PTE

POWER TRANSMISSION ENGINEERING™

FEBRUARY 2026

ACTUATORS

MEDICAL DEVICES

AEROSPACE & DEFENSE

TECHNICAL

Leveraging Software for Advanced Gearbox and Drivetrain Development

Input Shaft Tradeoff Options for Single Speed Gear Reducers

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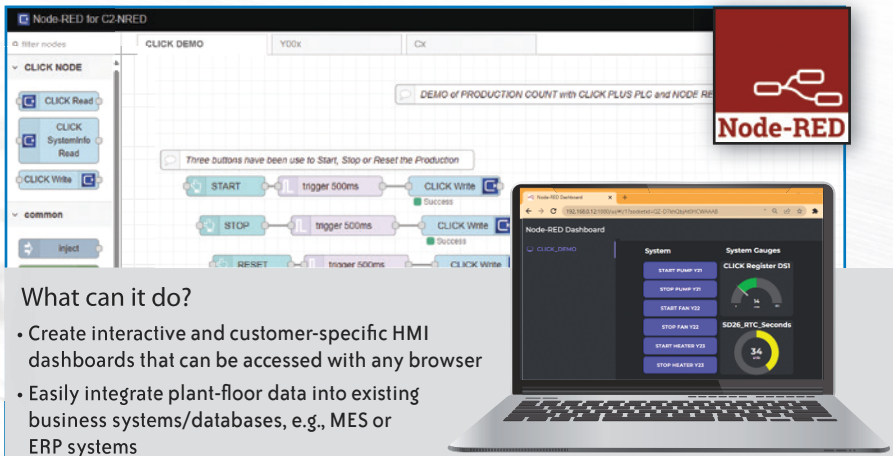

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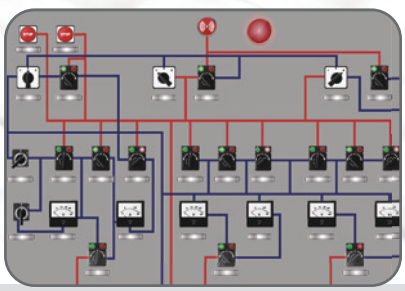

SCADA SYSTEMS

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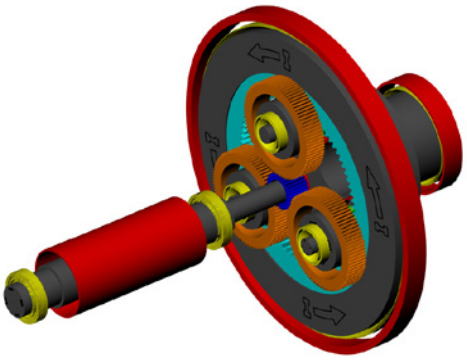

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MOTION + POWER MANUFACTURERS ALLIANCE™

