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SEPTEMBER 2021

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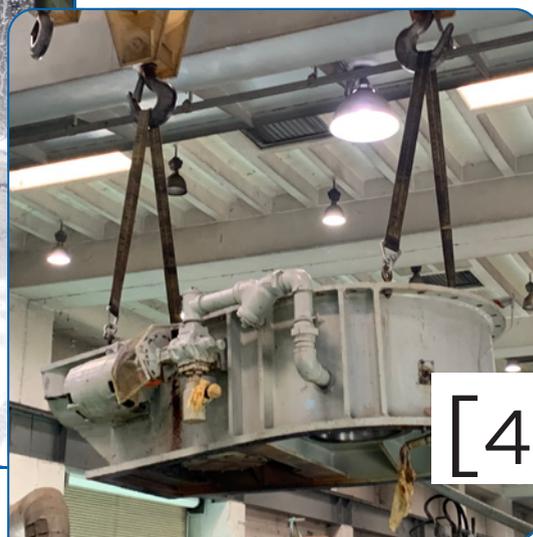
SEPTEMBER 2021



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The American Gear
Manufacturers Association



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Schaeffler recently launched the OPTIME condition monitoring system here in the U.S. and in Canada during the summer of 2021. By all accounts, the early adopters of this technology have been pleased with the results. "There are other competitive solutions on the market, so customers want assurances that the system they decide to spend their capital on actually provides value. We have numerous technical and financial case studies that will bolster our efforts to introduce OPTIME in the U.S. and throughout the world. Moreover, many of the companies we have worked with overseas are global organizations that have manufacturing facilities here in the Americas," said Frank Mignano, Schaeffler Americas manager for condition monitoring and Industry 4.0 service solutions. Learn more here:

www.powertransmission.com/blog/value-driven-condition-monitoring/



PTE Videos Regal Beloit System Plast Modsort

Unit material handling businesses are looking to keep employees safe, increase sort accuracy and ramp up production to meet consumer demand. From warehouse package handling, parcel post at the last mile to pre-packaged meals, online styling services, prescription eyeglass fulfillment and grocery distribution, unit material handling warehouses need flexibility, accuracy and options to adjust to change. Learn more here:

www.powertransmission.com/videos/System-Plast-Modsort-from-Regal-Beloit/

MiHow2 Splicing Narrow Belts

If you don't follow Motion's innovative How2 Series, now's the time. In this installment, Tony demonstrates how the Flexco Novitool Aero 325 can save your maintenance staff time and money by repairing belts quicker and easier than ever before.

www.powertransmission.com/videos/MiHow2-Splicing-Narrow-Belts/

Power Transmission Engineering



AGMA MEDIA
1840 Jarvis Avenue
Elk Grove Village, IL 60007
Phone: (847) 437-6604
Fax: (847) 437-6618

EDITORIAL

Publisher & Editor-in-Chief
Randy Stott
stott@agma.org

Senior Editor
Jack McGuinn
mcguinn@agma.org

Senior Editor
Matthew Jaster
jaster@agma.org

ART

Art Director
David Ropinski
ropinski@agma.org

ADVERTISING
**Advertising Sales Manager
& Associate Publisher**
Dave Friedman
friedman@agma.org

Materials Coordinator
Dorothy Fiandaca
fiandaca@agma.org

CIRCULATION

Circulation Manager
Carol Tratar
tratar@agma.org

ACCOUNTING
Luann Harrold
harrold@agma.org

MANAGEMENT

President
Matthew Croson
croson@agma.org

FOUNDER

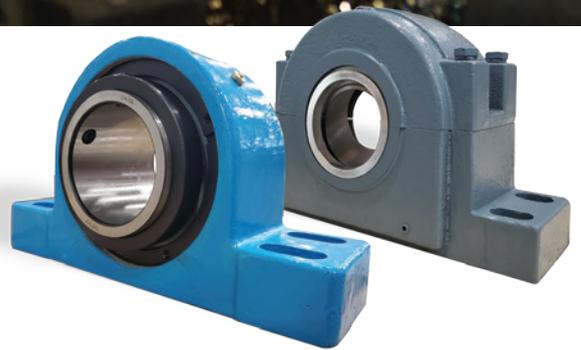
Michael Goldstein founded Gear Technology in 1984 and Power Transmission Engineering in 2007, and he served as Publisher and Editor-in-Chief from 1984 through 2019. Michael continues working with both magazines in a consulting role and can be reached via e-mail at michael@geartechnology.com.



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Freddie Mercury in the Show Me State



*"The show must go on
I'll face it with a grin
I'm never giving in
On with the show"*

— Queen, **The Show Must Go On**

The British rock band Queen wrote *The Show Must Go On* during a troubling time for the group. Although it wasn't yet public knowledge, the band's lead singer, Freddie Mercury, was already dying of AIDS. The song was recorded in 1990 and released as part of the album *Innuendo* in 1991, shortly before Freddie's death later that year. He never got to perform the song live, but the recorded version embodied his passion for performance right up until his dying days.

This is not a happy song. Although it *is* about overcoming adversity, there's no joyful victory or happy ending here. The song's somber tone and minor keys acknowledge that life can be full of anguish, tragedy and pain. But the chorus reminds us we have to keep on living anyway. In order to have meaning in our lives, we have to continue doing the things we love.

It's also a song that captures my mood—and probably many of yours as well—about the state of the world today. In 2021, it's not HIV and AIDS causing all the trouble, but rather COVID. Many have gotten sick. Many have died. In some places, COVID is worse today than it ever was. Just as it was with Freddie Mercury, the song of our lives today could easily be set to a background of B Minor chords.

And yet, the show must go on.

As many of you know, the Motion + Power Technology Expo takes place September 13-16 in St. Louis. It's going to be a different kind of trade show than most people have ever experienced. Attendance will likely be the lowest in anyone's memory. We'll all be wearing masks and doing our best to both network and social distance at the same time.

Not going to the show is a perfectly rational decision, so I won't blame any of you for staying home. But at the same time, if you feel safe enough to do so, I encourage you to come, because many of the world's leading manufacturers of mechanical power transmission components will be there, as well as many other suppliers of machine tools, materials and services representing the complete power transmission supply chain.

And most importantly, despite everything that's going on in the world, business is still happening. And if your company is facing supply chain issues and you'd like to interview new suppliers of gears or gear drives, there's really no better place in the world to get it done than at MPT Expo. You can learn more about some of these key exhibitors by reading our booth previews, beginning on page 20.

I'll be there, learning as much as I can about what these great companies have to offer. Our team will do our best to bring back as much information as we can about the latest technology to help you with whatever engineering challenges you face. But we'd really love to see you if you're able.

We'll be in the AGMA Booth, #2813.

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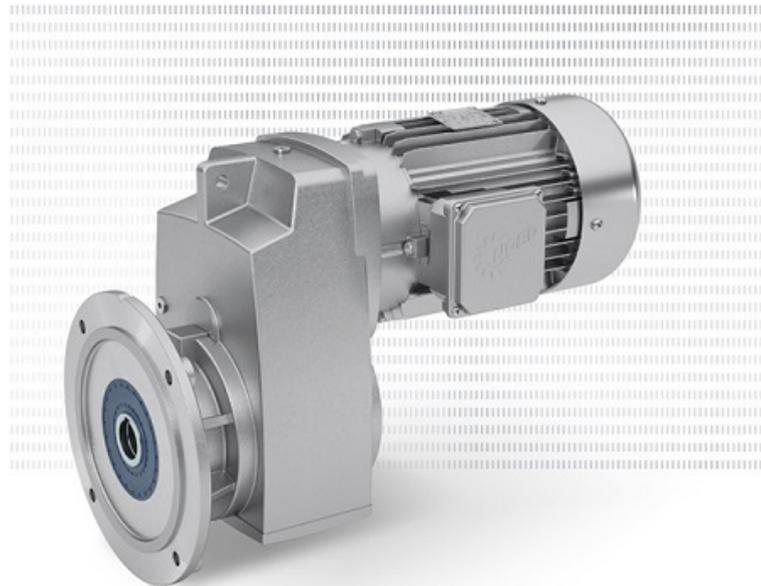
CLINCHER GEAR UNITS PROVIDE POWER AND FLEXIBILITY

NORD's redesigned line of small CLINCHER parallel gear units showcase increased power and torque capacity for a variety of applications. These re-engineered versions will be replacing the existing SK0182NB, 0282NB, and 1382NB units. They are lightweight, have improved heat dissipation, are more cost-effective, and are available with NORD nsd tupHTM sealed surface conversion for washdown and extreme environments.

These parallel shaft gear units are reliable, compact, and powerful. When combined with centralized or decentralized variable frequency drives, CLINCHER units provide ultimate efficiency and economy for a wide range of system solutions along with a rigid UNICASE one-piece housing to guarantee long service life, quiet operation, and low maintenance.

Small CLINCHER units include the SK0182.1, 0282.1, and 1282.1/1382.1 and are offered with a standard die-cast aluminum housing. Additionally, the SK1282.1/1382.1 units are also available with a cast-iron housing, which is required for the NORD Screw Conveyor Package and Spread Bearing Designs (VL2/VL3). Additional design flexibility has been made possible by offering two mounting executions: a B14 face flange/foot mounted version and a B5 flange version. Within each mounting style, there is an execution to match the mounting and shaft dimensions of legacy NORD product and an execution to match common competitor equivalents.

NORD's new CLINCHER models also come with extensive shaft designs including solid keyed, hollow keyed, shrink disc, GRIPMAXXTM (1282.1/1382.1 only), and screw conveyor (1282.1/1382.1 only). There are also a variety of input options including direct mount motors, universal motor



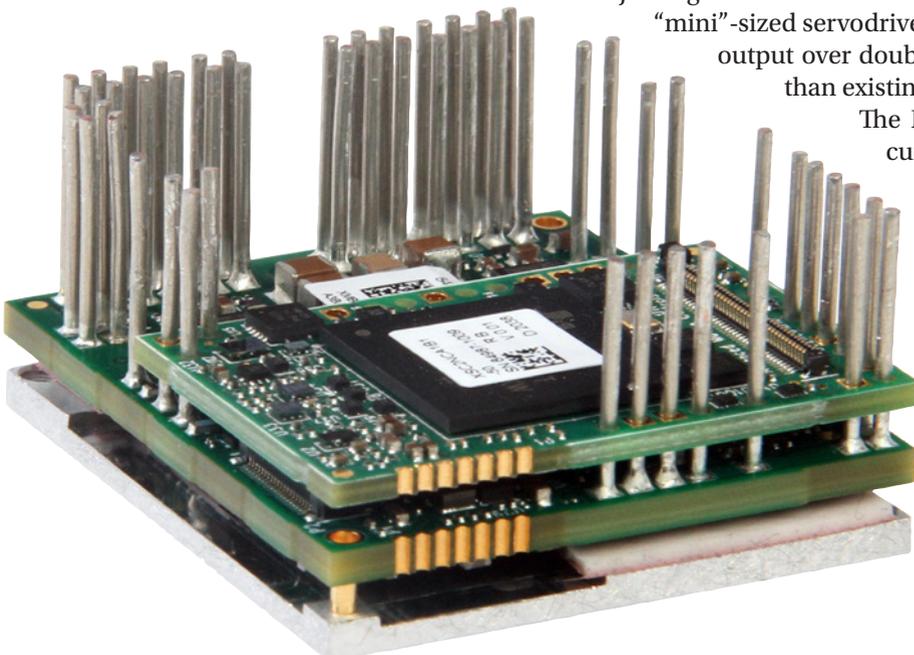
adapters—NEMA or IEC, and solid input shafts. This increases system flexibility and reduces installation space due to the units' slim design.

Small CLINCHER gear units are quite versatile, providing ratios of 4.85–356.89:1 and a power range of 0.16 hp–5 hp. With torque up to 3,540 lb-in they are the perfect solution for high efficiency operations where low operating costs are essential. With increased torque capacity of up to 33%, CLINCHER specifications match or exceed equivalent competitor units and provide more power in a smaller package.

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Now joining the Advanced Motion Controls FlexPro family are the first of their "mini"-sized servodrives. With a slight size increase, these drives can output over double the current and operate on higher voltage than existing micro-sized FlexPro drives.

The Mini Size FlexPro drives boast a continuous current rating of 50 amps and a peak current rating of 100 amps. The unrivaled power density will allow engineers to take advantage of FlexPro's advanced features in higher power applications, unlocking new possibilities in robotics, warehouse automation, machining, aerospace, and more.

Also available is the development board version designed to make development and prototyping as easy as possible.

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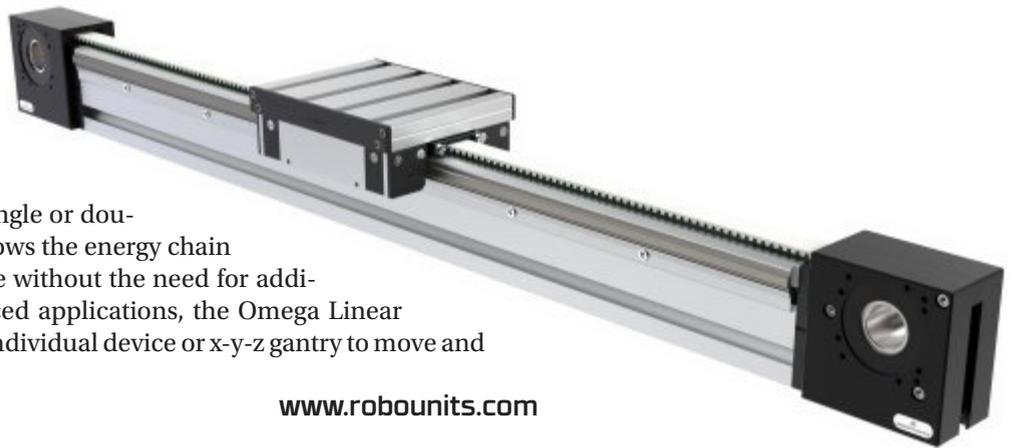
Robotunits

INTRODUCES LINEAR MOTION SYSTEM

The Robotunits Linear Motion System is designed to connect easily with the company's other systems, components and accessories to allow the easy creation of complete modular automation systems while reducing assembly time. This addresses the demands of plant operators for production systems that can be built, rebuilt and rearranged quickly to respond to changing needs.

The standard Linear Motion Unit includes 50-millimeter aluminum extrusions and a common 14-millimeter T-slot, making it compatible with other Robotunits systems. These key elements — along with the company's proprietary fastening technology — enable the Linear Motion System to work in combination with Robotunits' conveyors, material handling components, safety fencing and machine frames.

The unit is available with a single or double carriage, and the system allows the energy chain to attach directly to the carriage without the need for additional components. For advanced applications, the Omega Linear Motion Unit can be used as an individual device or x-y-z gantry to move and position parts with precision.



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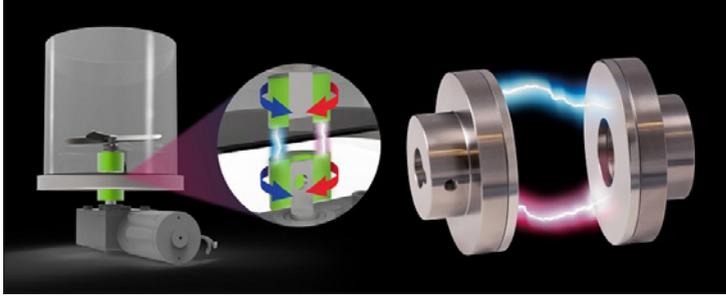
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Miki Pulley

OFFERS NEW MAGNETIC COUPLINGS

Magnetic couplings from Miki Pulley are ideal for machine designs involving food, pharmaceutical and laboratory applications requiring clean, non-contact connection between motor and shafts.

The mechanically isolated magnetic coupling transmits torque through the air. This occurs through both input and output hubs of the coupling which contain powerful rare-earth neodymium magnets. These magnets create a magnetic field that transmits torque through plastic, glass, alu-



minum, and other minimally ferrous materials without physical engagement.

Miki Pulley's Magnetic Coupling's non-contact design is particularly important where cleanliness and motor isolation is required in the mixing system design. The coupling

is clean and operates with no vibration. There is no dust, debris or mechanical wear using this coupling compared to conventional couplings. Also important, this coupling has a "softer" start/stop function compared to conventional, general-purpose couplings. In addition to mechanically isolating the connecting shafts and motor, the coupling also isolates thermal and electrical occurrences.

These magnetic couplings have an intended engineered torque limit at a specific air gap. The transmittable maximum torque may be adjusted by increasing/decreasing distance between coupling hubs. Depending on model, size, and installed air-gap, the magnetic couplings' maximum torque limit may be exceeded without mechanical damage. The hub simply slips to the next magnetic pole, without noise or mechanical wear.

While the magnetic field between the two hubs will transmit rotational force, it can also act as a torque limiter in an over-load event. The transmittable-torque and slip-torque may be metered by adjusting the distance between the hubs. After slipping, the hubs will re-engage each other and continue to transmit torque. This feature produces no mechanical wear on components.

Miki Pulley Magnetic Couplings are available in different configurations including shaft-to-shaft, parallel cylinder, perpendicular and well as stainless and plastic clad versions for food/washdown environments.

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Siemens Digital Industries Software is sponsoring Team Sonnenwagen Aachen— a German student initiative focused on developing new sustainable mobility concepts—in the design and development process of the Sonnenwagen 3 solar race car. Sonnenwagen leverages Siemens' *Teamcenter* software to address their challenge of coordinating and optimizing the interdependent areas of aerodynamics, mechanical and electrical systems, and vehicle structure on a tight schedule. By streamlining the exchange between *NX* software and *Simcenter* software including *Simcenter STAR-CCM+* software and *Simcenter Amesim* software, *Teamcenter* allows Sonnenwagen to exchange design models across applications more easily and efficiently.

Sonnenwagen is using *Teamcenter*, a tool within Siemens' *Xcelerator* portfolio of integrated software and services, to speed up their design process and limit the additional need for planning and coordination. Designing a solar car like the Sonnenwagen 3 requires a team to handle many different parts that need to be integrated into the main assembly. By using *Teamcenter* as a data management tool, Sonnenwagen has been able to accelerate

iteration loops and design a better Sonnenwagen 3.

"In past product development phases, we regularly ran into issues transferring models and data between different software solutions. This slows our designing process down and creates an additional need for planning and coordination," says Simon Quinker, vice chairman and head of marketing at Team Sonnenwagen. "The pivotal point of our development came from *Teamcenter*. In addition to software, Siemens has been very supportive with their know-how expertise and helped us overcome hurdles and get the best out



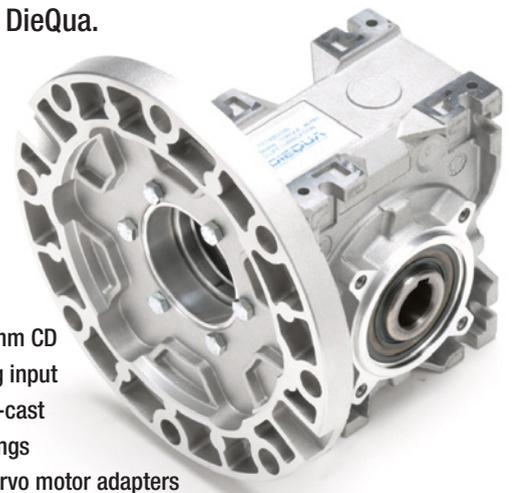
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of the software.”

Sonnenwagen has benefitted largely from the highly integrated software portfolio in combination with powerful simulation tools. Siemens’ NX software allowed Sonnenwagen to design a new outer shell of the Sonnenwagen 3 solar car, where they were able to transfer it to Simcenter STAR CCM+ and assess its aerodynamic efficiency. With Teamcenter allowing for efficient exchange of models across applications, the team can then take

those results back to Siemens’ NX software to optimize the design and initiate the iteration loop once again. Additionally, by utilizing *Siemens Amesim*, the team can quickly simulate components designed in NX according to their functionality and use the results for the optimization of the component in NX.

“We are very pleased with the developments Sonnenwagen has been able to make by utilizing Siemens’ software solutions as a whole,” said Naz Aydemir,

academic business development consultant for Siemens Digital Industries Software. “By working closely with the Siemens software product family throughout the development process, it’s great to see the Sonnenwagen overcome challenges and allow us as a proud sponsor to offer solutions that they can benefit from.”

www.sw.siemens.com

NTN

ANNOUNCES RELEASE OF KIZEI SPHERICAL ROLLER BEARINGS

NTN Bearing Corporation of America is pleased to announce the release of its latest innovation, the KIZEI (pronounced kee-zee) spherical roller bearing. KIZEI spherical roller bearings, developed by the NTN-SNR team in Annecy, France, are the first spherical roller bearings with metallic shields that protect the bearing from solid contamination such as dust, pebbles, and other debris.



