4.3-in. TFT LCD 480 x 272 pixel display (WQVGA) and a palette of 32 K colours for customizing objects, screen backgrounds and displaying bitmap graphics. A built-in alarm control activates beep, backlight flash, customized alarm banner and red LED blinking.

Both panels have two serial communications ports, one micro-USB programming port and one built-in RJ45 ethernet port.

These Micro panels are powered from a Class 2, 12-24 VDC power supply but also receive power from the serial communications port of most AutomationDirect PLCs or through the USB port. These new panels are programmed using the free downloadable EA-MG-PGMSW programming software.

AutomationDirect is a distrib-

utor of industrial automation products based in Cumming, Ga. www.automationdirect.com

MICRO PLC DELIVERS BIG PERFORMANCE



Doubles typical capacity.

MicroSmart FC6A Plus, a micro PLC with up to 2,060 local I/O from IDEC Corp., controls and monitors the largest machines or entire small-scale manufacturing facilities.

To ensure high-level performance with this expanded I/O count, basic instructions are executed at 21 nanoseconds combined with program memory of 800 kB (100 K steps). These capabilities are combined with extensive data memory to more than double the capacity of a typical micro PLC. This allows the FC6A Plus to handle large

programs with complex control requirements such as PID, flow totalization and recipes.

Two models are available, each with 24 VDC input power.

The 16 I/O has eight inputs and relay or transistor outputs. The 32 I/O has 16 inputs, and transistor outputs.

Each model, with an integral 0-10 VDC analogue input and 12-bit resolution, accommodate up to three plug-in discrete, analogue, serial communication or Bluetooth cartridges. Each discrete cartridge has four I/O points, either four inputs or 4 outputs. Each analogue cartridge has two I/O points, either two inputs or two outputs. And up to 63 I/O expansion modules can be added for handling up to 2,060 I/O with a maximum of 511 analogue I/O, much more than a typical micro PLC.

The FC6A Plus has full-featured app access from any iOS or Android smartphone or tablet and is IoT capable for remote monitoring and control.

IDEC is a manufacturer of industrial automation and control products based in Sunnyvale, Calif.

www.IDEC.com/usa

GET A GRIP ON A VARIETY OF SURFACES

DESTACO Deepdish Vacuum Cups with 65-, 90- and 110-mm bell-shaped bodies maximize grip on contoured and oily surfaces.

Moulded-in gussets prevent the cup edges from rolling up on convex surfaces and adhere to flat, convex, concave, domed and oily surfaces.

Polyurethane construction provides better wear-resistance than rubber, leaves no marks on handled objects and lasts through hundreds of thousands of cycles.

A 60 durometer makes it easier to pick up highly contoured panels, while withstanding the elevated shear forces created by increased acceleration and deceleration rates.

Mounting options include traditional 3/8-in. imperial NPT, 3/8-in. Metric-G and 1.25-in. square T-slot, along with a new lightweight plastic 3/8-in. Metric-G model.

All mounts are interchangeable with standard mounts.

DESTACO, a Dover company, is a manufacturer of high-performance automation, work holding and remote-handling systems based in Auburn Hills, Mich.

<http://destaco.com>



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ADHESIVES

FAST REPAIR FOR DAMAGED CONVEYOR BELTS



Advanced urethane.

The Devcon R-Flex Belt Repair Kit from ITW Polymers Adhesives North America quickly handles gouges, tears, holes and damaged cold vulcanized splices in styrene-butadiene rubber (SBR) heavyweight conveyor belts.

It improves on original R-Flex with greater flexibility, crack resistance, and a longer open time in hot climates.

R-Flex is an easy-to-mix hybrid polymer that self-levels in three minutes and cures quickly, allowing repaired belts to be returned to service within 90 minutes of application. It

also protects hinged and solid plate fasteners (after adequate preparation).

In addition to resin and curing agent, each kit includes a two-part surface conditioner, a mix bucket, a wooden paddle, a scrub pad, gloves, paper towels, and a plastic spatula. Working time is seven to nine minutes (even at temperatures above 24 degrees C), and functional cure is 1.5 hours. The 2-kg kit covers up to 2,838 square centimetres at a thickness of 0.64 cm.

ITW Polymers Adhesives North America in Danvers, Ma. makes engineered compounds for repair and protection of surfaces subject to wear and abrasion in heavy industries.

www.devcon.com

CONVEYORS

GRIP CHAINS HANDLE THIN-WALLED MATERIALS

Grip chains from iwis have wear- and corrosion-resistant clamping elements for the safe and reliable feeding, transport and positioning of thin-walled materials with a

large surface area.