American Gear Manufacturers Association®

ABMA American Bearing Manufacturers Association

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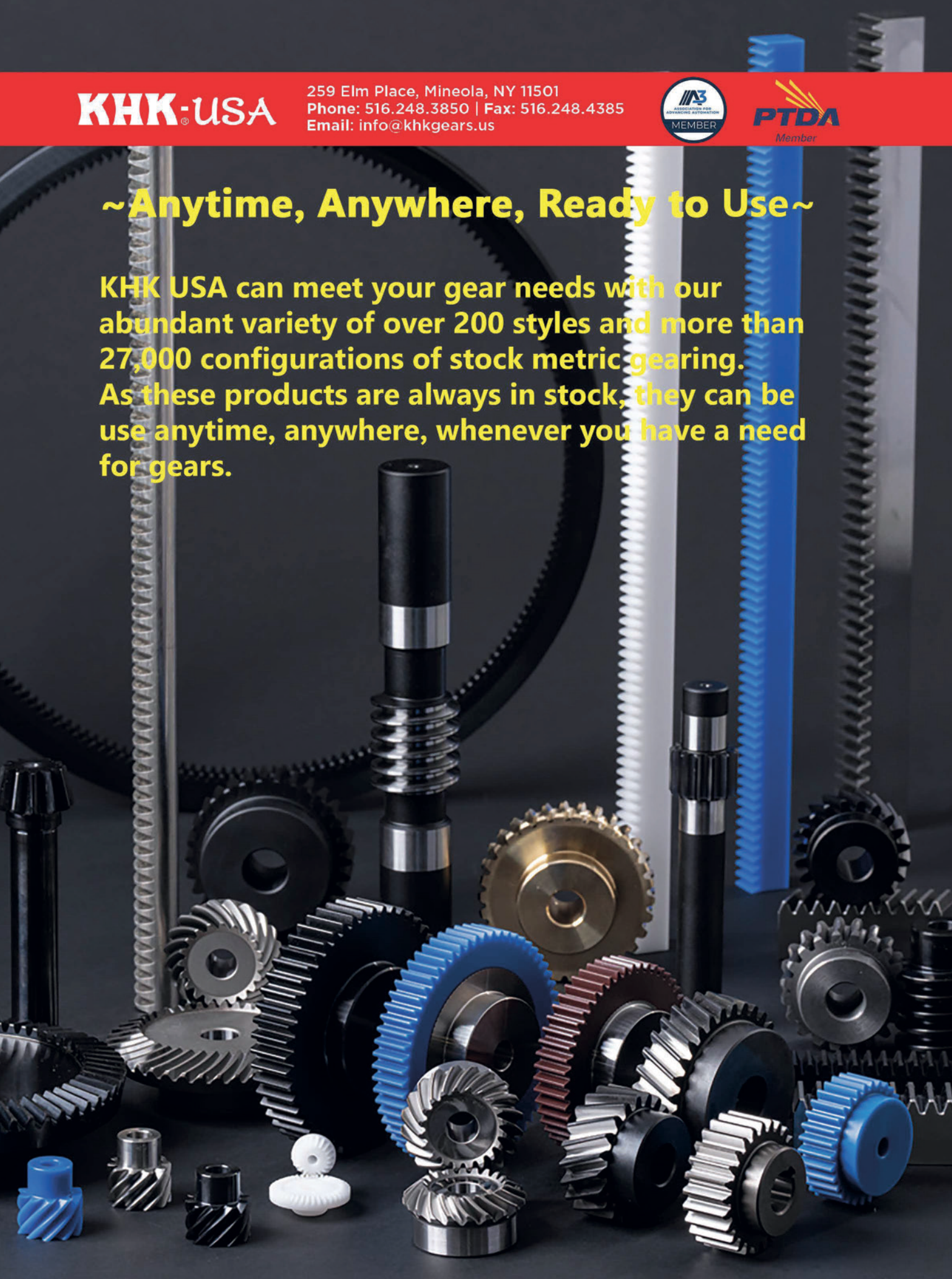
KHK USA can meet your gear needs with our abundant variety of over 200 styles and more than 27,000 configurations of stock metric gearing. As these products are always in stock, they can be use anytime, anywhere, whenever you have a need for gears.



PTE REVOLUTIONS

An All-Electric Playground

From January 9-18, 2026, Renault introduced its cheery, playful personality on the Renault stand at the Brussels Motor Show, alongside Clio, Renault 4 E-Tech electric, Renault 5 E-Tech electric and Renault 5 Turbo 3E, among others. Marking the event, the company introduced six mobility objects to promote future sustainability.

powertransmission.com/an-all-electric-playground

INDUSTRY NEWS SPOTLIGHT

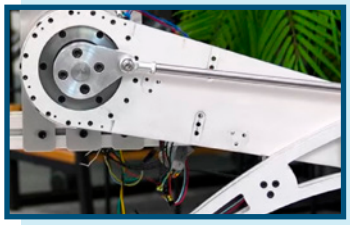
Sumitomo Machinery Corporation of America Strengthens North American Supply Chain with Acquisition of Riverside Spline & Gear