In Japan, “Kisei” with an “s,” means “regulation.” Since the shields on the bearing “regulate” how much contamination is going in and how much grease is going out, it made for a fitting name. However, we switched out the “S” for a “Z” because in bearing part number terminology, metal shields, like those used in this new series, are commonly symbolized by a “Z”



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suffix—hence the name KIZEI. A “ZZ” suffix is added to the standard ULTAGE part number to identify a shield on both sides of the KIZEI series.

“We are thrilled to be able to offer our customers the newest of our cutting-edge solutions,” exclaimed James Misch, Director of Marketing and Technical Services, NTN. “Over the last four years, KIZEI spherical roller bearings have undergone extensive research, development, and real-world testing to get to this point, and we are pleased to finally be able to offer this revolutionary product to our customers at large.”

The unique design of KIZEI spherical roller bearings incorporates the metallic shields with the bearing retainer to form a one-piece protective barrier to keep contaminants out. Additionally, the metallic shields improve grease retention which helps improve bearing life.

In addition to the integration of the metallic shields into the design, KIZEI products also maintain the new standards set forth by NTN’s ULTAGE® spherical roller bearings. Featuring the industry’s highest speed and load ratings, as well as wide operating temperatures, ULTAGE is the newest generation of high-performance bearings from NTN and is the new standard in its spherical roller bearing offering.

Furthermore, KIZEI products come in standard ISO dimensions, ensuring interchangeability with 22200 series spherical roller bearings. Unlike the larger sealed spherical roller bearing models that require special tools & accessories for installation, KIZEI utilizes the same mechanisms used with standard open bearings — housing, accessories, mounting, grease, etc. — reducing maintenance costs.

NTN’s KIZEI spherical roller bearings have been proven to provide superior performance in demanding industries such as mining, metals manufacturing, wood processing, aggregate, cement, infrastructure, and construction.

Additional information on KIZEI spherical roller bearings can be found on Bearing Finder. Designed to aid distributors, design engineers, and end users in finding the perfect bearing or related product to use in any

application, Bearing Finder is hosted on a proprietary platform that offers a customizable part search tool, interactive and downloadable CAD illustrations, comprehensive part interchanges, and exhaustive data sets.

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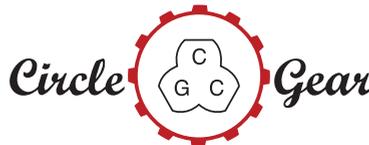
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one degree of motion, but these three new encoders do more to serve the demanding requirements of machines in the semiconductor and electronics industry, among others. They include the new LIP 6031 Dplus, the GAP 1081 and the MKV 1/9×30.

Traditionally, an encoder is only able to measure deviations along a single axis and although these can be corrected via some controllers, they can still be blind to common but unavoidable effects of guideway error or thermal linear expansion (to name a few) which would cause deflection along multiple axes. Using multiple reader heads allows for the detection of these deflections as in these new products, allowing for the necessary compensation at the inception and ensuring the integrity of the machine.

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www.heidenhain.us

Moticont

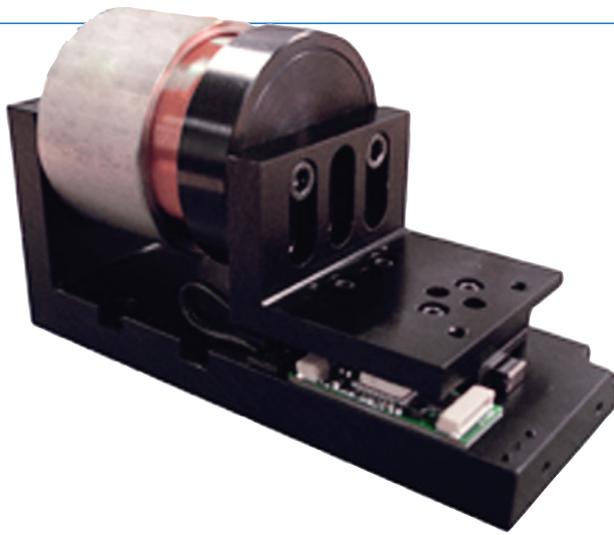
INTRODUCES HIGH PRECISION,
LINEAR VOICE COIL STAGES

Moticont has introduced two high performance linear DC motor driven stages. The VCDS-051-032-01-B1-30 (pictured) and the VCDS-051-032-01-F1-30 linear voice coil stages feature high speed, high acceleration/deceleration, zero backlash, smooth motion, precise positioning of 30 microns, high reliability and low cost. These non-commutated stages are clean room friendly, quiet, and available off-the-shelf. With a 0.97 in. (24.6 mm) travel length, a continuous force rating of 6.3 lbs (28.2N) and a peak force of 20.0 lbs (89.9 N) at a 10% duty cycle, these compact voice coil stages measuring just 2.000 in. (50.8 mm) wide by 5.000 in. (127.0 mm) long by 2.875 in. (73.0 mm) high, are ideal for applications such as: Positioning, assembly, laser cutting, welding and drilling, clamping, medical diagnostics and testing, and wafer handling.

Each of these linear voice coil stages features an optical quadrature encoder and home switch, and ball bearing linear guides. Easily accessible counter-sunk holes in the base allows for flexible and easy integration into new and existing applications. The 2.000 in. (50.4 mm) by 1.509 in. (38.3 mm) tables have a pattern of 8-32 UNC-2B threaded mounting holes for mounting tooling or fixtures.

If a longer travel, higher force, multi-axis configuration, or customized mounting are required consult Moticont's team of engineers. All of Moticont's voice coil stages are available as complete plug-and-play systems, including: Position sensor, servo controller, amplifier, power supply, and an optional return spring.

www.moticont.com



PRECISION GEAR MANUFACTURING AND DESIGN ENGINEERING

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S.S. White Technologies

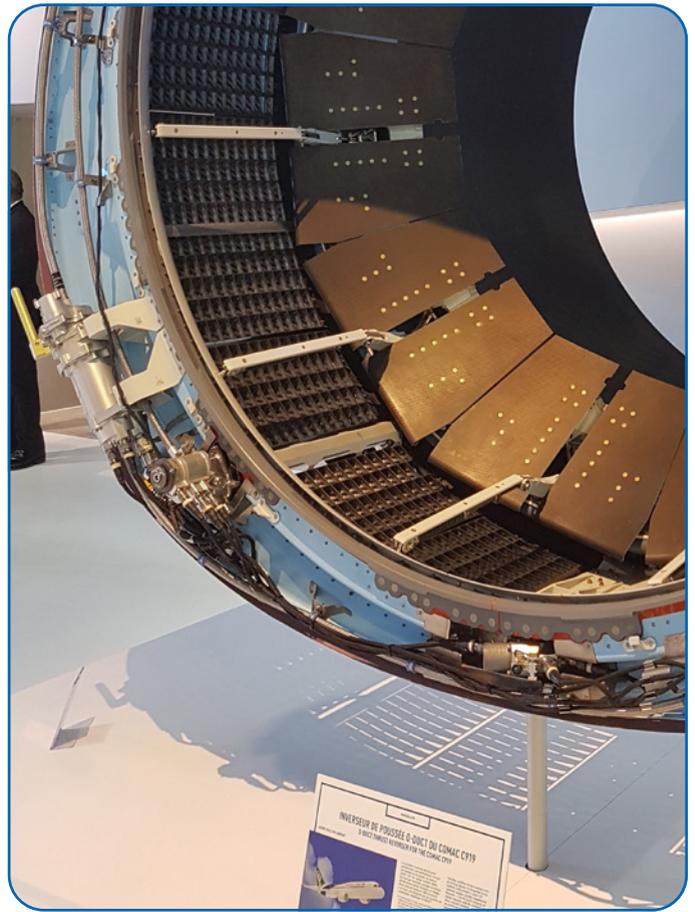
ROTARY SHAFTS PASS 250 MILLION FLIGHT HOURS OF SERVICE

S.S. White Technologies, the leading provider of flexible rotary shafts for the aerospace industry is the supplier of flexible shafts that transmit power to activate the critical Collins Aerospace Thrust Reverser Actuation Systems (TRAS) on the Pratt & Whitney (IAE) V2500 turbofan engines that just passed 250 million flight hours of service.

S.S. White provides a set of hydraulically activated flexible rotary shafts per IAE V2500 that transfer power and enable safe operation of the Collins Aerospace TRAS during flight and deployment of the TRAS during landing.

In addition, all aerospace flexible shaft products are designed to one of the industry's highest performance criteria by utilizing a unique computer modeling software program developed by S.S. White called PERFLEXION. This program allows the design engineers to more fully model the behavioral characteristics of the wire bundles within the shaft core and arrive at an optimum product that provides maximum bending flexibility and torsion strength while allowing minimal torsion deflection with up to a 30 percent improvement above current industry standards.

www.sswhite.net



TSN

CONTINUES ADVANCING INDUSTRIAL ETHERNET COMMUNICATIONS

Time-Sensitive Networking (TSN) is paving the way for industrial Ethernet to support the industrial communications needs of the future by providing innovative, highly beneficial functionalities. Companies are well aware of this potential, with multiple key developments happening to fully realize TSN-driven digital manufacturing strategies.

Arno Stock, Business Development Manager at CC-Link Partner Association (CLPA) member Renesas Electronics,

looks at what TSN can offer and the latest achievements that are shaping the future of industrial Ethernet.

TSN is an extremely promising technology that will allow industrial Ethernet to reach new levels. Operating at Layer 2 of the Open Systems Interconnection (OSI) model, it enhances standard Ethernet as we know it by making it deterministic by design. This characteristic, in turn, will benefit end users in a variety of industries by offering the ability to merge different types of data traffic, leading to more flexible and collaborative environments. At the same time, this creates simplified, more economical network architectures as well as unified hardware and software systems.

Therefore, the crucial role of TSN in future-proof, digital manufacturing is clear. This technology is the precondition needed to support key Industry 4.0 applications and trends, such as Edge and Cloud computing.

A smooth transition

In addition to these most obvious advantages, an instrumental feature of TSN is its continuity with existing network technology. In effect, while it offers unprecedented capabilities, it does so by evolving conventional Ethernet rather than by substantially disrupting the sta-



tus quo. As a result, businesses can seamlessly transition towards TSN-compatible industrial Ethernet systems.

This also means that TSN is compatible with legacy standards. Furthermore, it can be combined with additional solutions that are already available for conventional industrial Ethernet, such as gigabit bandwidth, which is key to support ever-increasing data throughput. In addition, it can accommodate the higher number of network devices and nodes resulting from converged architectures.

Additional advantages of mixing TSN and gigabit Ethernet include the ability to shorten cycle times, increase the accuracy and precision of control loops as well as strengthening the ability of a network to transfer various types of data, such as video. Such a solution can also reduce the complexity of distributed control systems, as it is possible to reliably move more functions to a single controller, also making the intended applications more robust as well as easier to set up and maintain.

End users are ready for TSN

The multiple benefits of TSN are evident to machine builders and end users. In particular, Renesas is noticing a high level of interest from its customers, who are aware the technology will be a must in the years to come. A key aspect that is extremely appealing to most of them is the standardization/simplification of protocols, enabling the connection of all parts within an enterprise.

In order to successfully implement TSN, it is necessary

to use a network technology with higher-level protocols, as these are needed to complete the OSI reference model and support TSN applications. An example is the open industrial Ethernet CC-Link IE TSN. In addition, companies require suitable hardware that can utilize this Layer 2 technology, such as Renesas' R-IN32M4-CL3 large scale integration (LSI) that leverages CC-Link IE TSN. Driver-level support is also important, as real-time TSN-compatible systems require a close interaction between low-level driver software and hardware equipment.

To address these aspects with leading solutions, automation vendors need to team up to deliver devices with TSN capabilities that meet customers' expectations and needs. Being part of an extensive partnership network, such as the CLPA, is thus extremely beneficial, as it offers a forum where solution providers come together to drive the development and consolidation of key automation products.

A look at the future of industrial communications

A number of major milestones have been reached to support the use of TSN. In particular, the IEEE 802.1 standards defining the technology are now complete and accessible. Also, the first network solutions have been released to the market, namely CC-Link IE TSN — the first open Ethernet that combines gigabit bandwidth and TSN capabilities.

Finally, the first prototypes and complete products have already appeared, with actual devices available and ready



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NSK

WWW.NSKAMERICAS.COM

for use now. More testbeds are also ongoing or planned to take place in the short term. These contribute to making the technology more mature and support its large-scale implementation.

The sector is working towards the finalization of IEEE profiles, particularly for industrial automation as well as the development of new applications for wider use, not confined solely to industrial settings. To support the global adoption of TSN, it will soon be essential to set up unified conformance testing to make sure that different solutions are interoperable, hence truly leveraging the full potential of TSN. Open technologies, such as CC-Link IE TSN, are therefore likely to be favored.

The transition towards TSN will be particularly exciting, as it is a natural evolution of Ethernet that will support its continuous improvement. Ultimately, we will be able to benefit from more and more building blocks that will open up new functions and higher performance while supporting existing, still functioning systems.

www.cc-link.org

IKO Cam Followers

ADDRESS AXIAL LOADING AND PROVIDE MAINTENANCE-FREE OPERATION

IKO International has introduced the CR...BSE Series of imperial cam followers, offering machine designers a versatile, reliable way to convert rotary motion to linear motion. Designed to resolve the main factors that can cause bearing failure, these heavy-duty cam followers feature two IKO innovations:



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Bearing MONITORING & MAINTENANCE TOOLS

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Our products are high quality, efficient, competitively priced and are sourced from the most recognized names in the bearing industry.

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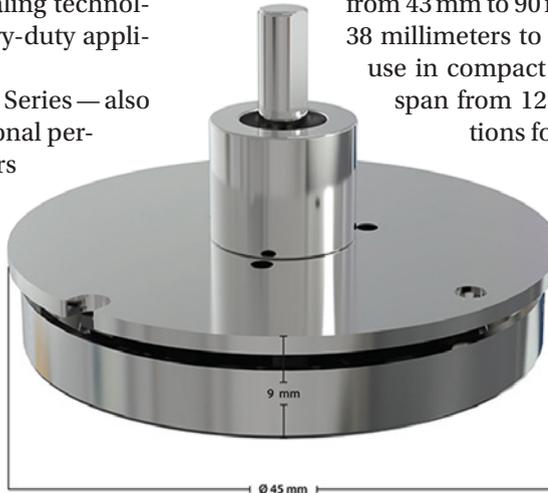
INTRODUCES NEW LINE OF BRUSHLESS DC FLAT MOTORS

The Orbex Group, a leading manufacturer of high-performance electric motors and slip rings, is pleased to announce a new line of flat brushless DC motors.

These compact motors, available with or without encoders, are useful for applications that require high torque density and have space limitations—including robotics, packaging, security, medical and more.

These high-performance motors feature a range of sizes, voltages and speeds to give you the best performance in space-limited installations. Motor diameters range from 43 mm to 90 mm and lengths range from 9 to 38 millimeters to give many options for efficient use in compact spaces. Available power levels span from 12 to 220 watts with winding options for different supply voltages.

www.orbexgroup.com



This ThrustDisk seal special seal slides into the outer ring's contact areas and handles axial loads caused by misalignment. It also resists heat and contamination to improve bearing life.

C-Lube. CR...BSE bearings are lubricated with a thermo-setting solid-type lubricant which fills the inner space of the bearing. This lubricant helps provide long-term, maintenance-free operation.

The cam followers' ability to handle thrust loads allows them to handle higher loads, while their sealing technology ensures the high performance that heavy-duty applications demand.

CR...BSE cam followers—part of IKO's Inch Series—also offer a low coefficient of friction, good rotational performance and easy mounting. Stud diameters range from 0.19 to 0.375 inches.

www.ikont.com



We answer EVERY CALL, EVERY TIME, within TWO RINGS.

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CHEMICAL PROCESSING

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- ▣ Failure Analysis

Power Transmission Suppliers Converge at AGMA's MPT Expo

St. Louis plays host to the leading suppliers in mechanical power transmission, September 13-16

Randy Stott, Publisher & Editor-in-Chief

Motion + Power Technology Expo will take place in September at the America's Center Convention Complex in St. Louis. More than 120 companies will exhibit at the show, including many leading suppliers of gears, gear drives, bearings and other mechanical components. To help you navigate the show, we've put together this preview of companies most relevant to *Power Transmission Engineering* readers.

motionpowerexpo.com.

Ancon Gear & Instrument Corporation – Booth 2107

www.ancongear.com

Highest Quality Manufactured Precision Gears!

Ancon Gear is a second-generation family owned manufacturing facility. They supply some of the world's top companies with precision gears and machined products. They use the most modern manufacturing techniques and equipment available, such as cellular manufacturing and CNC hobbing/shaping, to ensure the highest quality product leaves their facility. Ancon Gear is an ISO9001/AS9100 registered company. If you have any questions or special manufacturing needs, please do not hesitate to call or email them.

ASCO Sintering Co. – Booth 2027

www.ascosintering.com

ASCO Sintering Co., based in Los Angeles and having subsidiaries also in the **United Kingdom** and **South Africa**, specializes in complex, custom, high quality **Powdered Metal Sintering solutions**. ASCO utilizes advanced proprietary gear technology and high strength material that results in cost effective savings against CNC machining or MIM solutions. The company produces over 16 million gears annually, mainly in the automotive industry. The company is ISO 9001:2015 accredited, and all components produced conform to CE and ATEX standards. ASCO is an employee-owned company and an industry leader with over 35 design of excellence annual awards, since 1965 to date. Production capabilities and services include: Tool design, Metallurgical laboratory, Resin impregnation, Vibratory de-burring, Plating, Destructive torque, Tension/compression testing and Resonant non-destructive testing. Industries served include: Medical, Aerospace/Defence, Automotive, Advanced lock hardware, Irrigation, Fluid Power couplings, Military & Computer Hardware.

Berliss Bearing Co. – Booth 3421

berliss.com

Berliss Companies, established in 1932, is a fourth generation family owned business that manufactures and distributes roller bearings, mechanical seals and custom engineered bearing and products. In addition, Berliss is now an authorized distributor for INA, FAG, KBC, Nachi, IKO and FYH.



Bevel Gears India Pvt. Ltd. – Booth 2420

Bevel Gears (India) – The Bevel Gear Specialists!

www.bevelgearsindia.com

Bevel Gears India has manufactured and designed bevel gears and bevel gear boxes for over 40 years. With over 75 bevel gear grinding, cutting, testing and lapping machines, customers' bevel gears are manufactured to DIN and AGMA standards using the Gleason and Klingelnberg systems.

Bevel Gears India caters to the requirement of end users of ground spiral bevels, spiral bevels, straight bevels, zerol bevels, angular bevels and hypoids.

Customers are invited to learn more about the company's capabilities, decades of experience, Gleason CAGE prepared summaries, CNC gear testing and production facilities to develop the gearing solutions they need for demanding applications.



Services:

- Spiral Bevel
Ground: 0.8–28 in.
Lapped: 0.4–63 in.
Hard Cut: 3–48 in.
- Straight Bevel
Cut: 0.4–75 in.
Ground: 0.4–8 in.
- Skew/Helical Bevel: 2–40 in.
- Angular bevels & zerol gears
- High Ratio Hypoids
- Cube Gear Boxes
- Reverse engineering
- 3D gear modelling
- CNC gear measuring services
- Stock bevel gears including ground spiral and zerols – imperial and metric
- 5-axis machining

Brelie Gear Co. – Booth 3520
www.breliegear.com

Brelie Gear is a full-service gear manufacturer, specializing in fine- and medium-pitch spur and helical gears, worms, worm gears, and worm shafts. They offer gear crowning and carbide re-hobbing to improve gear quality and reduce gearbox noise. Components are produced using state-of-the-art Koepfer and Mitsubishi hobbing equipment. This equipment, along with the company’s ISO 9001 registered systems, allows them to produce gears up to AGMA 12. In addition to the company’s gearing capabilities, they also offer complete in-house turning and machining capabilities. Please give them a call to discuss your gearing and machining requirements.

Bunting-DuBois – Booth 2013
bunting-dubois.com

Bunting provides Total Magnetic Solutions for your industry. Their experienced team of specialized magnetics engineers and state-of-the-art manufacturing facility allows them to



deliver their customers custom magnets and magnetic assemblies. They supply all types of permanent magnet materials and offer rapid prototyping, stringent quality control, and high-volume production. At Bunting, the staff are committed to providing custom magnets and magnetic assemblies engineered to meet your exact needs.