The clamping elements allow the chain to grip and hold thin-walled materials with large surface area, such as films.

The gripper fits into its groove accurately for better retention force. More free space in the foil insertion area improves the feed without twisting or deforming at the edge of the gripper element. This design also reduces noise.

The pre-stretched chains exhibit only a minimal initial elongation. Being highly rigid, they're also used in long machines.

Basic chain versions are chemically nickel-plated but maintenance-free Megalife versions are also available.

The recommended maximum running speed is 2 m/s for the ½ in. grip chain and 0.6 m/s for the 5/8 in. version. A different control geometry is required for higher running speeds.

Grip chains are used in

packaging, medical technology, electronics, PCB production and metalworking. Chains used in food industry applications use food-grade lubrication.

iwis drive systems LLC is a supplier of precision chain systems for power transmission and conveying applications. Its Canadian office is in Surrey, BC. www.iwisusa.com

CAMERAS

FOCUS ON HOT SPOTS

The FLIR E85 advanced thermal imaging camera provides fast, accurate detection of hot spots and hidden deficiencies.

The 384 x 288 true native resolution delivers more



Covers -20 to 1,200 degrees C.

COMPRESSED AIR

KEEP YOUR DIAMETERS CLEAN

EXAIR's Soft Grip Back Blow Safety Air Gun blows debris and liquids from pipe or hose up to 4-in. inside diameters, channel, bores, holes, internal threads and other internal part features.

The Model 1006SS's ergonomic design can be used for hours without fatigue.

A 360-degree airflow clears out coolant, chips and light oils from machining processes. The nozzle fits inside openings as small as 7/8 in. and prevents blowing chips farther into a part, tube or pipe and eliminates any safety hazard created by blowing debris out of the far end of a pipe or tube.

Air consumption is only 22 scfm at 80 psig with a low sound level of 80 dBA.

Airflow that exits the nozzle is quiet and can't be blocked, which complies with OSHA standards 29 CFR 1910.95(a) and 1910.242(b). It's also CE compliant.

Since airflow is directed back toward the operator, personal protective equipment is recommended.

Exair Corp. is a manufacturer of compressed air-powered products based in Cincinnati.

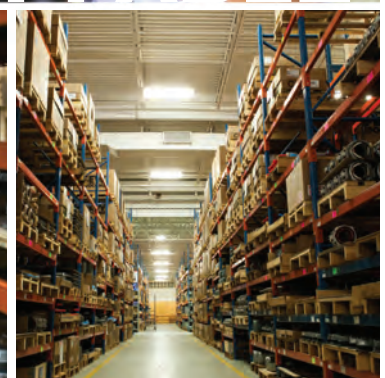
www.exair.com



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PRODUCTS AND EQUIPMENT

than 110,000 points of temperature measurement, while the laser distance meter provides data for measuring square areas on-screen.

Interchangeable lenses (14-, 24-, 42-degree) auto-calibrate with the camera, and the 4-in. touchscreen has scratch-resistant Dragontrail cover glass, plus a fast and responsive interface.

Object temperature range is -20 to 1,200 degrees C, thermal sensitivity is < 0.03 degrees C at 30 degrees C and image frequency is 30 Hz.

FLIR Systems Ltd. is a manufacturer of imaging and measurement systems with offices in Burlington, Ont.

www.flir.com

CAMERAS FOR LOWER SPEED APPLICATIONS

Teledyne DALSA's Genie Nano cameras were developed for cost-conscious imaging appli-



Colour and monochrome.

cations that don't require the higher speed of On Semi's P1 sensors.

Built around ON Semiconductor's Python P3 1.3M CMOS image sensors, the colour and monochrome versions feature a global shutter, with 1280 x 1024 resolution, and image capture of up to 83 frames-per-second.

Key features include TurboDrive for fast frame rates and full image quality; trigger-to-image-reliability for easy system control and debugging; a small footprint; temperature range of -20 to 60 degrees C; and support for the Linux operating

platform.

Teledyne DALSA in Waterloo, Ont. manufactures sensing, imaging, and specialized semiconductor.

www.teledynedalsa.com

MOTORS

MOTORS FOR FOOD-SAFE ENVIRONMENTS



Foot and footless configurations.

Baldor Electric Co.'s food-safe stainless steel motors fit into sanitary environments with clean-in-place (CIP) procedures.

Smooth contour motors with advanced sealing exceed IP69K for water to maximize motor life in high pressure, sanitary cleaning environments.