Sumitomo Machinery Corporation of America (SMA) recently announced the acquisition of Riverside Spline & Gear Inc., a Michigan-based gear manufacturer. This acquisition strengthens SMA's North American supply chain, ensuring faster response times and greater reliability for customers across North America.

powertransmission.com/sumitomo-machinery-corporation-of-america-strengthens-north-american-supply-chain-with-acquisition-of-riverside-spline-gear

PTE VIDEOS

Ultra-Compact Micro Actuator for Robotic Hands



With the goal of building a full lineup of actuators for every joint required in robot construction, Bonsystems has been developing robotic actuators and introducing the BCSA V4 Series. The BCSA Micro Series is a Cycloidal Micro Actuator designed specifically for robotic hands.

powertransmission.com/videos/ultra-compact-micro-actuator-for-robotic-hands

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ZERO-MAX®

A Daily Pursuit of Innovation

Matthew Jaster, Director, Editorial Content

I am bummed my schedule prevented a quick trip to CES 2026 in Las Vegas this year. Last year, I was wandering the technology halls studying the latest drones, e-bikes, humanoid robots, and electric motor technologies.

As an eighties kid, I remember the Consumer Electronics Show as the place to be for Atari, Coleco and Intellivision updates. A certain game called *Tetris* for Nintendo debuted on the world stage at CES in 1988. I begged my parents for a "golden ticket" to witness all these amazing video game debuts back then. Alas, my first trip was at age 49, long after I could successfully operate a Mario Kart or properly navigate a controller. (*https://www.ces.tech/articles/ces-the-world-s-gaming-showcase*)

The trade show has gone through quite an evolution over the years. Sure, the televisions, video games and VR headsets are still front and center, but now we see robots, electric vehicles, flying cars and all the standard acronyms not allowed on a *Scrabble* board (AMRs, AGVs, WTs, eVTOLS, SaaS, AI, IIoT, and CAE).

Despite envy for those able to drop-by the Schaeffler, Siemens, NVIDIA, and Caterpillar booths at CES 2026, I'm thrilled for the opportunity to report on similar technologies for *PTE* and *Gear Technology* magazines throughout the year. (*powertransmission.com/subscribe*)

Every day is like CES for the entire MPMA team—from editorial to emerging technology, education to the technical division, sales to digital content. Please say hello if you see us at CONAGG/CONEXPO, CTI Symposium USA, Automate, IMTS, Turbomachinery or Pack Expo later this year.

Our editorial game plan is to report on the lasting impact of collaborative robots, the fluctuating EV market and how condition monitoring is changing the way we operate our bearings, gears and motors. We will discuss automation, AI, IIoT and e-Mobility strategies from a mechanical power transmission/motion control perspective. Additionally, we'll roll out the occasional MRO story highlighting digital solutions to keep shop floors running efficiently.

Our mission is simply to explore how innovation and ingenuity is changing the way our industries design, build and deliver power transmission products moving forward.

Though we physically missed our CES opportunity this year, I promise you extended coverage in the coming weeks and months. Stories like Everrati and the Aria Group launching a new B2B electric vehicle platform designed specifically for manufacturers priced out of electrification, for example. (pictured above)

And with Vegas in mind, I will place a bet you will find one or two MPMA associates navigating the halls at CES in 2027!

Dealer's choice.

PTE

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NORD DRIVESYSTEMS

Powers OMI Crane Systems Heavy-Duty Components

Whether it's moving a coil of sheet steel to a stamping line or setting a massive cast iron forging onto the bed of a CNC boring mill, manufacturers depend on cranes, trolleys and hoists to lift and transport heavy objects. This is the job of OMI Crane Systems, a company that's been designing, building and servicing industrial lifting systems since 1969.

Founded in Dallas, the manufacturer has long since moved to nearby Royse City, where it now boasts a 76,000-square-foot manufacturing facility, more than 100 skilled employees and a support network that includes three full-service branches in Houston, Dallas, and Alabama, along with satellite service teams operating out of Florida and Ohio.