Capstan Atlantic – Booth 2430

Capstan Atlantic – The Powdered Metal Gear Specialists
capstanatlantic.com

Capstan Atlantic is a leading producer of precision Powdered Metal gearing and multi-level structural components. Combining advanced gear engineering with proprietary secondary operations, Capstan Atlantic offers precision Powdered Metal gears to meet demanding applications. Their process allows the customer to achieve original design tolerances, improved dimensional accuracy and reduced wear and noise characteristics while maintaining a cost advantage. They can produce AGMA class Q9 quality gears with their process.

CGI, Inc. – Booth 3529
www.cgimotion.com

Since 1967, CGI has consistently been providing customers exceptional craftsmanship and outstanding customer service. Known as a world class gear and precision component manufacturer, CGI also offers design and manufacturing of motion control subassemblies. Our team of highly skilled and diverse professionals will take your product from design through assembly. The USA based manufacturing facility is fully certified to ISO 9001, ISO 13485, and AS 9100 quality standards.

Cincinnati Gearing Systems – Booth 1907

www.cincinnatigearingsystems.com

Founding American Gear Manufacturers Association member Cincinnati Gearing Systems Inc. (CGS) announces a series of facility improvements and additional machines in response to new contracts and to meet ever increasing demand for precision gear manufacturing and design engineering.



CGS component gears and enclosed drives are manufactured, assembled and tested by a skilled workforce in Cincinnati, OH. CGS products support a variety of applications such as automotive drive gearing, diesel engine gearing, military and commercial marine propulsion, turbine powered generator drives, wind energy, pump drives and expander/compressor drives. CGS is ISO 9001:2015 and IATF 16949:2016 certified.

CGS assembly and test facility improvements include the installation of two 20-ton cranes with 5-ton auxiliary and one 10-ton crane. In the same facility there is a new dedicated full load test cell supported by a 1,500 hp motor.

Within the last two years, Cincinnati Gearing Systems has purchased 7 additional machines:

- Kapp-Niles gear grinder offers unique tooling for grinding double helical gears with limited clearance between the gear faces.
- Liebherr CNC shaper cutter doubles current cutting speeds and has laser apex alignment, increasing gear quality. This shaper cutter is capable of cutting tapered splines and any helix angle without the need for additional tooling.
- Höfler Porta internal and external gear grinder; The OD/ID grinding wheel finishes grind diameters and thrust faces in the same setup as tooth grinding, combining three separate machine operations into one.

Other machines recently installed include a Hyundai horizontal boring mill, Hyundai vertical mill, Hyundai CNC turning center and a Gleason GMS gear analyzer.

Machining Capabilities:

- Turning 1"-106"
- Hobbing and Shaping .5"-149"
- OD Grinding .75"-138"

- ID Grinding .5"-134"
- Tooth Grinding 16 DP-.75 DP (2"-130")
- Milling Up to 200"

Co-located with CGS is Cincinnati Steel Treating, a full service, fast and efficient heat treating source for all industries. CST offers a full line of facilities for atmosphere carburizing and/or hardening, carbonitriding, press quenching, induction and flame hardening. Their capabilities extend to gas nitriding and ferritic nitrocarburizing (FNC) with some of the largest furnaces in the mid-west. They process aluminum, tool steels, stainless steels and high temperature alloys. They also offer normalizing, annealing, stress relieving and sub-zero treating. Ancillary processes include straightening, both mechanical and thermal, along with blast cleaning. They offer metallurgical consultation and free local pick up and delivery. CST takes pride in the quality and efficiency of the work we provide for our customers.

Improvements to CGS's testing, assembly and manufacturing facilities have significantly increased capacity and production process flow while decreasing lead time. Established in 1907, visit Cincinnati Gearing Systems in Booth #1907 to see how CGS's in-house engineering, manufacturing, assembly and testing and heat-treating services can support your future gear and gearbox needs.

Circle Gear and Machine Company – Booth 3429

www.circlegear.com

Circle Gear is a leader in quality custom gearing, specializing in small to medium lot production. They are one of the only companies in the country that will reverse engineer and manufacture spiral bevel gear sets. Circle Gear services include: Bevel Gears (Straight & Spiral up to 36" diameter), Spur Gears, Helical Gears, Herringbones (up to 60" diameter), Internals, Racks, Sprockets, Worm and Worm Gears, to all other types of power transmission products. Circle provides servicing on Splines (involute & straight-sided, internal & external). They offer reverse engineering as well as breakdown services on many products. Circle Gear currently resides in a 125,000 sq. ft. full-service production facility. They also house a full-service gearbox rebuild division, Quality Reducer Service (QRS). QRS specializes in rebuilds of all major brands of gear reducers as well as manufacturing of custom designed units.

Columbia Gear Corporation – Booth 2230

Columbia Gear Corporation – Your custom gear supplier!

www.columbiagear.com

Columbia Gear Corporation is a premier supplier of custom gearing and power transmission products including precision spur and helical gears, splined gears and shafts and complete gearboxes. They are continually adapting to today's customer needs. They continually analyze manufacturing processes, build upon proven design solutions, streamline production and assembly schedules — always taking ground gearing quality to higher levels. Conveniently located in Central Minnesota, their facility encompasses 235,000 sq. ft.

Croix Gear – Booth 2831

Precision gears from a partner committed to your success.

www.croixgear.com

Take the risk out of your loose gear supply chain. Visit Croix Gear & Machining at Booth 2831 and compare notes on your supply chain experience and what they have learned from their collaboration with supply chain leaders.



From agriculture to warehouse automation, OEMs around the country rely on Croix Gear & Machining to keep their assembly lines running at maximum efficiency. Their manufacturing facility is outfitted with a vast array of the latest in high-performance machining, gear cutting, and inspection equipment, and their quality management system is certified to ISO 9001:2015.

By collaborating with a structured approach, they can help optimize the loose gear supply chain and protect your reputation.

Doppler Gear Company – Booth 2825

www.dopplergear.com

Doppler Gear has over 50 years of experience in custom gear manufacturing. Our four manufacturing facilities in the upper Mid-West United States of America serve the component needs of domestic and international corporations. Large organizations rely on us to provide competitively priced parts with uncompromised quality. Small companies and individuals look to us to support their projects with technical expertise and thousands of stocked standard tools.

From one piece to continual production, Doppler Gear specializes in unground commercial gearing. Our equipment can produce a wide range of products. Depending on type and configuration, our capabilities range from 120 Diametral Pitch and 0.100" diameter to 2 Diametral Pitch and 36" in diameter, and from .25 module and 2.5 mm to 12 module and 900 mm. We also specialize in spline shafts and internal spline hubs and couplers. We welcome the opportunity to review your requirements!

Elgeti Engineering GmbH – Booth 2725

www.elgeti-engineering.com

Elgeti Engineering is an independent engineering company with HQ in Germany and a branch in Indiana.

Their main services are:

- 3rd party failure analysis on gearboxes and transmissions
- Life testing of bearings and lubricants
- Design and production of test rigs for bearings, gearboxes and others

Forest City Gear Company – Booth 2513

Forest City Gear welcomes you to the 2021 Gear Expo!

www.forestcitygear.com

Forest City Gear is a family-owned and operated business in the gear manufacturing industry since 1955. They manufacture custom gears across a diverse array of industries covering a wide range of applications. Forest City Gear was chosen to produce all the gears and splines in the Mars Rover, where failure simply wasn't an option. They support gears for telescopes, artificial elbows, aircraft, automotive, racing, medical implants, industrial equipment, marine applications, and more.

Gear Motions/Kinatech – Booth 2425

gearmotions.com

Gear Motions is a leading gear manufacturer specializing in supplying custom cut and precision ground gears for OEMs all around the world. Kinatech is a new mechanical locking system that will hold any load in place without using electricity, pneumatics, hydraulics, friction, or any other external braking system. Together, we bring you the best in precision gear manufacturing and groundbreaking gearbox technology, all in one place.



Great Taiwan Gear Ltd. – Booth 2609

Welcome to Great Taiwan Gear, a leader in gear supply.
www.greataiwiangear.com

Great Taiwan Gear has an experienced team and modern equipment capable of handling orders for prototype gears or orders for thousands of pieces. Great Taiwan Gear specializes in production of gears and gear related parts. They produce gears for automotive use, gear pumps, and other power transmissions. They also provide fine-pitch gears and gearboxes, including gearboxes with motors for wheelchairs and gearboxes for scooters.

Innovative Rack & Gear Co. – Booth 3518

WELCOME to INNOVATIVE RACK & GEAR @ Booth #3518
ONE TEAM * ONE VISION * ONE GOAL...
www.gearacks.com

Since their merger with Avers Machine, they are able to offer more capacity in gearing including bevels.

IPM, Inc. – Booth 2019

www.ipminc.com

Please visit the IPM booth to discuss your custom gearing needs

IPM is an AS9100 – ISO 9001:2015 contract manufacturing business specializing in the production of a wide variety of precision machined components. Located in Waite Park, MN, IPM specializes in turning, milling, gear cutting, grinding and assembly work, utilizing some of the most up to date CNC equipment available. IPM has been in business since 1992 and currently employs about 45 highly skilled machining technicians and operates out of a modern 32,000 sq. ft. facility. The industries IPM serves are; aerospace, defense, off-highway, construction equipment, high performance automotive, agriculture, fluid power as well as others.



The latest services added to IPM's manufacturing offerings, is gear grinding. A Kapp ZE500 as well as a Gleason 245TWG have recently been added to their machine lineup, enabling IPM to offer extremely high-quality gear components to its customers.

Napoleon Engineering Services – Booth 2327

www.nesbearings.com

Napoleon Engineering Services, founded in 1997 in Olean, NY, is a privately-owned, one-stop shop for engineered bearing products, specializing in Bearing Inspection, Bearing Testing and Custom Bearing Manufacturing. With a thorough understanding of bearing design, manufacturing, inspection, and testing, NES provides clients with a resource for all bearing needs.

Philadelphia Gear, Power Systems by Timken – Booth 3532

www.philagear.com

Philadelphia Gear now supplies and services the complete industrial drivetrain

Drawing on a global pool of engineering expertise and technological advancements, their newest offering provides a comprehensive suite of industrial repair, upgrade and service solutions. When viewed as an integral part of your operations, these solutions can reduce downtime and your total cost of operation.



From electrical to gearbox to bearing repair solutions, the key brands under Timken Power Systems help maximize your powertrain and rotating equipment's reliability and performance.

- Greater Reliability & Performance
- Advanced Technologies
- Aggregate Cost Savings Achieved with a Comprehensive Service Partner
- Comprehensive Repair, Upgrade and Service Solutions for Industrial Powertrains
- Engineering Expertise
- In-depth Knowledge Base
- Network of Regional Manufacturing and Service Centers

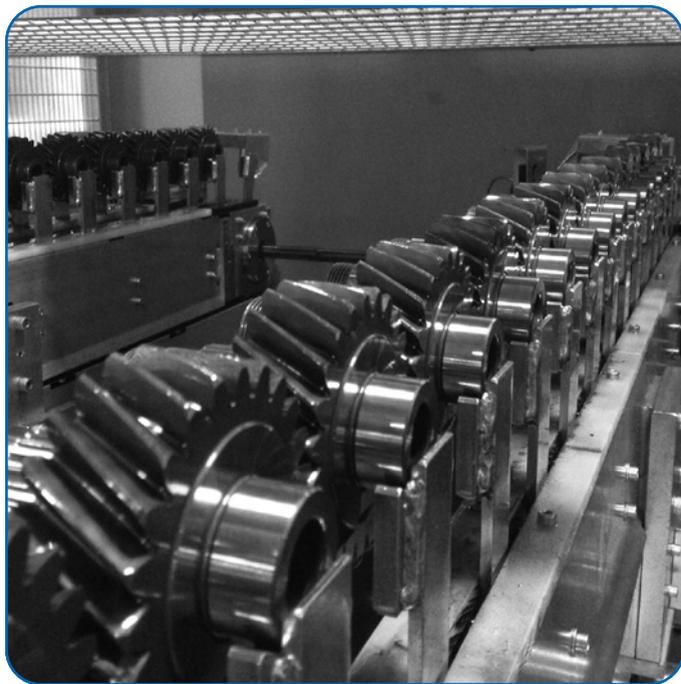
Riley Gear Corporation – Booth 3313

Riley Gear welcomes all participants to Motion & Power Expo.

www.rileygear.com

Riley Gear manufactures custom gearboxes and precision ground spur and helical gears. Manufacturing capabilities range from 0.25 inches to 40 inches in diameter. Their precision ground gears can meet AGMA Class Q15 or DIN 2 specifications. Precision is their business. For more than 75 years Riley Gear has partnered with original equipment manufacturers worldwide to create custom solutions for a variety of industries including:

- Aerospace and Defense,
- Machine Tools
- Centrifugal and Turbo Compressors
- On Highway Automotive
- Off Highway Vehicles
- Marine Propulsion
- Alternative Energy and Power Generations
- Pumps,
- Transportation
- Robotics



Their world class collaborative design and engineering services deliver prototype to production support for the most sophisticated of applications. Riley Gear is a registered TS 16949, AS9100, ISO 9001 and ISO 14001 manufacturing facility. With 100,000 square feet of manufacturing facility between Buffalo, NY and St Augustine, FL, Riley Gear is ready for your next project.

Shanthi Gears Ltd. – Booth 2130

www.shanthigears.com

Shanthi Gears is a Gearing Solutions Company. They design and manufacture Gears, Gear Boxes, Geared Motors and Gear Assemblies, using contemporary integrated manufacturing facilities spanning four decades of manufacturing excellence. They are now a part of the 5.5 Billion US\$ Murugappa group (since 2012) that has opened up enormous possibilities to explore new frontiers in technology, capabilities, product segments and markets.

Shanthi's commitment to quality has resulted in them getting the coveted AS9100D (Aerospace) certification. They have created end-to-end manufacturing facilities to assure the highest level of quality in their Gears. Their facility includes a captive ferrous foundry capable of pouring 4000 metric tonnes of SG and Ductile Iron castings using resin sand moulding and hand moulding techniques. Shanthi is equipped with a non-ferrous foundry that is capable of producing radiography levels sound centrifugal castings of all bronze alloys. In addition, Shanthi makes its own cutting tools to assure accuracy and quality of Gears produced.

Southern Gear & Machine, Inc. – Booth 2307

Custom Precision Gears Since 1957. Veteran Owned.

www.southerngear.com

For more than 60 years, Southern Gear has been delivering the highest quality precision gears and gearboxes to the world's most demanding industries, including aerospace, defense, medical, marine and more. Southern Gear provides the ideal combination of skilled, experienced personnel and cutting-edge technology to produce precision gears, on-time and on-budget. Southern Gear is equipped to handle all gear-making operations in-house including turning, milling, grinding, and gear cutting/grinding. The benefit to customers is that their parts are produced in their plant, under their control, and under their AS9100 D certified quality systems. As a veteran-owned company in business for more than 60 years, Southern Gear is an industry leader in precision gear manufacturing. The most demanding companies serving the most demanding industries trust Southern Gear. Visit to learn how they can solve your precision gear needs.

The Estell Group LLC – Booth 2206

Bearings, castings and machined components for your success!

www.theestellgroup.com

The Estell Group supports power transmission OEMs with bearings, engineered castings, and precision machined components. They add further value by offering scrap metal value optimization services, creating transparency in an opaque market and increasing revenue for under-valued material.

Key areas of focus:

- Internationally competitive bearings, domestically stocked, including:
 - » Rolling element bearings (all styles)
 - » Plain bearings
 - » Mounted bearings

QuickSilver Controls SilverMax™ Integrated Hybrid Servos

Motor + Encoder + Controller + Driver

High Efficiency Over Wide Speed Range
Highly Programmable
Handles Large Inertia Mismatch
NEMA 23 and 34

Bringing Our 23 years of
Hybrid Servo Expertise
to Your Project!



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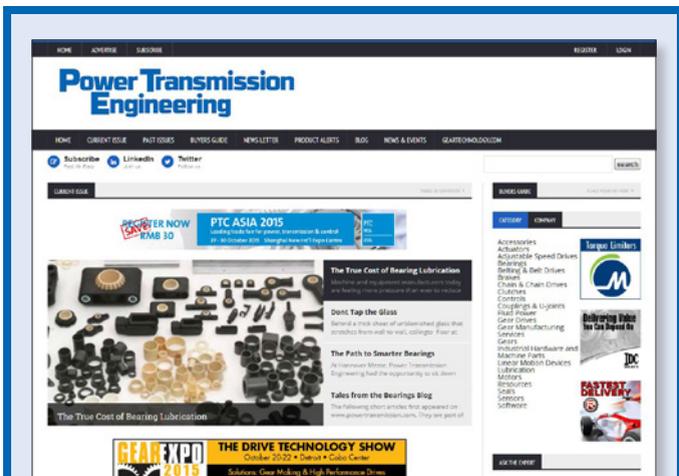


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- ▲ **85%** of American workers view in-person events as "irreplaceable"
- ▲ Trade shows contributed **\$101 billion** to the nation's GDP in 2019
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- ▲ **50%** of trade show attendees plan to buy what they see exhibited within 12 months after an event

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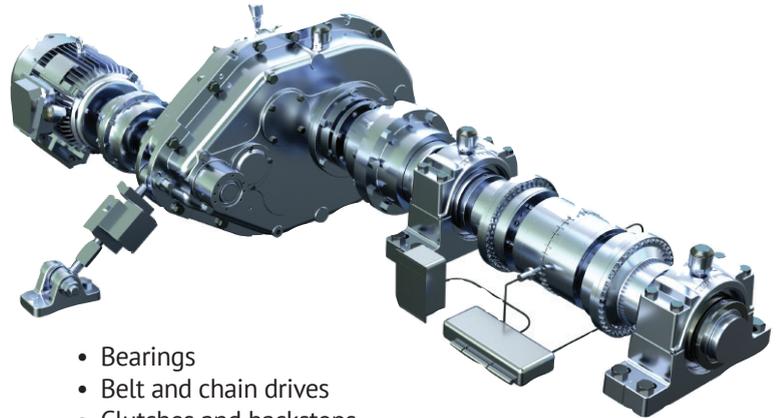
By using parts not optimized to work together, companies can keep their equipment running. But the powertrains often function with less-than-optimal efficiency, reliability and/or profitability. Additionally, sourcing their bills of material becomes an extensive, complex and expensive problem.

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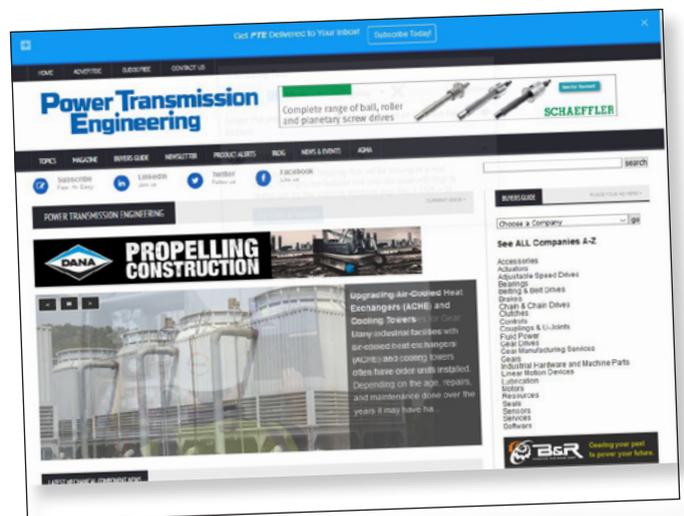
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The Packaging Perspective

Pack Expo Las Vegas Gears Up for In-Person Trade Show

Matthew Jaster, Senior Editor

The state of Nevada recently reinstated its mask mandate for public indoor settings; face coverings are not required outdoors, and there are no capacity or large gathering restrictions.

Pack Expo Las Vegas and Healthcare Packaging Expo (Sept. 27–29, Las Vegas Convention Center) will follow the current local regulations and continue to update exhibitors and attendees as things develop to ensure a coordinated effort and successful event for all, according to show producer PMMI, The Association for Packaging and Processing Technologies.

“In the planning of Pack Expo Las Vegas and Healthcare Packaging Expo, we recognize that information and guidelines will change constantly and have committed to updating our approach in line with CDC and local regulations, along with industry best practices,” says Laura Thompson, vice president, trade shows, PMMI. “Many events have already safely taken place, and we have taken best practices from those events along with current government guidelines to implement the PACK Ready health and safety plan for a successful in-person event.”

Pack Expo Las Vegas and Healthcare Packaging Expo is the only show this year covering the entire packaging and processing industry spread across four expansive convention center halls. More than 1,500 exhibitors will showcase the latest new materials, technologies and solutions to address the packaging and processing needs of over 20,000 attendees from 40-plus vertical markets. With multiple free educational platforms and countless networking opportunities, the event will provide endless prospects for exchanging ideas and professional growth.