The product line spans single and three phase ratings in foot-mounted and footless configurations.

Three phase ratings come in frame sizes 56-280T, ranging from 1/2-30 hp. Single-phase ratings are available from stock in a 56C frame, ranging from 1/2-1 hp.

Fully encapsulated windings and potted leads housed in a high ingress protection rated enclosure seal the motor inside and out, plus a laser marked nameplate eliminates food and debris from collecting on enclosure surface.

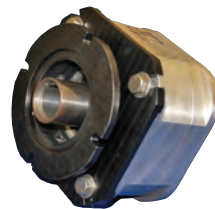
A unique output seal arrangement provides multiple barriers from ingress of foreign material and withstands high temperature and high-pressure sprays.

Three phase ratings have a round, three-piece rotatable conduit box for easier connection to incoming power supply, while single phase ratings have a single conduit box for capacitor and leads, minimizing joints around the motor.

Baldor is a motor manufacturer based in Fort Smith, Ark. www.baldor.com/Foodsafe motors

SPEED REDUCER FITS IEC OR NEMA MOTORS

Gearing Solutions has introduced a speed reducer that's super flexible. The FlexFrame 5 HP quickly switches or replaces motors, interchanges IEC and NEMA motors for export applications, adds face, flange or foot mounts, and uses GS convertible shaft adaptors to match virtually any motor to any gearbox.



Function as gearheads.

They function as gearheads. Built on the Nu-Lobe gear design, they come in standard ratios of 3:1, 4:1 and 5:1 for a wide range of industrial applications including mixers, conveyors, hoists and other material handling equipment, food processing equipment and robotic drives.

Aluminum housings make the units up to 50% lighter and with their small profile, they sport a premium weight to torque ratio (power density) for use in cantilevered and over-centre designs where heavier gearheads are not feasible.

Gearing Solutions is a manufacturer of gears based in Solon, Ohio.

www.gearingsolutions.com

MOTION CONTROL

A-82X OPTIMIZES MULTI-AXIS PERFORMANCE



Rack mounted.

Air bearings float on a cushion of air without rollers or sliding components and offer several advantages: no-particle generation; they're frictionless; vibration-free motion; highly constant velocity control; nanometre-precision repeatability; and optimal geometric performance.

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A high-performance air bearing motion controller from PI (Physik Instrumental) LP exploits these advantages as it handles 4, 6 or 8-axes of PIglide air bearing positioning stages and precision automation sub-systems.

The A-82x controller family integrates closed-loop digital servo control, drivers, and power supply in one convenient rack mount design. Depending on the number of axes, total output power is 1,100 W to 2,000 W with peak power to 3,900 W.

The controllers, based on ACS hardware, operate in stand-alone mode running on stored programs in the integrated flash memory – that's in addition to control via an external computer.

They support high-resolution incremental encoders with sine/cosine output and absolute encoders based on BiSS-C protocol. And ACS ServoBoost provides more consistent and stable servo performance that is insensitive to noise or changes in the system.

PI is a manufacturer of standard and custom precision products with piezoelectric and electromagnetic

drives with US/Canadian headquarters in Auburn, Ma. www.pi-usa.us

PUMPS

PUMPS METER AGGRESSIVE FLUIDS



Four drive options.

Watson-Marlow Fluid Technology Group has added two pumps to its industrial, environmental and food industry applications.

The 630 and 730 peristaltic pumps feature an enhanced operator and control system interface with a bright colour display.

With no valves or seals in the product stream the pumps provide reliable metering of totally contained, aggressive and shear-sensitive fluids without contamination.

Flow range extends from 0.000000264 (gal./min.) up to the 730's 14.53 gal./min.

Both are available with four drive options and two pump heads for single channel flows.

The 630 offers a precise 2650:1 speed control range, which increases to 3600:1 on the 730.

Minimal key presses of the HMI reduces the opportunity for costly mistakes and a 3-level PIN lock enhances security.

The pumps are self-contained and easily configurable, so there's no need for separate variable frequency drives or complex control devices.

Control options include manual, remote, analogue and RS485 digital communications, along with integrated PROFIBUS networking capabilities.

The process pumps are used in water and wastewater treatment, as well as food and beverage manufacturing.

Watson-Marlow is a global manufacturer of peristaltic pumps. Watson-Marlow Canada Inc. is based in Concord, Ont.

www.wmftg.com

Plantware



Checks plant conditions.

PRODUCTIVITY IN REAL TIME

Schneider Electric's EcoStruxure architecture and platform optimizes the reliability of assets and operations in real time by responding quickly to emerging conditions from anywhere in the plant.