OMI sells many of its cranes to companies in its home state, but as Vice President of Operations Brandon Rue points out, the manufacturer has customers in New York, Washington, Ohio and many places in between. "We ship all over the country," he says.

Unlike companies focused on ports or marine work, OMI specializes in indoor overhead cranes—mainly electric overhead traveling cranes that operate inside steel warehouses, coil handling plants and metal fabrication facilities. Its products aren't mass-produced, however. "Everything we make is engineered to order," Rue explains. "That's because every facility is different, and every customer calls for different lifting capacities, travel speeds, duty cycles and so on. That said, probably 95 percent of the gearmotors on our heavy-duty OEM components come from Nord Drivesystems."

It's a relationship that spans more than 25 years. At first, OMI began using Nord gearboxes and motors on a fairly selective basis, but the partnership deepened around 2011 when the company started building its own hoists. That move called for bigger gearboxes and more horsepower whereready-made drive solutions were even more critical. Nord provides a complete, preassembled unit that fits neatly into OMI's production flow.

"We didn't start using Nord almost exclusively until we started offering a complete hoist that we build inhouse," Rue says. "A lot of suppliers in this industry will make a gearbox and then put a motor on it, and sometimes vice-versa, but not only does that slow everything down, it also makes it harder to get parts. We didn't want to go that route, so we decided to standardize on Nord gearmotorsroughly 15 years ago. Since then, we've found that using pre-engineered drive units directly from the catalog makes it easy to customize to our customers' needs, which is where we differentiate ourselves from the competition."

At its core, OMI specializes in the design and manufacturing of electric overhead traveling cranes. Unlike many suppliers that offer off-the-shelf systems, OMI takes a customized approach, tailoring every crane to the exact specifications of the building and the application it serves. "Yes, there are similarities between jobs and customers, but every crane fits a specific building layout and a specific application, so the ability to optimize each one is hugely important."

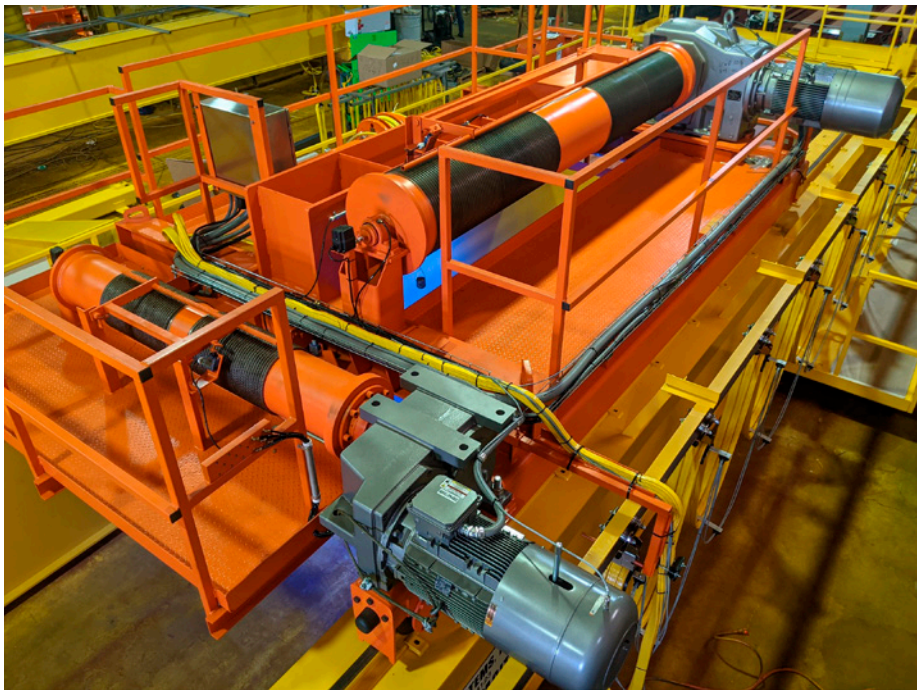
Most of OMI's cranes are designed for indoor environments such as manufacturing plants and coil handling facilities. While the company can also produce outdoor gantry cranes, its primary focus remains on precision indoor lifting, with steel processing and warehousing centers representing its largest market share.