Industry partners continue to support the event with 28 association partners already signed on to support and exhibit at the show, including the Association for Contract Packagers and Manufacturers (CPA), Institute of Packaging Professionals (IoPP), The Organization for Machine Automation and Control (OMAC), Flexible Packaging Association, Reusable Packaging Association and more.

The Packaging & Processing Women’s Leadership Network (PPWLN) breakfast at Pack Expo Las Vegas will bring together a panel of experts to discuss how to thrive in a fast-changing



world. First will be Tracey Noonan, co-founder and CEO of Wicked Good Cupcakes, as the keynote speaker.

Noonan and her daughter turned a small home-based baking business into a multimillion-dollar corporation through creativity, perseverance and an investment from Shark Tank's Kevin O'Leary. Recently acquired by Hickory Farms, Noonan will reflect on her experience of scaling an e-commerce business, managing a growing workforce and her insights into how the food and beverage industry is evolving.

Noonan will then join Yolanda Malone, vice president of global RD Foods at PepsiCo, and AJ Jorgenson, vice president of strategic engagement at The Manufacturing Institute, for a candid conversation about the new world of work and what it means to the future of manufacturing.

The breakfast will take place September 28th from 7:15-9:00am in Room N-247.

Lenze Americas is sponsoring lounges for exhibitors and PMMI members at Pack Expo Las Vegas and co-located Healthcare Packaging Expo.

With over 1,500 exhibitors, no other event in 2021 will bring together a more comprehensive gathering of packaging and processing suppliers offering new products, technologies and solutions. It's where executives and plant managers, engineers, brand managers and packaging designers come to see machinery in action, connect with suppliers, network and gain the latest perspective on industries in over 40 vertical markets.

"Pack Expo will reunite the packaging and processing industry in 2021 and these lounges are a welcome retreat for members and exhibitors after spending hours on the bustling show floor," says Jim Pittas, president and CEO, PMMI. "We're grateful to Lenze for providing this resource again this year."

The lounges will provide seating, coffee and a chance to take a break away from the busy show floor.

"Lenze recognizes how important it is for members and exhibitors to have a space to recharge between networking with attendees in their booths, and we are proud that we are able to sponsor these lounges again this year," says Susan Duval, senior marketing communications manager, Lenze Americas.

Lenze will sponsor two Exhibitor Lounges, located in rooms N-114 and S-222, and two PMMI Member Lounges, located in rooms N-101 and S-221. The lounges will be open on Sept. 27 and 28 from 8 a.m. until 5 p.m. and on Sept. 29 from 8 a.m. until 3 p.m.

Another highlight this year is an interactive exhibit that takes attendees on a journey through the evolution of packaging and processing and see what the future holds.

PACK to the Future celebrates the role of packaging and processing through history and the impact it is poised to have on our future.

Presented in the North Hall (N-11030), the curated exhibit includes nearly 30 pieces of historical equipment, materials and photographs spanning 250 years, journeying through the evolution of packaging and processing and highlighting how the industry developed alongside civilization. The exhibit will also pay tribute to PMMI members' response to COVID-19.

Booth Previews: Pack Expo 2021

The following is a snapshot of some of the must see exhibitors at the Las Vegas show in 2021:

B&R Industrial Automation Booth C-4709

B&R Industrial Automation will present its latest packaging solutions at the industry's premier event, PACK EXPO. B&R specializes in standards-based, scalable and modular control systems integrating logic, motion, robotics, human-machine interface (HMI), safety, I/O and data acquisition in a unified software development environment.



With ACOPOS 6D, B&R heralds a new era of manufacturing. Magnetic levitating shuttles move individual products freely through the machine. Gone are the days when conventional transport systems imposed rigidly defined timing on the production process. ACOPOS 6D is ideal for small-batch production with frequent changeover between products of different designs and dimensions.

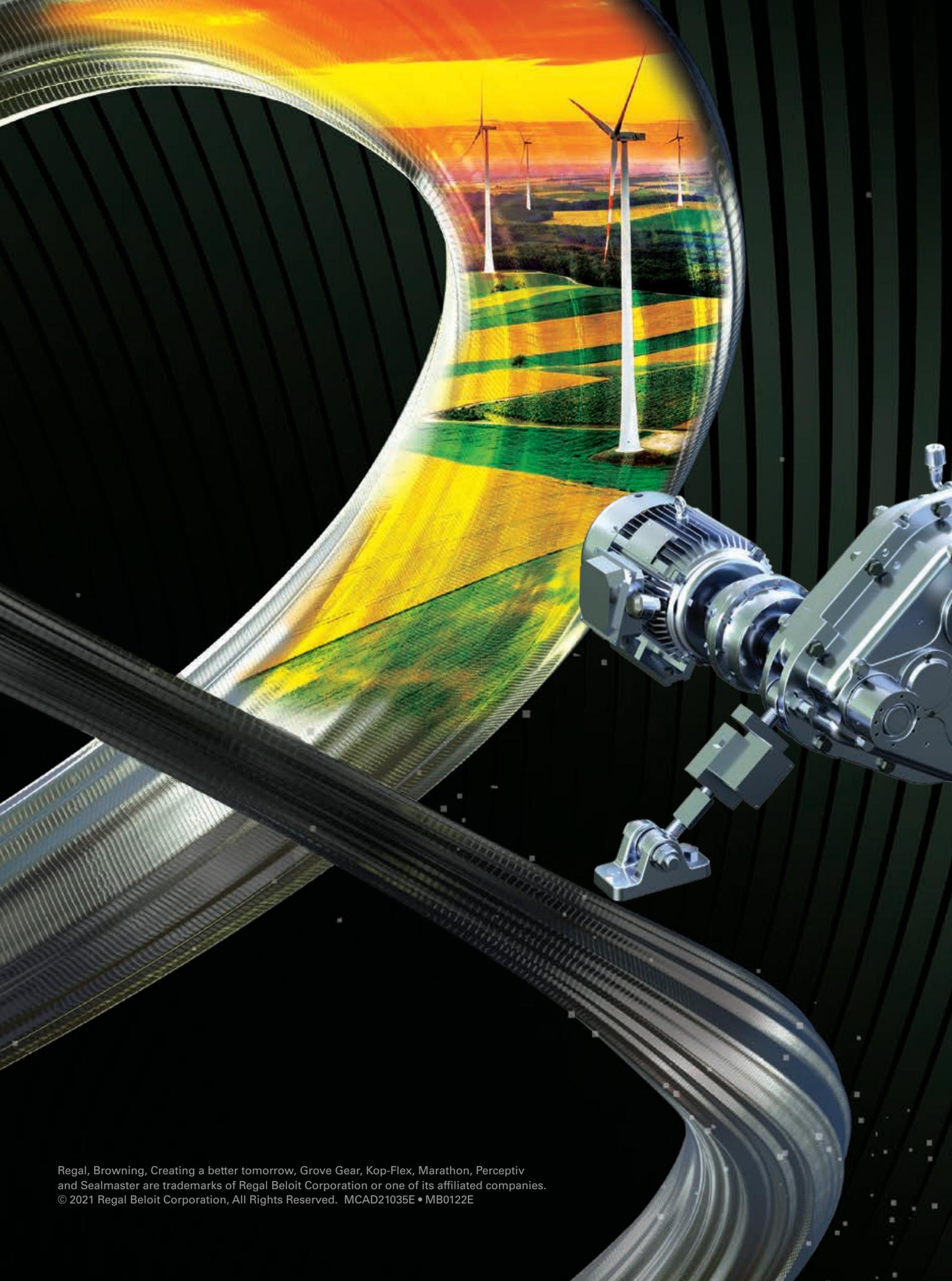
ACOPOS 6D is based on the principle of magnetic levitation: Shuttles with integrated permanent magnets float over the surface of electromagnetic motor segments. The modular motor segments are 240 x 240 millimeters in size and can be arranged freely in any shape. A variety of shuttle sizes carry payloads of 0.6 to 14 kilograms and reach speeds of up to 2 meters per second. They can move freely in two-dimensional space, rotate and tilt along three axes and offer precise control over the height of levitation. Altogether, that gives them six degrees of motion control freedom.

www.br-automation.com

Mitsubishi Electric Americas Booth SL-6661

From filling and labeling to bagging and palletizing, our automation products and solutions span the needs of the consumer packaging industry. End users are challenged to adjust to rapidly changing consumer demands, and OEMs are challenged to incorporate the latest technologies to improve the effectiveness of their machines.

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designed to improve the performance and ultimately lower the total cost of deploying smart packaging machines.

Developments include updates to the MELSERVO-J5 Series like the “quick tuning” function that allows users to quickly and reliably tune their servo mechanism in approximately 0.3 seconds. The servo amplifier sets the speed loop gain and suppresses machine resonance through the servo on command. No tuning experience is required because gain values are automatically generated, reducing machine setup time and effort.

MITSUBISHI ELECTRIC SERVO SYSTEM MELSERVO-J5



MELSERVO-J5's new and improved features unlock benefits across various industries. Industry leading communication cycle time combined with a 3.5kHz speed frequency response rate ensures precise, responsive movement and short settling time. Compatibility with CC-Link IE TSN facilitates IoT infrastructure across the manufacturing enterprise and enables time synchronization across all connected devices at one gigabyte per second (1 Gbps). The MELSERVO-J5 Series is also able to meet any axis requirements, from single axis to a 256 multi-axis system, due to its scalable synchronous axes—while all the motion modules are programmed in a single software environment.

The FR-E800 Series features a built-in PLC, and will include safety functionality meeting IEC 61508 standards and support various networks, including Ethernet/IP, MODBUS/TCP, and the soon-to-be-released CC-Link IE TSN. The FR-E800 Series is designed for engineering, technology, and product managers in industries such as packaging, material handling, food and beverage, and water and pumping, as well as those who are adopting PM motors to improve their energy efficiency.

The FR-E800 is built upon Mitsubishi Electric's proven variable speed control technology through years of reliable operation across various applications. It incorporates advanced capabilities in a compact footprint allowing for bookshelf style mounting. Additional features include extended programming functions, advanced fault detection features, and auto-tuning of PM motors for applications where energy efficiency is extremely important. The auto-tuning function

includes configurable parameters to reach optimum performance, higher torque, faster acceleration, and lower noise level for quiet operation. This results in efficient control of motors and equipment to meet or exceed energy efficiency regulations.

For those OEMs that use induction motors in their equipment, the FR-E800 can control both induction and PM motors, helping to consolidate inventory and spare part management. The drive series is also dual-rated for light duty and normal duty, which may help achieve desired performance in smaller frame sizes.

us.mitsubishielectric.com

Emerson Booth #SL-6307

Branson DCX-F Offers Performance & Flexibility in a Compact Power Supply

Data access is the number one factor influencing IIoT and smarter factories. Because of this, OEMs building and supplying packaging machines are selecting components and subsystems based on their ability to fill this need. One example of this kind of technology is the Branson DCX Series of ultrasonic welding automation power supplies from Emerson. Along with patented power supply circuitry that provides significant benefits in performance and consistency, the DCX-F system supports real-time data transfer via EtherNet/IP and Profibus fieldbus protocols, two of the most widely used automation protocols.



In addition, DCX supports remote control and diagnostics via a standard HTML-based communication interface, so users can perform remote product setup, custom I/O configurations and system diagnostics. The DCX also supports the demand for higher packaging throughput through multiple power levels, tiered control levels (four control levels with up to five weld modes), a special DCX-HD high-dynamic option that provides greater control in high-speed packaging

applications, as well as Balun technology, which expands the weld area and can also help increase throughput. In addition, the DCX provides enhances flexibility via multiple weld modes in a compact, automation-friendly form factor. These form factor options allow for integration across horizontal, vertical and rackmount installation environments.

AVENTICS Flow Sensor Monitors and Measures Air Consumption

All too often, packaging lines operate without any way to monitor and measure their air consumption. When machines use more compressed air than needed and leaks go undiagnosed, manufacturing facilities waste energy and prematurely wear equipment. The Emerson AVENTICS Series AF2 flow sensor monitors air consumption in pneumatic systems, enabling actionable insight around air consumption and leakage. The leakage rate can be monitored by looking at the used air volume, so leaks can be diagnosed early



and addressed before they become major issues. By giving end users actionable insights on machine data such as flow, pressure and temperature, the AF2 helps to optimize energy consumption, prevent machine downtime and reduce costs. The AF2 is a highly flexible flow sensor that can be directly interpreted by many controllers, and offers multiple communications options, including an IO-Link connection, Ethernet connectivity, OPC-UA server, MQTT communication and on-board webserver. The sensor can be fitted on new installations and its seamless IoT integration makes it perfect for retrofitting existing machines.

Transmitter Provides Accurate and Reliable Measurements

Emerson will also showcase the world's first Non-Contacting Radar Level Transmitter designed specifically for food and beverage applications with IO-Link connectivity.

Emerson has developed the Rosemount 1408H Level Transmitter, which provides accurate and reliable continuous level measurement. The radar features a hygienic compact design, Fast Sweep Technology and hybrid communications, helping manufacturers maximize their production capabilities, reduce product losses and ensure food safety.

Industrial PC Boasts Increased Performance Capabilities

PACSystems RXi2-BP industrial PC delivers rugged, mid-to-high-range performance computing, powered by AMD Ryzen processors for increased performance and faster storage, improved graphics and enhanced security features—all in a surprisingly compact footprint. Emerson's IPC includes



a patented thermal design, enabling 100 percent CPU performance across extreme temperature ranges without throttling. Performance benefits of RXi2-BP are enhanced when paired with PACEdge and Movicon software, providing HMI, historian and analytics applications right at the machine or edge.

www.emerson.com

Siemens Digital Industries Booth #SL-6356

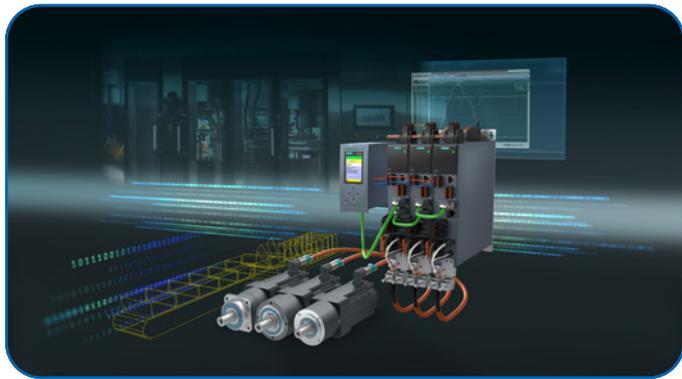
The demand for filling and packaging lines is growing worldwide, particularly in emerging and developing countries. The trend toward individualized packaging requires dynamic, flexible plants with high throughput rates. As a specialist for the packaging industry, Siemens offers future-oriented modular solutions as well as complex motion control. Here are some highlights:

Siemens Extends Range of Servo Drive System

Siemens has added new servomotors to its proven Sinamics S210 single-cable servo drive system, thereby expanding its range of applications. Specifically, for use in the pharmaceutical and food industries, the Simotics S-1FS2, a motor version with a stainless-steel housing, the highest degree of

protection IP67/IP69, and high-resolution 22-bit absolute multturn encoders.

The servomotor thus meets all hygienic conditions and can be used for mixing and stirring, air conditioning and ventilating, dosing and filling, as well as conveying, packaging and storing a wide variety of end products in the food and beverage sector and in the pharmaceutical industry.



The Simotics S-1FK2 servo planetary gearmotors also complement the Sinamics S210 drive system. They are used when high cycle rates need to be achieved with a lightweight and low-inertia gear design, or when inertia matching is required to move heavy loads precisely. The motors are ready mounted and as a unit available in a wide range of gear ratios and sizes, allowing them to be optimally adapted to different applications. Thermal dimensioning is done via the digital twin in the TIA (Totally Integrated Automation) Selection Tool.

With the Simotics S-1FT2, Siemens has a servomotor that offers a wide range of different options for the Sinamics S210 servo drive system. For example, encoders with a resolution of up to 26 bits improve system accuracy, and the high IP67 protection rating and various motor coatings make the solution suitable for use in harsher environments. In addition, new machine options, such as higher rated speeds, are available for extended use.

The Sinamics S210 servo drive system consists of a servo converter and servomotor. All motors of the servo system are connected via a single cable that combines power wires, encoder signal and brake in one line. The range of applications includes highly dynamic servo solutions such as those found in handling systems, packaging machines and machine building applications. To meet the high demands on motion control functionality in these applications, for example dynamic positioning, gear synchronization or cams with multiple axes, the system works perfectly with the Simatic S7-1500 controller via Profinet IRT.

Packaging Toolbox

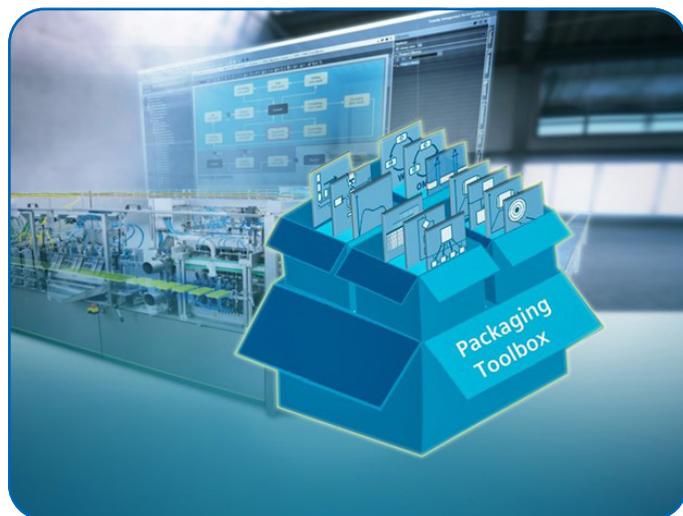
The Siemens' Packaging Toolbox is now available in its entirety for the Simatic S7-1500 controller in the TIA Portal engineering framework. It offers users packaging specific libraries which can be integrated into existing or new machine applications as well as program blocks. The Toolbox supports international standards such as OMAC, PackML and Weihenstephan Standards. By adding or modifying

function blocks it can be adapted to suit individual requirements, while at the same time saving the user time during engineering and commissioning through tested functions and software solutions.

The Siemens' Packaging Toolbox is now available in its entirety for the Simatic S7-1500 controller and supports international standards such as OMAC, PackML and Weihenstephan Standards.

The toolbox comprises basic functions, technology functions and international standards. Typical Basic functionalities that the toolbox provides are axis control, TCP/IP communication, acyclic communication and alarm handling. The Intelligent Belt technology function enables sequentially arriving products to be picked up and made available in groups at an unloading position. The Intelligent Infeed application is used to pick up products arriving in a continuous but irregular flow and make them available to the downstream station with defined and equal gaps between them. The Form, Fill and Seal library contains functionalities for the overall coordination of foil feeders, dosing units, and cross sealers in horizontal and vertical applications.

www.usa.siemens.com/packaging



Belden Booth #SL-6520

Belden is a leading manufacturer of signal transmission and security solutions that are built outperform and outlast in the most demanding conditions. Offering a comprehensive line of industrial cabling, connectivity, and networking devices, Belden's products ensure seamless data communications at all times and in all industrial environments.

Belden Inc. opened its first Customer Innovation Centers (CIC) in Stuttgart, Germany earlier this year. The center provides an ecosystem for Belden customers to co-innovate with sales and product engineers to develop, test, document, and deploy proven solutions that drive efficiency, security and innovation.

The Belden CIC model was developed to address key business goals and outcomes that encompass various areas of customers' operations. These include safety, automation, quality, and productivity, all tested to simulate challenges

and stressors a network may face. A team of Belden technologists and application experts work together to accelerate the design and implementation of future-ready networks. Teams consist of Digital Automation Consultants who study customers' existing networks to recommend opportunities for enhanced digitization and data flow management, Solutions Consultants who work with customers as architects of the network, and Service Engineers who provide implementation and post-sales support. To date, the Belden Stuttgart CIC team has worked with leading companies in the industrial environment providing best-in-class consulting to transform ideas into solutions and technical support, empowering them to feel secure and maintain focus on their business objectives. The Belden CIC, by joining hands with third-party software and application partners, is taking a step further in providing a complete solution to its customers and enabling their digital transformation journey.

Belden has enlisted a number of partners to grow this existing roster in the areas of security, edge computing, data management and analytics.

www.belden.com

Bosch Rexroth C-5214

Bosch Rexroth will showcase a new world of automation with its ctrlX AUTOMATION platform, making automation as easy as using a smartphone. Machine builders and end users can virtually eliminate the boundaries between machine controls, the IT world and the Internet of Things with the flexibility to add new automation functions and updates via apps to create complete Industry 4.0 automation solutions. The heart of the ctrlX AUTOMATION platform is the ctrlX CORE, the most consistent, open and flexible control platform in the industry. With a Linux real-time operating system, open standards, app programming technology and web-based engineering, ctrlX AUTOMATION reduces components and engineering costs by 30% to 50%.