The IoT-enabled, open and interoperable system architecture and platform covers connected products; edge control; and apps, analytics and services, with best-in-class cybersecurity built into every layer. And Maintenance Advisor software with embedded Condition Advisor provides predictive maintenance and decision support for plant-wide assets.

Schneider Electric, based in Mississauga, Ont., specializes in energy management and automation.

www.schneider-electric.ca

EVALUATORS TEST WORKFLOWS AND SYSTEMS

Savigent Software Inc. has enhanced its suite of event-driven manufacturing operations management software. Version 7.0 introduces its Evaluator Framework, which exercises and tests workflows and related systems.

Evaluators are integrated into Savigent Workflow, which supports both simple and complex development environments – including multiple users. Use them alongside a staging server to provide complete end-to-end system/functional tests.

Evaluators also mock or simulate overrides to test certain boundary conditions or where real data is not available. Multiple test conditions are set up using click and select options for any data within a workflow.

Multiple Evaluators grouped into an Evaluator Plan organizes and runs tests based on anything from capabilities to system boundaries. Overall summary and pass or fail status is provided in an easy to review chart.

Savigent Software, based in Bloomington, Minn., is a provider of Smart Manufacturing solutions and Workflow Automation software.

www.savigent.com

EVENTS

MODEX 2018 MHI

April 9-12, Atlanta

Supply chain expo presented by MHI hosts 850 exhibitors, plus more than 100 educational sessions. Visit www.modexshow.com.

STLE 73rd Annual Meeting & Exhibition STLE

May 20-24, Minneapolis

The annual meeting of the Society of Tribologists and Lubrication Engineers includes technical presentations, education courses, plus an exhibitor trade show showcasing the latest products, services and technologies. Visit www.stle.org.

Energy Summit 2018 EMC, NRCAN, CIPEC

May 30-31, Vaughan, Ont.

Presented by the Excellence in Manufacturing Consortium (EMC), Natural Resources Canada and the Canadian Industry Partnership for Energy Conservation. The focus is energy efficiency. Experts will help manufacturers maximize profitability, reduce maintenance costs and combat climate change. Visit www.emccanada.org/group_spaces/energy_summit/register; e-mail smcneilsmith@emccanada.org or call (866) 323-4362, ext. 223.

FABTECH Canada 2018 FMA, SME, PMA, CCAI, AWS

June 12-14, Toronto

World-class suppliers, the latest products and developments and tools to improve productivity are featured. Presented by Fabricators & Manufacturers Association (FMA), SME (Society of Manufacturing Engineers), Precision Metalforming Association (PMA), American Welding Society (AWS) and Chemical Coaters Association International (CCAI). Visit <http://fabtechcanada.com>.



Canada is paying the price for pipeline intransigence



More pipeline capacity is needed to provide oil producers with access to world markets.

PHOTO: FOTOLIA

BY KEN GREEN

“...OIL TRANSPORT IN CANADA STILL FACES SIGNIFICANT CONGESTION, AND SLOW RESPONSE BY RAIL COMPANIES ISN’T ALLEVIATING THAT BOTTLENECK.”

If Canada’s governments won’t push to get pipeline projects built, Canadians will be the poorer for it.

Canada’s overwhelming dependence on one market for its oil and gas exports comes with a serious price tag. Canadian Western Select crude oil sells at a substantially lower price than oil from other jurisdictions, such as West Texas Intermediary, Brent crude or Mexican Maya crude.

In 2016, Canadians were getting 25% to 30% less per barrel of oil sold into the US than the price we would command if our oil could get to more lucrative world markets in Asia or Europe.

The end of 2017 delivered the bad news that the situation has only deteriorated and Canada’s price discount approached 5%.

Despite the approvals of Keystone XL pipeline and the Kinder Morgan Trans Mountain expansion, oil transport in Canada still faces significant congestion, and slow response by rail companies isn’t alleviating that bottleneck. As Reuters reports, export pipelines are near (or beyond) capacity, and stockpiles of oil are growing. No additional pipeline capacity is expected until at least 2019. Rail is slow to deploy because it’s a more costly way to ship oil and Canadian shippers face a backlog of grain they also have to move.

The costs to Canadians – citizens and governments – are considerable. As The Fraser Institute calculated in 2016, exporting an additional million barrels of oil to world

markets, and getting \$60 a barrel (world price as of this writing was US\$63.35), would have netted Canada an additional \$4.2 billion in export revenues. With a 50% price discount, the situation is even worse today.