The new platform is ready for standardized and manufacturer-neutral interfaces. In addition to EtherCAT, the system also supports PROFINET and IO-Link. The ctrlX CORE also supports more than 30 interfaces to IT systems such as OPC UA and MQTT, ensuring seamless communication and connectivity—from field level up to the cloud. With ctrlX WORKS, the Bosch Rexroth software toolbox, users can also easily assign ctrlX AUTOMATION apps or their own apps to the control. The ctrlX AUTOMATION platform also includes ctrlX DRIVE, a new generation of servo drives that utilizes cutting-edge power technology and integrated functionality that previously required extra space, enabling users to achieve space savings of up to 50%. ctrlX DRIVE can support as many as 20 axes per meter width, making it the most compact modular drive system on the market. On September 27 from 3:00 to 3:30 pm, Bosch Rexroth will present “Easy Machine Development and Customization with an Open Automation Ecosystem and App Store” at the Innovation Stage 2 (Booth C2058).

Imagine a new world of automation where pre-engineered solutions and ready-to-use apps speed up time to market and reduce or entirely eliminate development effort. Learn how an open automation ecosystem fosters innovation and helps businesses to perform automation tasks more flexibly and individually than ever before. Bosch Rexroth will discuss how a smartphone approach to industrial automation can make automation easy and accessible for machine designers and support end users over the entire machine life cycle. **PTE**

www.boschrexroth.com



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Monitoring Coefficient of Friction

Optimize Manufacturing Line Efficiency and Productivity With Condition Sensors That Trigger Automatic Cleaning and Send Alerts for Needed Maintenance

Ted Van der Hoeven, Business Leader – System Plast, Regal Beloit



Properly handling the flow of containers along a manufacturing line and avoiding unplanned downtime — especially a dry-running line in bottling or canning operations — depends on controlling friction.

Here's why it's critical: Spillage of beverage or food products occurs as part of normal processes. In wet-running lines, water applied as a conveyor lubricant helps to wash away much of the spillage. However, in dry-running lines, buildup of grime from product spillage increases friction on belts and chains along the container conveyance system. The additional friction can make equipment less efficient, slow down container handling, and cause premature equipment failure.

In beverage plants, which typically have fewer resources available to monitor and maintain conveyors, continuous and automatic condition monitoring can ensure that production line efficiency stays at desired high levels.

Therefore, it's essential to monitor the coefficient of friction (COF) of belts and chains while they're running in order to maintain optimal flow.* Variations in COF reliably indicate changing conditions or pollution of the conveyor. Understanding real-time friction changes and trends also can enable manufacturers to maintain line efficiency and an optimum cleaning regime.*

Devices that automatically monitor COF can be installed in any conveyor where stable friction is required. In dry-running lines, the COF can more easily be affected by the cleanliness of the conveyors. COF monitoring is especially useful at in-liners, feeders or the points where the containers change their speed quickly. In addition, COF condition monitoring devices are ideal to keep the back-line pressure under control along mass conveyors. (*Bearings News*, August 2020).



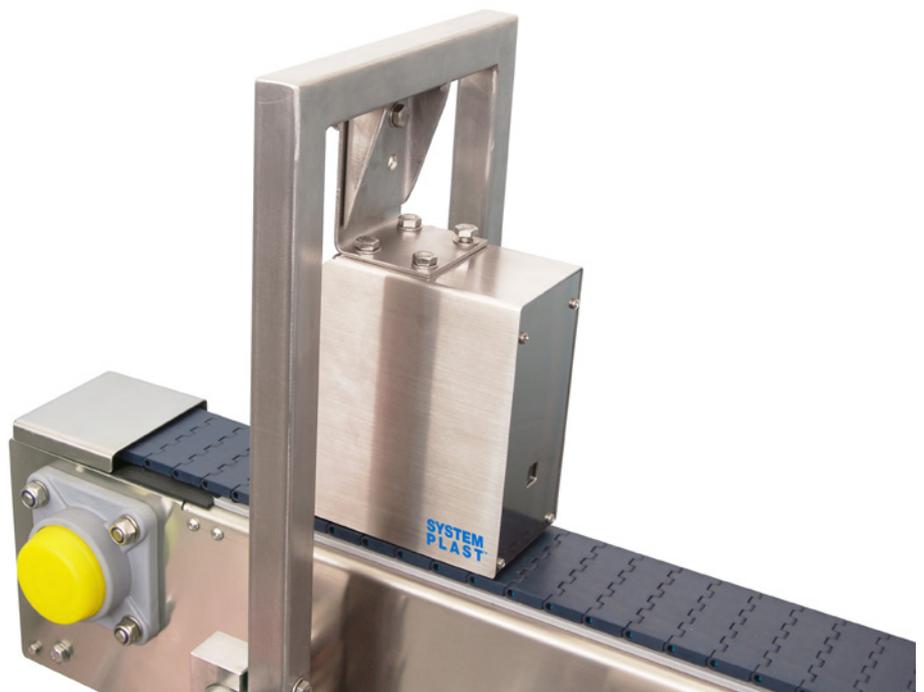
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How COF Monitoring Works

COF devices monitor the condition of bottling or canning lines or other manufacturing processes by continuously sensing and measuring changes in pressure between the containers and the conveyor belts or chains. No operator intervention is required to utilize COF devices, which:

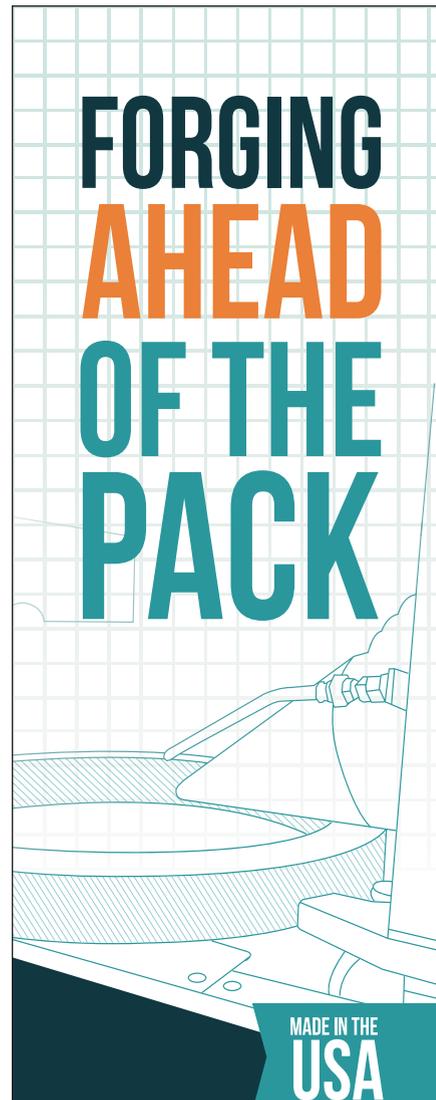
- Can be mounted along a conveyor and integrated into the production line control system or used as a stand-alone or portable device for spot measurements
- Used with all container types (PET, glass and cans)
- Independently and continuously measure changes in friction on belts and chains
- Calculate average COF values, standard deviation from preset ranges and trends
- Trigger a signal through Ethernet or Modbus connections once a pre-set limit is passed
- Alert operators to take corrective action, ranging from automatic cleaning to in-person troubleshooting as well as repair or replacement of conveyor components

Benefits for Bottlers and Other Manufacturers

Many manufacturing operations can benefit from COF monitoring, but the technology is well-suited for beverage or liquid food producers handling 40,000 to 50,000 bottles, cans or other containers per hour.

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The Art of the Rebuild

Gearbox Modifications Protect 1.2 Million Acres of Arkansas Farmland

Matthew Jaster, Senior Editor

2020—in short—was complicated. The world was essentially closing down, companies were scrambling to create remote offices and work travel was limited. Unfortunately, even during a pandemic—critical components need to be upgraded and/or replaced in many applications.

Case in point—the Memphis District’s W.G. Huxtable Pumping Station, located near Marianna, Arkansas. The station is one of the largest stormwater pumping plants in the world. According to the Memphis District website, the station was completed in 1977 and serves two purposes:

First, it prevents backwater from the Mississippi River from entering the lower St. Francis Basin when the Mississippi River is at bank full stage. This is accomplished by four 27’×28’gravity flow gates, thereby becoming a dam. Second, its 10 enormous pumps remove excess surface water impounded by the Mississippi River and St. Francis Basin levees in the most efficient manner possible. The watershed served by the plant is more than 2,000 square miles, equal to the size of the state of Delaware.

The Huxtable Pumping Station, operated by the Memphis District of the U.S. Army Corps of Engineers (USACE), serves to prevent flooding in Lee County, Arkansas, a mostly rural county in the Mississippi Delta that includes 1.2 million acres of farmland.

According to the last U.S. census, the county had a population of 10,424 with a median household income of \$23,716 and 42.6 percent of the population living below the poverty line. Bordered on the east by the Mississippi River, Lee County also has two smaller navigable rivers, one of which is the St. Francis.



Memphis District’s W.G. Huxtable Pumping Station.

Navigating the Equipment and a Pandemic

In 2019, two 50-year-old gearboxes were damaged, leading to an operational failure that threatened nearby residents with potential catastrophic flooding.

“The pump station had ‘a high-water event’ in 2019 which may have overloaded the pumps and the gearboxes,” said Craig Massa, vice president—sales, at Atlanta Gear Works.

Thankfully, Atlanta Gear Works, located in Dawsonville, Georgia, had a successful track record with other USACE projects and the company was awarded the contract to repair/rebuild the components in March of 2020—right when things globally were beginning to shut down due to COVID-19.

Management at the plant had analyzed the failed pumps and estimated the time needed to get them up and running again to be a year, but like many large projects, the problems turned out

to be more complicated than initially thought, according to Massa.

“The original job specs required the contractor to rebuild the two failed gearboxes on site,” said Massa. “They knew they had a broken shaft and other wear, but we knew the repairs would be complicated and wanted to bring them back to our shop [in Dawsonville] because of our infrastructure.”

“We began work on the Huxtable project right at the beginning of the pandemic, so there were a lot of unknowns,” Massa added. “We followed CDC guidelines with face coverings and social distancing, etc.”

Field repairs in this industry can sometimes begin as a guessing game.

“You really do not know if there is any other damage than what can visibly be seen until you disassemble and inspect the gearbox. With a field repair, you are sometimes limited to what can be done, and therefore repairing in a shop environment is always preferable,” Massa said.

When the Atlanta Gear Works team brought the gearboxes back to the shop and opened them up, they discovered the repairs would be more involved than expected. And though the gearboxes were identical, the repairs would be different for each one, with a focus on the gears themselves.

For the first gearbox, the team made all new gears, plus a spare set. In addition to the original specs, they identified that the thrust bearing and back-stop needed to be refurbished and the lubrication pumps and coupling disc packs needed to be replaced.

For the second gearbox, they were able to use gears provided by Huxtable. Since the intermediate pinion shaft

had sheared and greatly damaged the gears, to prevent future failures, they made a modification on the gears on that shaft at the point where it broke to reduce stress concentration. They also refurbished the thrust bearings and the backstops to prevent the gearbox from running in both directions.

At the request of plant management, to reduce future wear and tear, they also hired and supervised a subcontractor to perform vibration tests on a total of ten gearboxes and overhauled where necessary. “We took a baseline vibration reading for all ten gearboxes,” said Massa, “because proper preventive maintenance requires regularly scheduled vibration testing.”

The field service team and the company’s extensive field service rig, under the leadership of AGW Engineer Taylor Simms, made two 500-mile trips to the site for removal and installation of the gearboxes. Altogether, 20 people worked on the project, and most of the actual repair work took place in Dawsonville.

Expanding Capabilities

Late last year, Atlanta Gear Works invested in a 24-tool ATC+C vertical boring mill featuring a turning diameter of 36 inches and a height of 24 inches — all capable of turning a workpiece of up to 4,000 pounds. It joined six CNC (computer numerical control) turning lathes and two manual lathes enabling the team to produce parts faster and more efficiently than with slower lathes, with the added benefit of deeper and sharper cuts. This equipment means faster turn-around time for customers with no sacrifice in quality, resulting in fewer machining hours per job and ultimately lower-cost repairs.

In addition to the Memphis District’s W.G. Huxtable Pumping Station project, Atlanta Gear Works has been involved in the USACE Graham Burke Pump Station gearbox cleaning and inspection, Greenup Lock & Dam gearbox replacement, Alum Creek Gearbox rebuild as well as the Delaware Lake gearbox rebuild.

Massa summarized the pump station project by saying that Atlanta Gear Works’ expertise and knowledge of gearbox repair and gearing helped the team to accurately estimate the repair cost and the timeline. “This led the team to successful execution in less time than originally estimated — two months ahead of schedule,” Massa said. **PTE**

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Disassembly and removal of one of the gearboxes.



JIE JDRIVE

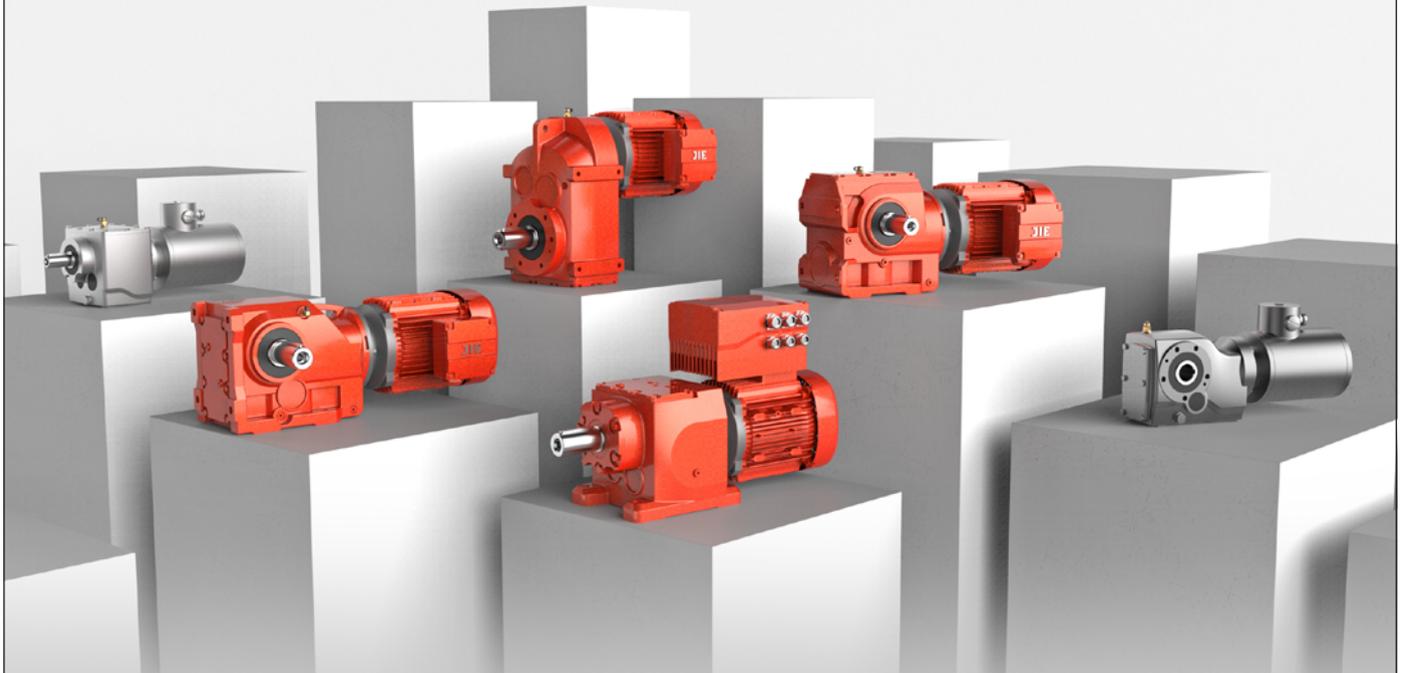


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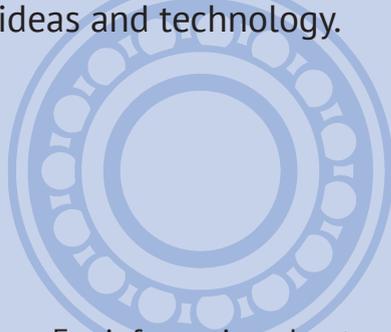
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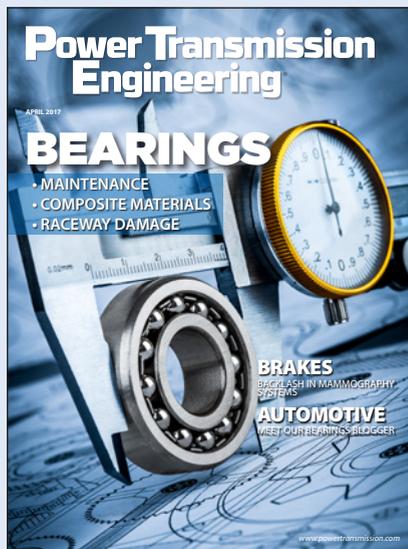
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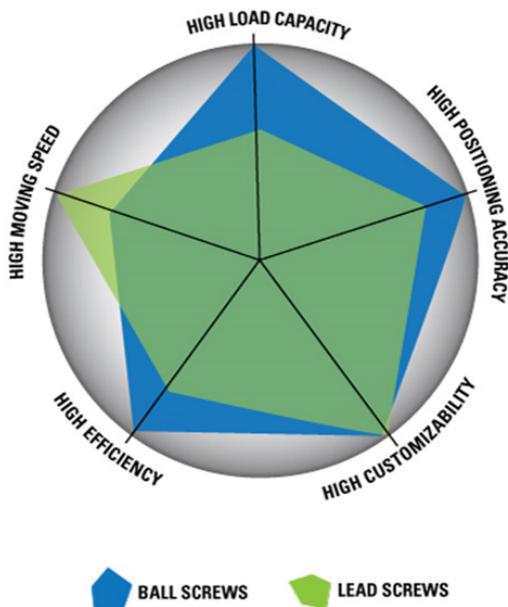
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Lead Screws vs. Ball Screws: Which Will Work Best for Your Application?

Reviewing the characteristics of lead screws vs. ball screws can help you select the right screw-driven system for your linear motion application.

EXPERT RESPONSE PROVIDED BY Dave Arguin.

Both lead screws and ball screws convert rotary motion to linear motion, and there is overlap in the applications in which they are utilized. The primary difference between them; how the load is carried along the moving surface. Reviewing the characteristics of lead screws vs. ball screws can help you select the right screw-driven system for your linear motion application.



Ball screws have significantly higher dynamic and static load ratings than lead screws. They are generally preferred in industrial applications with higher loads or that require more substantial torque and thrust.

- High load ratings, and are therefore suitable for high static and dynamic loads
- Excellent efficiency ($\mu > 0.9$)
- Low drive power required
- Low energy consumption
- Low self-heating
- Low-friction operation
- No stick-slip effect
- High accuracy for positioning and repetition
- High reliability and long service life with minimum need for maintenance
- Wipers available on request

Lead Screw Characteristics

Lead screws utilize sliding friction; the nut travels on the lead screw. The friction coefficient can vary greatly depending on both the material of the lead screw and the material of the nut used. Lead screw assemblies are quieter than ball nut assemblies, and lubrication for a lead screw is only necessary when using a metal nut. This makes lead screws ideal in situations requiring clean environments such as medical and food handling applications.

Lubrication can be considered depending on factors such as friction, noise, and life. Many plastic materials contain lubrication additives in varying amounts (2% to 15%), such as PTFE, silicone, or graphite. PTFE (*Polytetrafluoroethylene*) has a coefficient of friction of .05 to .10. (Note: Friction is a relative number and is dimensionless. Zero is considered frictionless, and one is where the force to move an object is equal to normal force.)

- Highly customizable
- Small to medium load ratings, therefore suitable for low to medium loads

Ball Screw Characteristics

Ball screw nuts contain rolling ball bearings that travel along the screw. Rolling friction in a ball screw assembly is generally .003 (with normal lubrication), resulting in efficiency as high as 96%. This level of efficiency is greater than the highest efficiency achieved by a multi-start lead screw.

Due to the metal-to-metal contact of a ball nut rolling on a ball screw, lubrication is necessary to maintain the rolling elements. Without it, the balls will not move freely and begin to skid, causing brinelling and premature failure. Debris is also catastrophic to a ball screw assembly. Metal fragments and dirt cause the ball bearings to skid and are not recommended for use in applications where debris is present.

- Very high traveling speeds, due to over-square pitches ($p \leq 6 \times d$)
- High efficiency ($\mu=0.5...0.8$), due to high surface quality of lead screws, and nuts made of high-performance plastics
- Weight optimization possible through the use of lighter materials
- Performance optimization possible based on coatings
- High reliability and long service life with marginal need for maintenance

Axial Force

Axial force is determined by multiplying the coefficient of friction of the guidance system by the load.

$$F = \mu \times N$$

μ = coefficient of friction of the guidance system

N = Load

Example:

μ = Coefficient of Friction for lubricated Helix Linear Bearings = .0013

N = 5,000 lbs

$F = \mu \times N$

$F = .0013 \times 5000 \text{ lb}$

$F = 6.5 \text{ lb}$

Lead screws offer more design flexibility and customization. Lead screw nuts can be designed in various materials, incorporate additional features, add functionality, save assembly time, reduce components, and avoid potential error due to stack up of tolerances. However, when using plastic nuts, sliding friction has limitations, referred to as the material's PV limit. PV limit is a combination of pressure and velocity (psi-fpm). In order to avoid overheating and degradation, a material's PV limit should not be exceeded.

Some common lead screw nut materials include acetal grades ranging from 8,000 psi-fpm to 15,000 psi-fpm, and higher PV materials such as PEEK ranging from 30,000 psi-fpm to 45,000 psi-fpm. Wear testing at different PV values can help determine nut materials, lead screw materials, and coating selection to achieve the desired life requirements.

For similar specifications, the price of a lead screw assembly is less than a ball screw assembly. A significant difference is the cost of the nut. In most cases, lead screw nuts (including custom nuts) can custom molded to reduce cost significantly.

Calculating Efficiency

Efficiency in linear motion is the measure of how well the lead screw converts torque (rotary energy) into force (linear motion.) Friction is a significant component of the efficiency equation. Lead screw efficiency can range from 20% to 86% efficiency, depending on the lead angle of the screw thread.

$$e_f = (\tan \lambda) \left[\frac{\cos \Phi_n - \mu \tan \lambda}{\cos \Phi_n \tan \lambda + \mu} \right]$$

Higher efficiency is good but not always better. Where ball screws are prone to back driving, lead screws are often a better fit. Especially in a z-axis if there is no holding torque to the motor, or in power down situations, the lead screw or

balls crew will back drive and lose position or create damage in a sensitive application. Brakes can be used to close on the output shaft of the motor when the power goes out to keep the motor shaft from rotating. Though a valid solution, adding breaks is costly, while a lead screw can handle this mechanically. At less than 50% efficiency, the lead screw is considered self-locking and will not back drive under any load.

Critical Speed

Critical speed (the maximum rotating speed of a shaft before whipping occurs, creating unwanted vibration) is a vital factor to consider when selecting lead screws or ball screws. Shaft diameter, shaft length, shaft support, and material type all impact critical speed (rpms). Critical speed formulas and charts typically account for 80% critical speed in order to create a margin of safety.

$$\text{rpm} = \frac{(4.76)(10^6) dF_s}{KF}$$

In applications where rpms may exceed critical speed, the diameter of the lead screw should be increased or the end support enhanced. However, due to space constraints, this may not be possible. In that case, a change to increase the lead is the solution to reducing rpms.

Lead screw designs inherently allow for high diameter to lead ratios. A 4:1 ratio is achievable for rolled lead screws: a 1/4" diameter lead screw can have a 1.000" lead, and a 1/2" diameter lead screw can have up to a 2.00" lead. Compared to a ball screw that generally has a 1:1 ratio 6x6, 8x8, 12x12, etc. A lead screw's advantage: longer leads can turn at much slower rpms while at the same time maintaining fast linear speeds.

Design specs, space constraints, price points, quantity, accuracy, customization, and product limitations are all considerations in determining whether to use a lead screw or a ball screw in your linear motion application. Choosing the right product relies on an evaluation of all these attributes and benefits. **PTE**

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Dave Arguin, President of Helix Linear Technologies, has over 28 years of linear motion expertise. His initiatives in product innovation, manufacturing excellence, and engineered solutions help Helix Linear Technologies' customers achieve the most significant outputs in their linear motion projects.



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Animatronics

Animatronics covers a wide range of applications, power levels and interfaces, as well as different actuator methods.

Don Labriola

Animatronics is a very interesting field which covers a wide range of applications, power levels and interfaces, as well as different actuator methods.

Puppets are the term for characters that interact with guests or actors with the help of human intervention—the puppeteer. A complex puppet typically has multiple puppeteers to handle different aspects of the puppet. Think of the dolphin robot used in several movies. One puppeteer controlled the many actuators involved in the body and tail motions, while another focused on the face, mouth, eyes.

The motions were controlled real-time via RC plane-type controllers; in this case with a wired connection as the dolphin puppet (Fig. 1) was in salt water, which greatly attenuates RF signals. The use of real-time puppets allows for much more life-like interaction with the actors as the puppeteers can improvise with the actors in the shoot. The RC style controllers typically use

1-2 millisecond PWM signals (Fig. 2), with multiple axes multiplexed into a single TTL stream. As high as 20 channels may be commonly multiplexed. This multiplexed stream may be carried via an RF signal or via wires (bottom of Fig. 2). Within the puppet, a demultiplexor splits the single stream into multiple individual PWM connections, with one connection to each servo. The PWM signal can represent either a position (as was used for this puppet) or a speed, such as for the forward motion of an RC-truck. The exact positions can be mapped to PWM duration, and multiple axes can be joined together via the RC-controller so that up-down and left-right can be easily controlled, even though there may be many axes coupled to actually make the motion in a puppet as complex as this one. Typically, 1.5 milliseconds represent the neutral location, with 1 millisecond being one extreme end, and 2 milliseconds being the other extreme range.

Some controllers and servos can extend this timing to allow 0.5 milliseconds to 2.5 milliseconds ranges for a bit more accuracy.

Shows refers to scenes which include the mechanized characters and the surrounding set and props. These can be used either in theme park “theatres” or scenes in rides. For shooting scenes in a movie, the motions of the camera, the lighting, and any characters are often synchronized to the shutter speed of the camera (film or now more commonly video), so that multiple layers can be filmed individually and then post-production combined. The timing of the motion with respect to the shutter can be controlled to vary the level of blur present. Static images with no blur look very artificial, while over-emphasizing the blur can make for a creepy super fluid motion effect.

DMX-512: Where lighting and special effects are included, DMX-512 is the standard for digital communication. DMX-512 controllers can control lighting flood orientation, color, intensity, smoke machines, camera location and shutter, focus, and the props and characters, so that these can all be synchronized to the camera. DMX-512 is a well-defined serial stream with a RS-485 hardware format. The most basic format uses a 250k-baud (4uS/bit), 1 start bit, 8 bit data, no parity, 2 stop bit format (44uS per “slot”) with a minimum 2 slot (88uS) break to indicate the starting of a new frame. The first character defines the “universe” (which devices are to respond to the frame) as well as special packets, and the remaining up-to 511 slots carrying data to control the various devices. More advanced versions of DMX-512 allow for diagnostics with the controlled devices being able to respond to special query packets. Multiple slots can be combined to allow 8, 16, 24, and 32 bit data to be represented in the stream; these are normally configured as big-endian (MSB

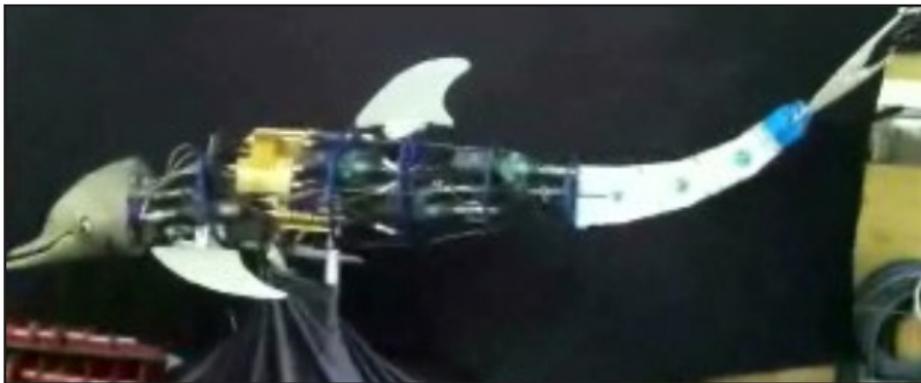


Figure 1 Internals of Dolphin Puppet

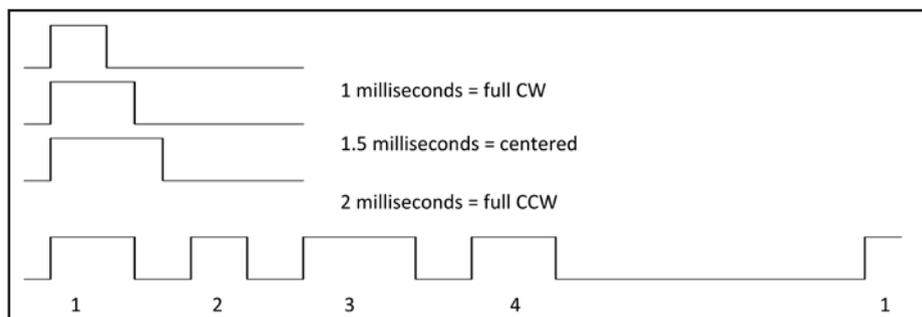


Figure 2 PWM Signals and Multiplexing

sent first). Each device checks the sent universe (first byte in the frame) addressing that device, and then counts off the bytes to see which bytes or groups are applicable to that device. Some devices include the ability to check the first 100 slots to help avoid corrupted data. Although DMX-512 can convey up to 512 slots, shorter frames are commonly used to allow the frames to be fast enough to allow a frame of data to be synced to one shutter of the camera. Figure 3 shows a short frame, starting with break characters to mark the start of the frame, the mark after frame to let the serial converter settle after the break, and then the slots (8 total in this example). The frame then repeats.

Analog control: Earlier shows also used analog channels to control motions, with a dedicated analog channel and its return used for each actuator. These were commonly either 0-10v or +/- 10v signals. The signal is sent relative to the dedicated reference signal with a differential amplifier used to remove ground difference between the show controller and the individual axis electronics. Analog control requires many individual wire pairs to be run and can have ground noise issues. As such, analog control is being designed in less frequently, while other digital methods are gaining market share.

CAN protocol: Many shows and ride props are starting to go over to CAN (Controller Area Network). This protocol originated at Bosch for control of under-the-hood electronic control units, and was designed with multiple levels of protection to help ensure delivery of the correct data. The data is carried as a differential signal, on the CAN-H and CAN-L signal bus. Two electrical states exist on the bus — “Dominant” — which represents a “0” level and has CAN-H driven high and CAN-L driven low, and “Recessive” where none of the nodes is driving the bus, and the terminating resistor pull CAN-H and CAN-L to a

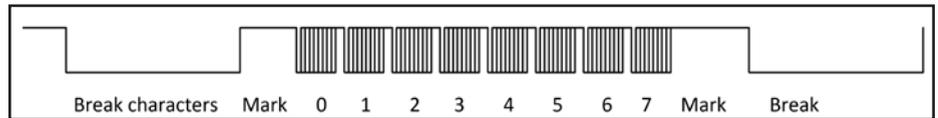


Figure 2 PWM Signals and Multiplexing

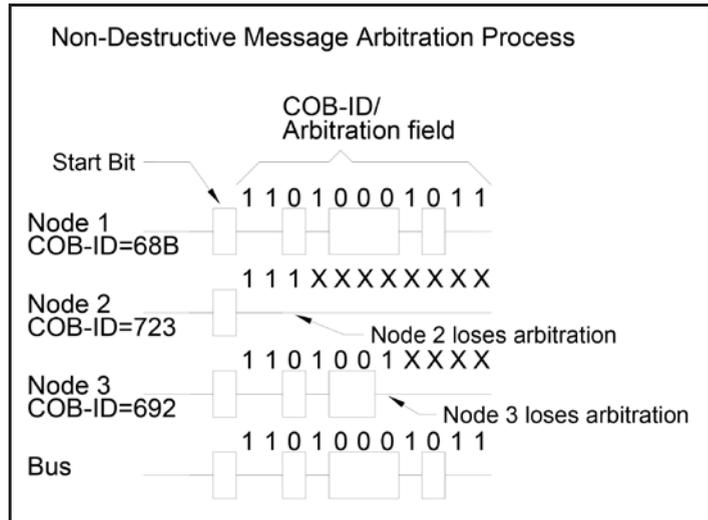


Figure 4 CAN

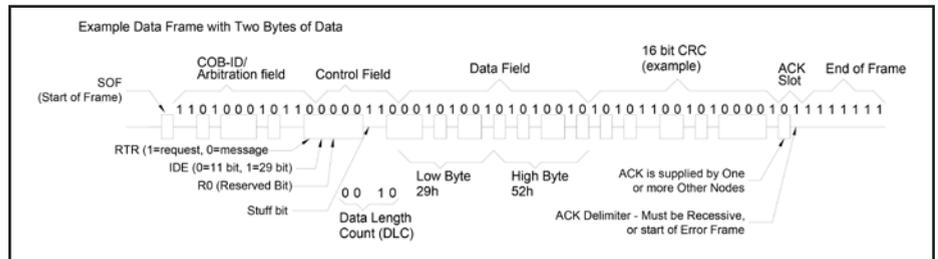


Figure 5 CAN Frame

small residual differential voltage. Each driver is essentially “diode-or’ed” on the bus, allowing multiple can drivers to simultaneously assert a dominant level without loss of signal. After a quiet (recessive) period between frames, any device with a message to send asserts a dominant start bit. All other devices having a message to send synchronize to this start bit and also assert their own start bits. The identification for the packet — called the COB-ID — is then sent, with each of the devices having a message sending each bit from high to low, while also monitoring the CAN bus. Figure 4 shows three nodes all trying to send a message. As long as each node sees the bus in the same recessive or dominate state that node has driven, the node may proceed to the next bit. If the state does not match, then that

node loses the arbitration and must wait for the frame to complete before trying again. This allows the highest priority frame (lowest numbered COB-ID) to proceed on its first try while lower priority messages are delayed until no higher priority message is vying for the bus. Multiple types of frames are defined allowing different modules to communicate in one-to-one communications, as well as one-to-many (or none) broadcasts, and background status (heartbeat) messages as well as network management control. Each frame can carry 0 to 8 bytes of data for basic CAN; newer CAN-FD allows longer data fields up to 64 bytes, as well as higher data rates for the data fields and data CRC portions of the frame. An important aspect is that a particular COB-ID may only be assigned to a single device

on the bus to allow proper arbitration.

Figure 5 shows a full frame with 2 bytes of data for the basic CAN signals (non-FD). Not shown in the figure is bit-stuffing: all of the units on the bus resynchronize their timing with each transition of the bus to compensate for differences in their internal clock speeds. To prevent too much drift in their relative timing, the protocol does not allow more than 5 bits of the same polarity before a bit of the opposite polarity is inserted (stuffed) into the frame. These extra bits provide the transitions needed to resynchronize timing between units. These extra bits make the frame time slightly longer dependent upon the data present, and are discarded when the frame is received.

Both real-time show information and back channel diagnostics can share the bus by proper assignment of priority through the selection of which COB-ID numbers are assigned to which functions. CANopen focuses on how these COB-IDs are used as well as standardizing the various interactions between modules. There are multiple CAN protocols with varying flexibility.

Ethernet: Ethernet is continuing to become less expensive, but not to the levels of the already described protocols. Higher level automation supports the added size and cost, but most animatronics has not yet made that jump to the lowest level of actuator. Ethernet, however, is commonly used to drive one level up from the bottom actuator, bringing show data to the analog output cards, CAN output cards, and DMX output cards, with each of these cards commonly controlling 8 to 32 actuators.

Combination: Multiple communication types may be combined. Figure 6 shows a water fountain show. This application used both DMX and CANopen. The DMX was used for the main show choreography. This included controlling pumps, pointing the fountain head in polar coordinates, setting light colors, and pointing/spinning certain fan type nozzles. CANopen was used to calibrate each station. Each fountain is mounted to concrete set within the fountain. The nozzle needs

to be calibrated to compensate for tilt—front and back and side to side. It also needs to be calibrated for rotation so all fountains agree on what is zero degrees—“North.” Calibrating each fountainhead then makes it much easier to program the show rather than having to compensate these variations inside the show itself. This also eases maintenance if a fountain must be replaced. Recalibrate the new fountain head and

the show stays the same. The local axes monitored both their primary DMX position slots, some diagnostic control slots, and their paired axis. The two axes interacted via a lever arm, which required adjusting the position of each actuator to compensate for the effects of the lever arm. Again, doing this compensation at the motor controller level allows the show to output desired angles to make programming multiple



Figure 6 Water Fountain Show



Figure 7 Bar Tender Prop

shows across the many fountains much easier. The CANopen backchannel allows diagnostic functions to run while the show is active without affecting timing of the show.

Actuators: The actuators cover a wide range of speeds, sizes, and power ranges. These can vary from the tiny actuators designed for RC planes to multi-horsepower motors to move props.

At the low end are open loop air cylinders which are switched on and off. The rate of movement may be adjusted by controlling the rate of air flow, but changes in friction can affect the motions. There are also closed loop air cylinders which use feedback and proportional valves to make the motions better controlled. The quality of motion and the price both go up. The moving seal can limit the no-maintenance life of both of these actuator types, as can the quality of the air supply.

The small RC plane-type controllers are commonly a small brush motor with potentiometer feedback, although brushless motors with absolute feedback are available. These are usually limited to 1-2 millisecond PWM control. These compact actuators greatly gear down the motor, trading speed for higher torque. The small size can handle functions like eye and eyelid movement, small light props such as ears and tails. The DC brush motors tend to have a shorter life—from a few hundreds of hours, to a few thousands of hours for high-quality units. Brushless motors commonly go 10k to 20k hours at the low end to significantly more—the quality of any gear train starts to dominate the life expectancy at that point.

Up a level are brushless motors with integral gear heads; single stage harmonic drive type gearheads can gear 300:1 to produce substantial torque with good life expectancy. This style of motor can range from 5mm diameter through full industrial robot cable motors.

Figure 7 shows a 3-axis rig operated via CANopen used to move the bartender in the *Passengers* movie front and back and side to side while also rotating the actor playing the bartender.

The actual low pitch growl of the high torque hybrid servo motors was recorded and mixed into the soundtrack of what a robot of the future would sound like! The rotation was done with an A34HC-2 motor and a 5:1 gearhead to rotate approximately 180 pounds of actor and rig 180 degrees in 0.5 seconds—although they tested this motion down to about 0.3 seconds!

QuickSilver supports power levels from ~20W up to 600W, with CANopen, PWM, and/or DMX across most of the product line, supporting voice coil actuators, DC brush motors, and both 2- and 3-phase brushless servo motors. **PTE**

Donald Labriola P.E. is president at QuickSilver Controls, Inc. He has been working with step motors since high school, and has had these motors operating field-oriented closed loop control since 1984.



don_labriola@quicksilvercontrols.com

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Motor Matters with George Holling; The technical director at Rocky Mountain Technologies regularly contributes articles regarding motors, power quality, power factor, efficiency and more.

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Another Thought: Brace for the Impact of “The Washington Solution to Fix Climate Change” and How It Impacts Our Industries

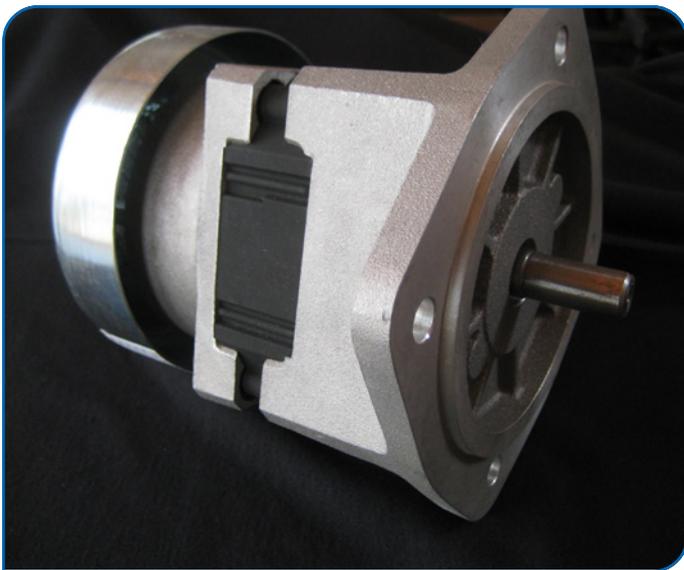
George Holling

Hardly a day passes where the Washington Mafia does not offer another proposed fix to our climate change problems. Yes, the climate appears to be changing and we must look at viable solutions, if they can be found. The magic formula in Washington appears to be: “eliminate all fossil fuels, switch everything to electric, and promote green energies.”