Oil price and production volume drive the Alberta and Saskatchewan crude oil royalty formulas. The importance of price is underscored by the impacts of much lower prices on royalty revenues. In Alberta’s October 2015 budget, royalty revenues were projected to plunge to \$1.5 billion in 2015-16 from \$5 billion. Royalties from conventional oil production were estimated at \$500 million compared with \$2.2 billion in 2014-15.

And Saskatchewan’s February 2016 budget update projected oil royalty revenue of \$347.9 million in fiscal 2015-16, 38.5% less than previously forecast. Again, the shortfall in government revenues can only worsen as the Canadian/US price differential increases.

In the meantime, US President Donald Trump has opened the spigot on US oil and gas development. The US Energy Information Administration estimates in 2019 US production will surpass 10.85 million barrels per day. That beats a previous record high of 10 million barrels per day last seen in 1970. Not only have federal lands been opened for oil prospecting and development, the doors have been flung open on parts of the Arctic National Wildlife Refuge and offshore development.

US oil exports have also boomed since the ban on exports was lifted in 2015, rising from 400,000 to 2.13 million barrels a day in 2017. Increasingly, the US will compete with Canada for oil export markets, while more of its domestic needs are met by its own producers.

And environmental groups such as Greenpeace and the Rainforest Action Network continue their crusades against the safe development and transport of Canada’s oil and gas resources.

Clearly, it’s critical to Canada’s energy exports that provincial and federal governments work to overcome entrenched resistance to pipeline construction with the same zeal as BC Premier John Horgan has pledged to oppose them “with every tool available.”

Lip service, which we’ve seen in plenty, isn’t nearly enough.

*Kenneth Green is senior director of Natural Resource Studies at the Fraser Institute.
Troy Media © 2018*

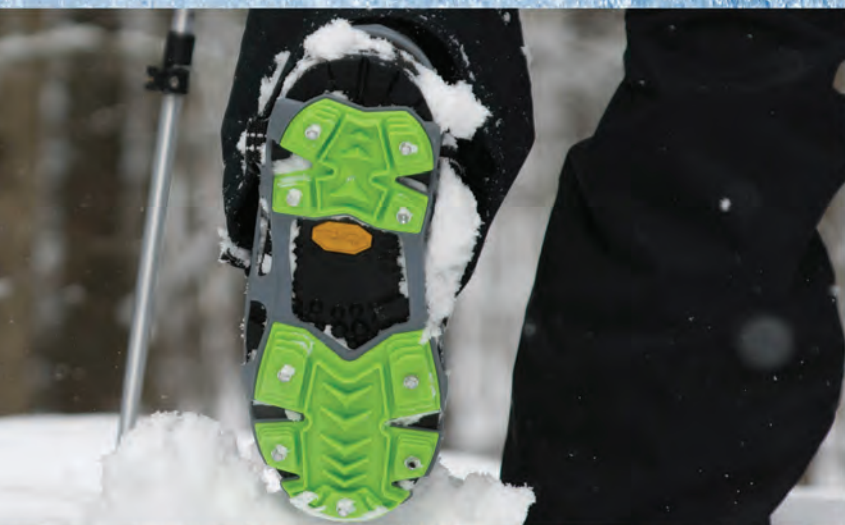
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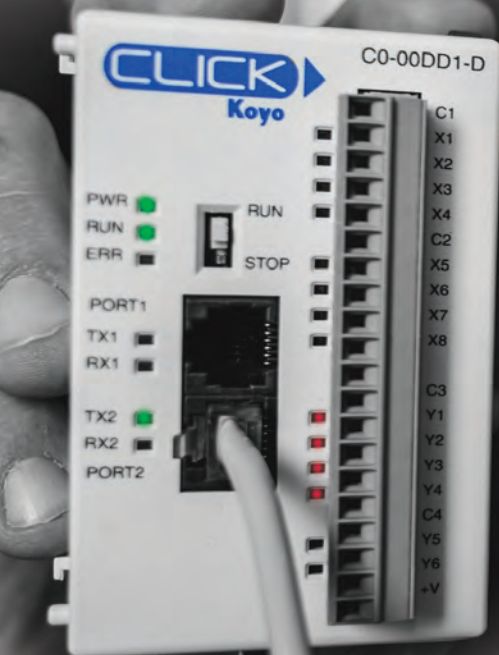
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www.CLICKPLCs.com



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C-more Micro HMIs provide graphical system status and operator interaction for a fraction of what you'd pay elsewhere. Paired with the CLICK PLC, C-more Micro panels provide practical and complete control for any small system.

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www.CmoreMicro.com



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