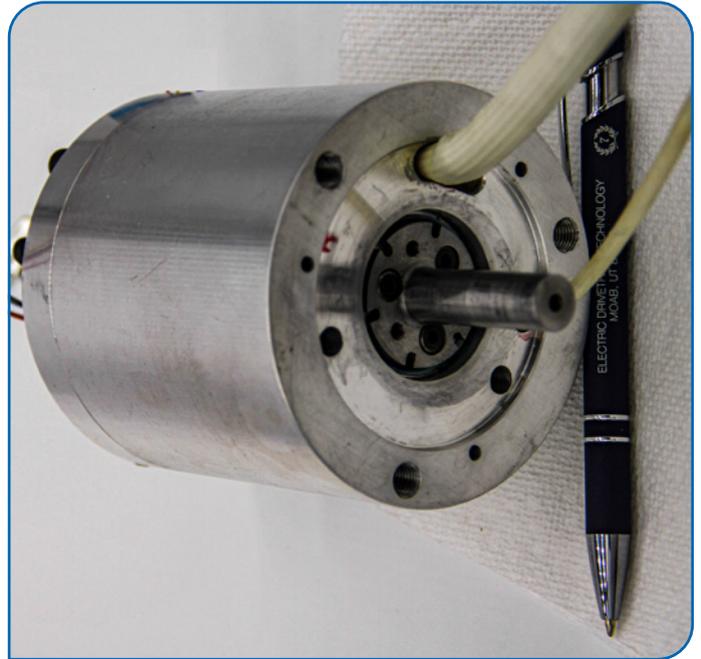
I could dwell on the fact that the majority of our electricity is still generated from fossil fuel sources — maybe more efficient than the automobile, but still dirty. It is also a well known fact that the construction of solar panels and batteries is not exactly clean and many of these emotional and politically motivated proposals have no hard facts and they offer trade-off studies to validate that the “green energies” which are being promoted will, in fact, result in a beneficial net reduction in green house gases and pollution.

Instead, I want to focus on the technical feasibility and the impact on the electric motor industry.

For many years the industry has been working diligently to improve the efficiency of electric motors and it is continuing to do so. After all, electric motors account for over 65% of the industrial electric energy consumption in the US; if it could be achieved, a 5% across-the-board efficiency increase can reduce the industrial power consumption 3.25%. Yet, we are still left with a huge amount of power that the industry consumes. In addition, we now start to add the power used by electric vehicles (EV), which will become significant as the use of EVs increases.



SR165 => A 4.5 HP Switched Reluctance Motor.



4 Nm VSR => A 75 mm diameter Switched Reluctance Motor that will deliver 8 Nm peak torque.

The transition from fossil powered cars and the increases in electric motor efficiency have implications that many politicians do not understand and even those in the industry that are familiar with motors and power can easily overlook: the limited supply of crucial raw materials.

20 years ago most industrial motors were AC induction motors, as were EV motors 10 years ago. To improve motor efficiency and to make motors smaller and lighter, permanent magnet (PM) based motors are steadily replacing the AC induction motors. This means our demand for high energy magnets, specifically Neodymium-based with current technology, is ever increasing. As we transition larger motors from AC induction to PM based ones, we need increasing amounts of rare-earth magnets, most of which are made in China.

It was not that long ago when China flexed its muscle and Neodymium prices shot up, which paralyzed the motor industry and led to inflation in the motor costs. Even worse, I suspect that all the rare-earth mines currently in production would not provide sufficient output to provide all the magnets required for a U.S. or worldwide transition from gasoline power to electric cars, leading to shortages and sky high prices for magnets, motors, cars and a wide variety of industrial and consumer products.

I will concede that more rare-earth mines could be placed in operation, and even some in the U.S., but that creates another slew of contamination-related issues beyond the scope of this discussion.

It also gives foreign governments undue power to influence and blackmail the U.S. into submission, which undermines the rhetoric of fighting unfair competition and bringing industrial production back to the U.S. Maybe in order to buy the magnets we now have to purchase the complete EV from China.

Similar considerations hold true for lithium in the use of batteries, which is increasingly in short supply, but which is, once again, not the topic of this discussion. However, this issue remains for the availability of other raw materials such as copper, etc. where we also experience rapid price increases and shortages.

My personal opinion: rather than having a lot of ideologists in Washington, we may need some knowledgeable folks there who can really work through the technical aspects and feasibility and assess all the related implications. Wishful thinking can and will not remedy the climate issues.

Now let us move on: What are the implications? I remember back after the last recession when the availability of rare-earth magnets was restricted and prices shot up 1,000% and higher — manufacturers were hurting. One reason was the cost of their products increased, but more importantly, sometimes the magnets simply were not available. That was bad for the motor manufacturers, but it really helped consultants and small design companies that could offer alternatives.

One of these alternatives was the proliferation of internal permanent magnet (IPM) motors which had a high reluctance component, also referred to as PM-assisted reluctance motor. One of the designs I was involved with was a 60 KW traction motor that achieved wide operating range efficiency between 97.5% to over 98%, with only a small amount of rare-earth magnet materials. This efficiency had been validated by multiple dyno tests at different test locations and measured by independent consultants.

Similar results can be achieved if the rare-earth magnets are replaced with AC-8 ferrite magnets. There is at least one U.S. manufacturer left, but the U.S. has plenty of raw materials (mines) that can be ramped up quickly to provide U.S.-based magnets for such traction and industrial motors at a very beneficial cost infrastructure. Yet, little research is spent on advancing such motor designs, which opens up a potential magnet trap in the future. Ferrite magnet-based IPM motors can be one of the solutions to solve the pending magnet crisis, but it will require foresight and proactive R&D investments.



SYR pump => A 80 mm diameter high efficiency 1.5 KW pump motor.

The (variable) switched reluctance (VSR) motor has also been investigated as a potential solution to the magnet crisis, and we have seen many more VSR designs enter the marketplace. Unfortunately, the VSR motor requires very specialized controllers along with some operating noise, which offsets some of the potential cost savings that they offer. Yet, we can build VSR motors in the 1 KW range that operate at >95% efficiency, which compares favorably with similar PM motors. Thus, in the correct application, the VSR motor can be an attractive motor alternative to a PM design.

Lastly, we also have the synchronous reluctance motor (SYR), which I have talked about before. The SYR has low torque ripple, low operating noise, high efficiency and it runs with standard brushless PM motor controller hardware. We are currently designing a highly fault-tolerant 1 KW SYR motor for the Army that will operate at >95% efficiency with low noise and which can be powered by a standard brushless motor controller. In fact, we are designing a similar SYR motor for a commercial client that plans to use it in production along with a standard brushless motor controller which they are currently already using in production.

We are just completing the design of a 50 KW SYR traction motor with a 240 mm outer diameter (OD) that will deliver

similar performance compared to a 50 KW 230 mm OD IPM motor. The SYR will achieve over 97.2% operation efficiency compared to 97.9% for the IPM design.

While the Army's focus is on high-temperature operation, the commercial application is concerned about the continued reliable availability of cost-effective rare-earth magnets.

As a quick note, I will not discuss AC induction motors, as I am not aware of any AC motor design that can achieve similar operating efficiencies and power densities in the motor sizes that I discussed above.

What I do want to stress is that a small and growing number of manufacturers and OEMs perceives the disruptions in the continued availability of rare-earth as a significant threat to their business, and they are taking active steps to investigate other motor options that can be U.S.-made with all U.S.-sourced materials and which have the potential to support the required electric motor efficiency improvements, along with potential cost reductions to protect their competitive strengths. Such motors could also be the key to replacing fossil fuel power systems with electric-driven ones.

The motor manufacturers must explore such alternatives on their own to strengthen their technology base and prevent potential shutdowns if critical rare-earth magnets cannot be easily obtained at reasonable cost.

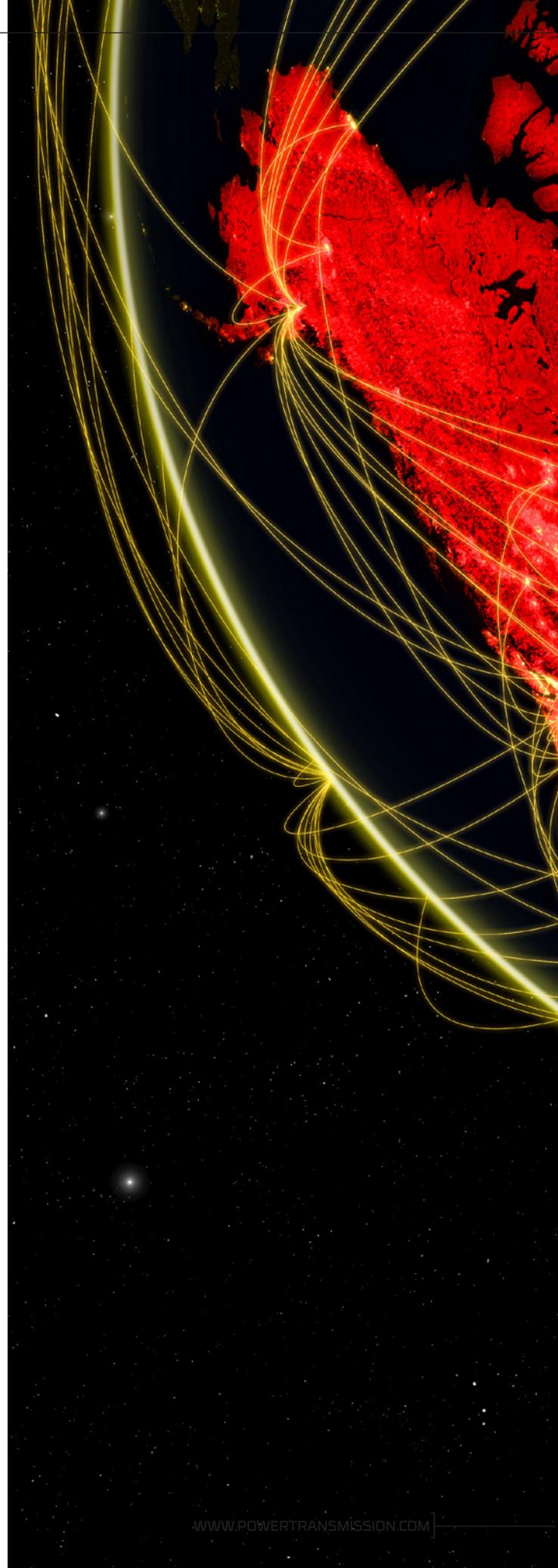
More research and investments will be needed. Washington tries to throw money away — here is a cause that will actually provide a broad range of benefits, as it is environmentally and climate-friendly and beneficial for the independence of the U.S. manufacturing base. **PTE**

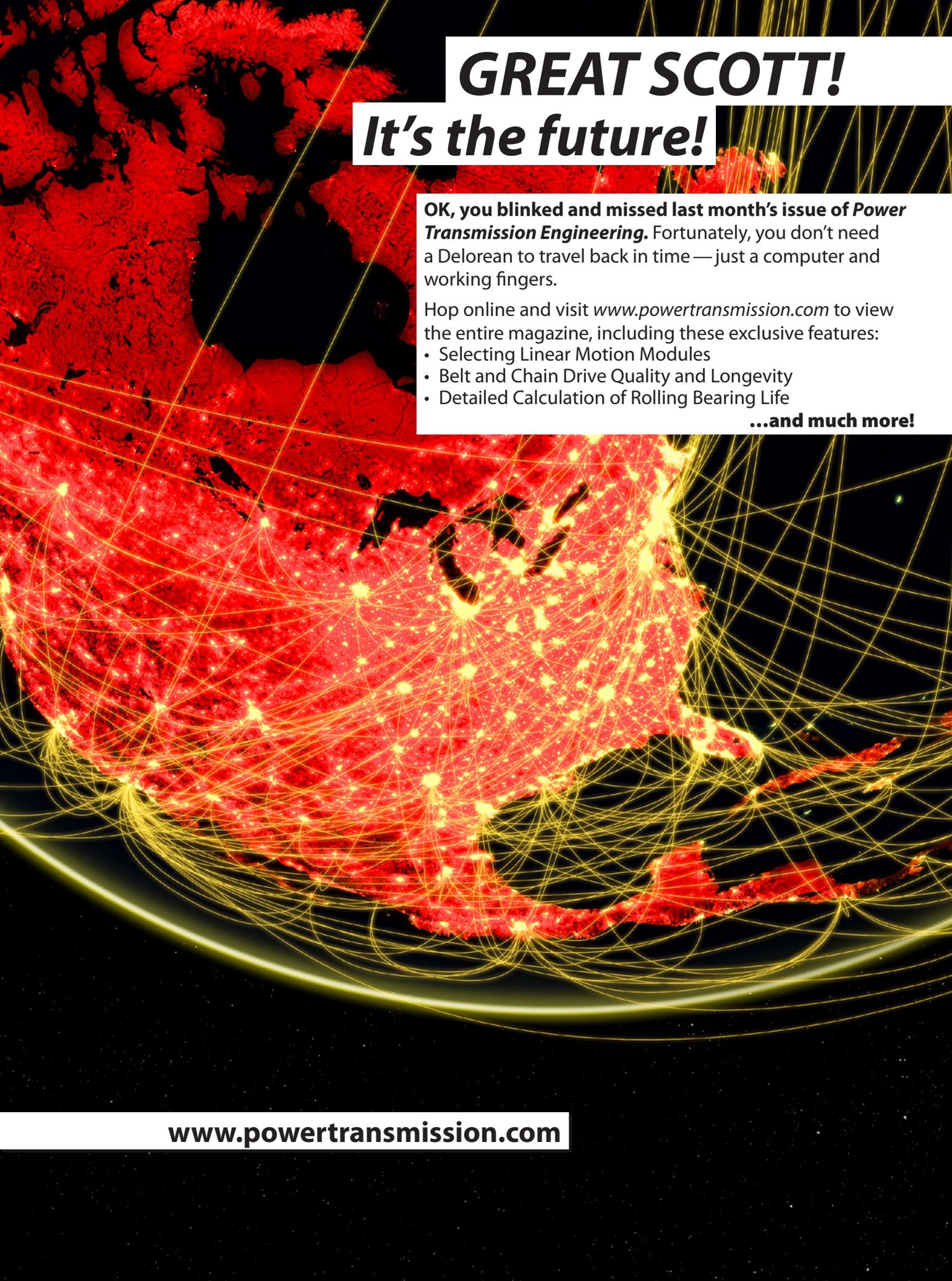
George Holling is Technical Director of Rocky Mountain Technologies
(george.holling@rockymountaintechnologies.com).

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A stylized globe with a red and yellow network overlay. The globe is rendered in a dark red color, and the network consists of numerous yellow lines connecting various points across the globe, creating a complex web of connections. The background is black, and the globe is set against a starry space background.

GREAT SCOTT!

It's the future!

OK, you blinked and missed last month's issue of *Power Transmission Engineering*. Fortunately, you don't need a DeLorean to travel back in time — just a computer and working fingers.

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- Selecting Linear Motion Modules
- Belt and Chain Drive Quality and Longevity
- Detailed Calculation of Rolling Bearing Life

...and much more!

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Schaeffler

ACQUIRES BEGA INTERNATIONAL

Schaeffler has acquired BEGA International B.V. (Bega), a leading manufacturer of special tools for mounting and dismounting rolling bearings. The acquisition marks another step in the expansion of Schaeffler's lifecycle service portfolio. Access to the IIoT platform created for Schaeffler's OP-TIME condition monitoring solution also opens up new possibilities for Bega's intelligent maintenance tools. Customers will also benefit. They will have a common user interface for all touchpoints, which will help ensure a seamless user experience across the rolling bearing lifecycle, from installation to monitoring and maintenance, right through to repair. Customers and partners will be able to source solutions and services for rolling bearing maintenance and monitoring from a single provider and will benefit from more streamlined access to a range of upkeep and repair solutions.



“The thinking behind our strategically important Industry 4.0 business is to be the partner of choice for predictive and prescriptive maintenance solutions. By working with Bega, we can offer our customers top-quality total lifecycle services and solutions for bearings and other powertrain components,” said Rauli Hantikainen, head of Schaeffler's Industry 4.0 strategic business field.

“Thanks to this new partnership, Schaeffler and Bega will rank among the top providers of maintenance solutions,” said Henk van Essen, who is the current CEO of Bega and will stay on in that role going forward. “We also want to be the most innovative provider of maintenance tools.”

www.schaeffler.de

VDMA

REPORTS POWER TRANSMISSION ENGINEERING MARKET UPSWING

At the board meeting of the VDMA Power Transmission Association on July 15, 2021, the sales forecast from the spring was increased from plus 5 percent to plus 10 percent.

The decisive factor here is the strong increase in incoming orders since the beginning of the year, which in the period from January to May 2021 are up 33 percent compared to the same period last year. Important customer groups, such as wind power, agricultural technology, construction machinery and materials handling technology, as well as the important export markets of the United States and China are supporting this development. However, a major challenge for both customers and suppliers are the restrictions in the global supply chains, which lead to delivery difficulties and cost pressure along the value chain.



10 percent increase in turnover expected

Despite these challenges, the industry is confident that it will close the current year with an increase in turnover of at least 10 percent. Due to the customer structure and product diversity of power transmission engineering, growth can vary greatly from company to company. Some companies in the automotive supply environment still have major transformation processes ahead of them.

The positive outlook should not obscure the fact that the power transmission engineering sector has come through the crisis relatively quickly in the post-COVID era, but from today's perspective the high production level from 2018 of just under 18 billion euros cannot be achieved before the end of 2022.

Setting strategic topics in the association's work

Wilhelm Rehm, chairman of the Power Transmission Engineering Association within the VDMA and member of the board of management of ZF Friedrichshafen AG, comments: “Power transmission engineering is technologically well positioned. The challenges of the future for our industry will lie in the areas of digitalization—in the process, in the product and in the supply chain—and in the large area of climate neutrality, sustainability and circular economy. This is also reflected in our association work with the strategic lines Drive4Green and Drive Technology 4.0.”

Hartmut Rauen, managing director of the Power Transmission Association within the VDMA, adds: “Today, Germany is the best innovation area for power transmission engineering and it also wants to remain the best production area. The industry is highly committed and is currently managing around 200 research projects at top universities with its Drive Technology Research Association (FVA e.V.), which

are addressing precisely these issues. However, in times of massive transformation processes, we need a transparent cost-benefit analysis from a new federal government, as well as from the EU, and framework conditions that are as market-based and open to technology as possible. In addition, the competitiveness of the production location must be at the center of policy in order to leverage the potential for climate protection.”

With 92,300 employees (2020, in Germany), power transmission engineering is the largest sector within the mechanical engineering industry. The components and systems of power transmission engineering are the decisive performance modules. They are where power, torque and data flow together in one movement. The industry is well positioned thanks to the VDMA's push to build a global Industry 4.0 ecosystem, as Rauhen explains: “We are working on the digital twin, machine information interoperability, laying the foundations for digital-based processes and will also use them to efficiently realize the solutions towards intelligently networked, climate-neutral production.”

www.vdma.org

Worldwide Electric

ACQUIRES GEORATOR

Worldwide Electric, LLC has announced that it has acquired Georator Corporation and its subsidiary, Athlon. With this acquisition, Worldwide Electric is pleased to add frequency converters and generators to its extensive offering of motors, motor controls, and gear reducers.

Established in 1950, Georator Corporation designs and manufactures a complete line of rotary and solid-state power frequency converters for 50 Hz, 60 Hz, and 400 Hz applications in the industrial, aerospace, and government sectors. Georator products are recognized for reliability and longevity, many remaining in continuous service for decades. Worldwide Electric will continue to proudly manufacture Georator frequency converters in the United States, at Worldwide Electric's ISO certified Louis Allis facility in Warrior, Alabama.

In 2009, the Georator Corporation founded Athlon to offer a reliable line of generators for industrial applications. Over the past decade, Athlon AC synchronous generators have become a trusted staple in industrial, marine, and light tower applications. Worldwide Electric will build on the success of the Athlon product line through an expanded product offering and improved delivery times while incorporating the world-class customer experience that Worldwide Electric customers have grown to appreciate and rely on.

Through this expanded product offering, Worldwide Electric will become a more effective partner for their existing customer base while also having the opportunity to



meet and serve new customers. “Over the last 20 years, we’ve worked hard to attract and maintain a loyal customer base by providing exceptional customer service. We’re excited to have the opportunity to serve our existing customers with new products while also introducing a new set of customers to the convenience of our customer-centric business model. I’m truly excited to add these quality products to the Worldwide Electric portfolio,” said Jim Taylor, president and CEO at Worldwide Electric Corporation.

“We are pleased that a company with the outstanding track record of Worldwide Electric will be carrying on our 70-year history,” said George Ripol, retiring CEO of Georator. “We have great confidence that Worldwide Electric will be able to take Georator and Athlon to the next level.”

The acquisition of Georator and Athlon follows Worldwide Electric's acquisition of Louis Allis in the Spring of 2020, making Worldwide Electric Corporation a single source for off-the-shelf motors, controls, and gear reducers, custom specialty and large horsepower motors, and now frequency converters and generators.

Worldwideelectric.net

SKF

NAMED GM SUPPLIER OF THE YEAR

SKF has been named a GM Supplier of the Year by General Motors for 2020. This is the ninth time that SKF has received this award. The annual awards highlight GM's top 2020 calendar year suppliers from 16 countries who have exceeded GM's requirements and provide GM customers with innovative technologies that are among the highest quality in the automotive industry.

“We’re grateful to be recognized again by GM as a Supplier of the Year and for the



continued partnership with them as a customer. For over 70 years, our world-class bearing and seal technologies have been a critical component for many GM vehicle programs, and more recently, we are proud to also be supplying GM with bearings and seals for the next generation of all electric vehicles. In addition, SKF stepped up to the GM challenge to supply bearings used in building ventilators as part of the global response to the COVID-19 pandemic,” said Greg Zimmerman, President, SKF Automotive North America. “As GM works to achieve a future with zero crashes, zero emissions, and zero congestion, we are proud to have innovative and dedicated suppliers around the world as partners in this mission,” said Shilpan Amin, GM vice president, Global Purchasing and Supply Chain. “Throughout a challenging year, our suppliers have shown resilience and dedication in working toward our shared goal of long-term sustainability for our planet and the communities we serve while meeting our present needs,” Amin said. “We are pleased with what we’ve accomplished together in the past year, and we are excited by the opportunity that lies ahead.” The Supplier of the Year award winners were chosen by a

global team of GM purchasing, engineering, quality, manufacturing, and logistics executives. Winners were selected based on performance criteria in Product Purchasing, Global Purchasing and Manufacturing Services, Customer Care and Aftersales and Logistics.

www.skf.com

Trelleborg

EXPANDS ONLINE STORE WITH SEALS AND BEARINGS FOR MARINE APPLICATIONS

Trelleborg Sealing Solutions expands its online store to include Seals-Shop Marine, which makes seals and bearings for the marine industry available to order direct at the click of a mouse or swipe of the finger.

Christian Pachur, manager distribution and online sales, says: "Trelleborg's Seals-Shop is highly successful. On average, we are seeing more than 150 transactions per month and with the addition of Seals-Shop Marine we expect that to increase. The Seals-Shop offers over 16,000 seals for standard and special applications, and through its clear structure and easy-to-use search interface, we know that visitors appreciate being able to quickly find the right sealing solution for their needs."

Seals-Shop Marine, is a section within the existing Trelleborg Seals-Shop, offering seals and bearings for a full range of marine applications, including ships, boats, and hydroelectric power plants. In addition to dynamic and static seals, the Orkot portfolio of fabric-reinforced composite bushings and semi-finished products, which is widely used in the marine environment, is listed and available for purchase.



In Seals-Shop Marine, an extensive range of application-specific products can be searched, according to a variety of criteria such as material, diameter or width. Prices and availability are immediately displayed, meaning even complex orders can be rapidly expedited.

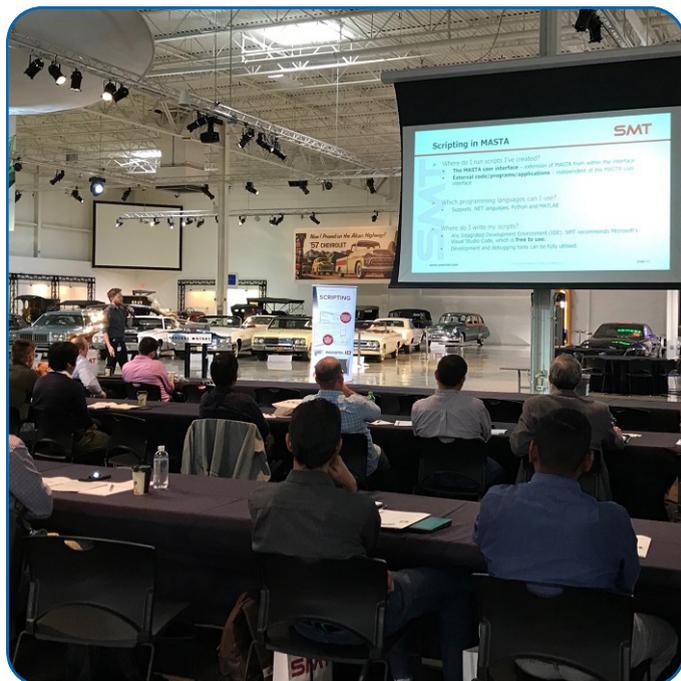
The Seals-Shop Marine is an expansion on the existing Seals-Shop. Through this online store, which serves customers in the EU, Norway, Switzerland and the United Kingdom, Trelleborg Sealing Solutions has been providing direct access to its sealing products for several years. By registering to the shop, users can submit orders for seals, gain access to detailed product data and installation guides and reach out to a knowledgeable customer service team.

www.seals-shop.com/eu/en/marine-shop

SMT

OFFERS KNOWLEDGE SEMINARS: USA

SMT recently announced its Knowledge Exchange seminar events. Regardless of your speciality, SMT looks forward to visiting professionals from across the industry and sharing the latest research & development on a selection of the industry's hottest topics. With no cost to your business & no time-consuming travel to manage, this is a great way to keep your edge at the forefront of transmission technology. A free three-month trial of the MASTA software will be made available to all who participate and even if you are an existing user, this gives you the chance to try other modules or train additional people. Topics include:



- Time Domain Durability
- NVH Operating Maps
- Gear Blank Tuning
- Planetary NVH & Sidebands
- Asymmetric Cylindrical Gears
- Efficiency Modelling & Optimization
- Use Scripting to Automate Design & Analysis Processes
- Cylindrical Gear Manufacturing
- Advanced Loaded Tooth Contact Analysis Method
- Bearing Analysis Method
- Cycloidal Drives Analysis
- Automation, Design Space Exploration & Optimization
- Transmission Performance Optimization

www.smartmt.com/usa-seminars/

NTN

ANNOUNCES RECENT PROMOTIONS

NTN Bearing Corporation of America is pleased to announce the promotions of **Lou Payan** to director of corporate accounts and **Tim Bell** to director of warehouse and logistics, respectively.

Payan, a 24-year veteran of the industry who has spent the last five years with NTN, has extensive experience building successful sales and marketing strategies across all major channels and has developed a strong reputation for his knowledge and leadership. In his new role, he will continue to develop and grow NTN's corporate accounts team and the strategy for capturing corporate account sales opportunities for the industrial aftermarket. He reports to Jim Misch, director of industrial marketing and technical services.

"Using his outstanding knowledge of the industry and his leadership skills, Lou has developed a very strong program that allows he and his team to successfully capture critical corporate accounts and improve our growth," said Misch. "He has been a critical member of the Industrial Aftermarket Business Unit and will continue to be as we move forward."

Bell has spent the last six years of his more than 25-year career with NTN. He has a diverse background in transportation, warehousing and supply chain management with special focuses in operations, systems, organizational and analytical skills, purchasing, IT systems, customer service, material handling, and Six Sigma and Lean methodologies. In his new role, Bell will be responsible for overseeing all of NBCA's warehouses as well as the logistics group. He reports to John Husemann, director of operations.

"Tim was instrumental in transitioning our Des Plaines Distribution Center to our new Distribution Center in Whitestown, Indiana," said Husemann. "He has provided great leadership in helping to get Whitestown up and running effectively and efficiently while supporting his team in overcoming daily obstacles associated with a new warehouse. The accurate and on-time delivery of our parts is critical to our success and Tim and his team do an outstanding job for us."



Ntnamericas.com

Continental

INTRODUCES MAKE POWER SMART APP

Continental has developed its Make Power Smart app to support distributors by digitizing the tachometer, tension frequency meter and laser alignment tool for improved productivity.

"Make Power Smart is designed to save money, while extending the life and improving the operation of belt systems," said Mariano Alvaro, Continental's head of distribution-Iberia and a member of the Make Power Smart team. "This app will revolutionize how fast we can help our customers troubleshoot their manufacturing process and significantly improve their belt life."



The app offers the ability to check belt tension, realign pulleys and set proper pulley distance, all through a mobile phone. This allows Continental customers to adjust on the fly rather than calling in an external team to troubleshoot. Make Power Smart has been in beta testing for months with Continental distributors able to test the product in real world situations. The initial launch went live June 28 for a wider audience.

"We had an opportunity to try this app out, and the time savings and convenience have a real-world benefit," said James Stratmann, president of Sunset Industrial Parts. "When you add time benefit with properly operating systems, longer product life and more efficient processes, significant savings will be a real value add from this software."

"It's been a great experience trying this software out and working with the Continental team to further hone it in," said Mark Balcom, president of Pooley Inc., another Continental distributor, and Make Power Smart beta tester. "Their focus on creating tools which help us, and our customers, save time and money, provides a whole new level of customer service we're able to offer to our customers."

The app will initially be released for free to Continental distributors and Partners of Choice to better serve their customers. The company plans a full purchasable release of the app in early September for those outside of that demographic.

www.continental.com

Xometry

APPOINTS CLARK TO BOARD OF DIRECTORS

Xometry, Inc. has announced the recent appointment of **Ranjana Clark** to its board of directors. Clark, the Head of Global Transaction Banking, Head of Transaction Banking Americas, and Bay Area President of Mitsubishi UFJ Financial Group (MUFG), will provide counsel to Xometry on payments and business strategies, as the company disrupts and transforms the \$260B manufacturing industry.



With more than 30 years of executive experience in the financial services industry, Clark brings a wealth of knowledge to Xometry's board of directors from her previous roles spanning payments, marketing, strategy and business leadership. Currently, Clark is leading Japanese banking giant MUFG's move to a global business model for its Transaction Banking line of business, spanning the Americas, Asia, Europe, the Middle East and Africa, in addition to continuing her role as Bay Area President. Prior to joining MUFG, Clark was the Chief Customer and Marketing Officer at PayPal and served as President of Global Business Payments and Head of Global Strategy at The Western Union Company. She currently serves on the board of directors of StanCorp Financial Group, Inc, and was named as one of American Banker's Most Powerful Women in Banking in 2020.

"We're excited to welcome Ranjana to our board of directors as we focus on disrupting one of the largest industries in the world by providing real-time equitable access to global capacity and demand," said Randy Altschuler, CEO of Xometry. "Her deep expertise in payments, business strategy and marketing will prove valuable as we continue to help thousands of manufacturers grow and more efficiently run their business through the Xometry marketplace."

"Xometry is transforming the manufacturing industry with its AI-enabled on-demand manufacturing marketplace, allowing thousands of small manufacturers to grow their businesses, improve their cash flow and create more jobs," said Clark. "I am thrilled to work with Randy and the team to help accelerate the company's growth and advance its set of financial products and services that help its sellers manage cash flow at all stages of job production."

Clark holds a master's degree in business administration from Duke University's Fuqua School of Business, a master's degree in business administration from the Indian Institute of Management, Ahmedabad, and a bachelor's degree from the University of Delhi.

www.xometry.com

Bosch Rexroth

PRESENTS CONNECTED HYDRAULICS ROADSHOW TRAVELING EXHIBIT

Bosch Rexroth's Connected Hydraulics Roadshow is a traveling exhibit, bringing a complete "trade show booth on wheels" to plants and industrial parks across North America beginning September 2021.

The Connected Hydraulics Roadshow is a self-contained exhibit, housed in a specially created tractor trailer that is designed to present a full array of Bosch Rexroth's smart, networked hydraulics technology directly to engineering and operational personnel at industrial plants and other facilities.

The Connected Hydraulics Roadshow is scheduled to begin touring in September, with its debut at the FABTECH show in Chicago, IL.



Technology demonstrations and exhibits in the showcase will give visitors detailed insights into the ways Rexroth industrial hydraulics solutions can help simplify industrial system design, streamline installation, reduce production equipment footprint, maximize productivity and minimize downtime.

Bosch Rexroth's Connected Hydraulics concept is focused on introducing new and updated technology that is quieter and more compact, flexible and efficient than previous generations of industrial hydraulics. Connected hydraulics systems incorporate advanced digital controls and connectivity features, so hydraulic components will not only be integrated easily into the machine control and factory network, but also seamlessly with each other into an ecosystem of components and digital services.

The Connected Hydraulics Roadshow brings this wealth of information about the advantages Bosch Rexroth's advanced hydraulics offers directly to local industrial sites and other convenient locations. Engineering staff and plant operators will have the opportunity to view technology presentations given by Rexroth technology experts and consult one-on-one with them about current challenges and future needs.

www.boschrexroth-us.com/IHroadshow

EASA

PRESENTS EXCEPTIONAL ACHIEVEMENT SERVICE AWARD

The Electrical Apparatus Service Association (EASA) honored Doug Moore of HECO Kentucky Service Company as the 2021 recipient of the EASA Exceptional Achievement Service Award.

Established in 1997, this annual award recognizes individuals who have provided exceptional service to the electrical apparatus sales and service industry over a lifetime. "It is the highest honor an individual can receive from our association," said Linda Raynes, EASA president and CEO. "We view it as our Nobel Prize for achievement and service."

In announcing the award, Past EASA Chairman Gary Byars noted, "The EASA award recognizes those who have gone above and beyond, providing exceptional service and demonstrating steadfast dedication to the electrical apparatus sales and service industry. This prestigious distinction is bestowed only to the extraordinary in our community."

"This year's recipient has been active in EASA for many years. He served on the international board of directors from 2009 to 2016 and was chairman of the board in 2014-15. He served for nearly twenty years on EASA's Technical Education Committee and chaired it for several years. His commitment to our industry is evident in the nominating letters we received."

In nominating Moore for this award, one letter from a repair firm member read, "Through his foresight, insight and proactive approach, he was instrumental in assisting in the development of many of the top-notch educational materials that benefit our members today."

Another member wrote, "He is one of the giants in the industry and deserves the recognition this award would bestow, for all of EASA has been able to benefit from this great leader and communicator."



Past EASA Chairman Gary Byars (left) presents EASA's 2021 Exceptional Achievement Service Award to Doug Moore of HECO Kentucky Service Company.

Yet another said, "When I think of my friend and EASA leader, three words come to mind: committed, passionate and proficient."

One final letter noted, "Beside his dedication for EASA for more than 30 years, he is a real inspiring person with an open mind."

www.easa.com

RBC Bearings

SET TO PURCHASE ABB DODGE

RBC Bearings Incorporated has announced that it has entered into a definitive agreement to acquire the Dodge mechanical power transmission division of ABB for \$2.9 billion in cash.

With headquarters in Greenville, South Carolina, Dodge is a leading manufacturer of mounted bearings and mechanical products with market-leading brand recognition. Dodge manufactures a complete line of mounted bearings, enclosed gearing and power transmission components across a diverse set of industrial end markets. Dodge primarily operates across the construction and mining aftermarket, food & beverage, warehousing and general machinery verticals, with sales predominately in the Americas. DODGE generated revenue of approximately \$617 million and adjusted EBITDA of approximately \$174 million, representing an adjusted EBITDA margin of 28%, for the 12 months ended June 30, 2021.



RBC Bearings Chairman, President and Chief Executive Officer, Dr. Michael J. Hartnett, said, "We are very pleased to announce the execution of an agreement between ABB and RBC Bearings to acquire Dodge. The combination will enhance RBC Bearings' capabilities, footprint, and customer base while increasing our access to Dodge's attractive end markets. Our businesses are highly complementary, with Dodge bringing new offerings, new end markets, and more scale to the combined organization. The combined company will have an attractive position in the aerospace, defense and industrial markets with a diversified client base and expansive geographic footprint. We look forward to welcoming Dodge's talented team to RBC Bearings."

"We are delighted that Dodge has found an excellent new home with RBC Bearings, where it can continue its exciting growth story," said ABB CEO Björn Rosengren. "This transaction further strengthens ABB's balance sheet. In line with our capital allocation priorities, we plan to first use the proceeds from the transaction to fund organic growth, pay a rising sustainable dividend per share and make value-creating acquisitions."

www.rbcbearings.com

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The Toys That Make Engineering Noise: Part 2

Matthew Jaster, Senior Editor

Who doesn't love LEGO? While no parent enjoys *stepping on them* in the living room, I'd rather have my kids building a castle, a tower or a giant LEGO wind mill then watch their faces glued to their cell phones for hours on end.

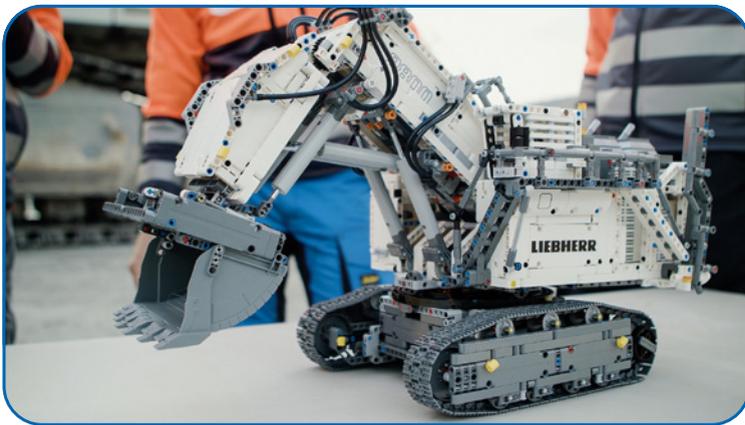
Regular *Gear Technology* contributor, Liebherr is one of many companies immortalized with LEGO building sets. A 19,000 piece 370 EC-B Fiber tower crane was prominently on display at Bauma in Munich back in 2019. The company also had a R-9800 mining excavator created in 2019 with 4,000+ pieces.

www.geartechnology.com/videos/Liebherr-R-9800-by-LEGO/

The R 9800 Excavator came with an array of true-to-life features and functions, introducing LEGO builders to advanced elements of engineering. A multi-function control screen on the app enabled users to drive the excavator in all directions, rotate the superstructure, extend and raise the boom, open and tilt the bucket, play realistic sound effects and get real-time feedback, such as boom position, power usage and drive distance.

When I wrote my first article on toys that influenced engineers in the gear manufacturing and power transmission industries, the conversations always came back to LEGO.

www.geartechnology.com/issues/0519x/addendum.pdf



Each year, my favorite building block company of all-time, continues to innovate in the areas of science, technology, engineering and mathematics (STEM). This summer, LEGO celebrated yet another special milestone.

A LEGO Technic Ferrari 488 GTE "AF Corse #51" had the honor of speeding through the legendary Modena circuit in Italy. This memorable event was possible thanks to a team of about 20 people, who installed the brick version of the racing car on a real Ferrari 488 GTE, driven for the occasion by



Giancarlo Fisichella, Ferrari Competizioni GT Official Driver.

The LEGO model was installed on the front of the racing car thanks to a mechanical arm specifically designed for this occasion. 8 cameras and 2 drones were involved in documenting the very first time a LEGO set was launched at full speed onto a real racetrack, from every point of view.

These images and sounds will be edited to create a video where all LEGO fans and motor enthusiasts will be able to experience the speed, the engine roar and the vibrations of the race as if they were part of the race themselves. Absolutely amazing!

The LEGO Group launched the LEGO Technic Ferrari 488 GTE at the end of 2020. Designed for LEGO fans and those who love motor racing experiences, this 48 cm long racing model is crafted from 1,677 LEGO Technic elements, making it a rewarding immersive building experience for older builders aged 18+ who love endurance racing, motorsport and Ferrari cars.

"The LEGO Technic Ferrari 488 GTE is packed with authentic features and beautiful design elements from the original racing car model. It is so similar to the real one, and all that it needed to really come alive was to be able to speed through a real racing car circuit," said Camillo Mazzola, marketing director at the LEGO Group Italy.

LEGO crane? Check. LEGO mining excavator? Check. LEGO Technic Ferrari 488 GTE? Check.

It's time for other manufacturing companies to get on the horn with LEGO and celebrate gear manufacturing and power transmission brick by beautiful brick.

The question I would like answered before I write Part 3 in this series is simply, "Where's my LEGO Girth Gear for the Mining Industry or my LEGO Perseverance rover with working Forest City Gear components?"

Please keep the LEGO engineering marvels coming! **PTE**



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