The demands of these industries are unique. Steel coils, for example, can weigh tens of thousands of pounds, and facilities often run 24/7 operations where a stalled crane can halt production. Many customers require cranes that not only lift heavy loads but also perform a high number of cycles each day without overheating or wearing down prematurely. That makes the engineering behind each crane and its components critical to long-term reliability.

One of the standard and most requested options is the company's "built-up hoist and trolley" system. As Rue explains, these assemblies

are often the most customized and technically demanding parts of the crane. “The hoist does all the work, which is why we’ll often use one of the bigger Nord units, such as the SK 10 with a hundred horsepower motor.”

This broad horsepower range—from half-horsepower travel motors to the 100-horsepower hoist drive just mentioned—gives OMI the ability to spec out each crane's lifting capacity exactly to the application. Yet speed is also crucial. In high-throughput environments like coil warehousing, even minor differences can significantly impact production, which is why it’s not uncommon for customers to request lifting speeds tailored to the flow of their assembly lines or staging areas, where even seconds shaved off a cycle can add up to meaningful gains over time.



“We cater the hoist to our customers’ needs,” Rue says. “For instance, a couple of feet a minute on a hoist, when spread out over several days or a week, makes a big difference in the number of picks they can make. So, if they want the hoist to go 21 feet per minute instead of 19 feet per minute, we make it go 21.”

As any manufacturer knows, delivering this level of customization

day after day can be expensive. Piecing together motors and gearboxes from different vendors wasn't an option for a company focused on delivering made-to-order systems at scale. Eliminating assembly steps inside the factory also reduces risk during final crane assembly, since every matched set arrives from Nord already configured for integration.

"To remain competitive, we need to build a crane as quickly and efficiently as we can," Rue says. "Ease of manufacturing played a big role in our decision to partner with Nord."

Using standardized components also helped to streamline OMI's engineering process. The company's design team can size and select drives from Nord's catalog without relying heavily on external technical support, and they routinely use myNORD online customer tools to quote units, download 3D models and generate drawings directly compatible with OMi's internal CAD libraries. "We size it, we pull the drawings and we drop it into our models," Rue explains. "It's simple and it saves a lot of back and forth."

Several recent projects show the scale of their partnership. One job in Bowling Green, KY, required eight cranes and 56 Nord units, with motor ratings from three to 100 hp. Another in nearby Brandenburg involved 16 cranes and 110 Nord gear motors across six bays, while a third—this one supporting an aluminum processor—used five cranes and 50 Nord units.

Each facility came with its unique challenges. In Bowling Green, for example, OMI built the cranes for a completely automated coil handling system where cranes communicate with the facility's ERP software to manage inventory movements without human input. In Brandenburg, the facility required high-speed coil stacking capabilities and extremely high service levels able to withstand the company's continuous operation. And the aluminum processor project, though smaller, demanded precision movement with fine load control to protect delicate material during handling.

In every case, OMI designed each crane to fit the customer's plant layout, throughput needs and uptime goals. "If a customer loses a motor or gearbox, Nord can usually get us a replacement very quickly, sometimes within a day or two," Rue says. The service side has been just as strong. "With some vendors, we might have to call several times before we can get somebody on the line," he adds. "With Nord, we don't have that problem. Even when our primary contact is unavailable, we quickly get routed to someone who can help, avoiding costly downtime."

OMI has never had to use Nord's 911 emergency breakdown hotline despite running a high volume of the company's products over many years. Instead, their engineers work independently, sizing components, pulling drawings and submitting orders directly through myNORD, without having to stop and make phone calls to sales or technical support.

If a crane goes down, production can grind to a halt, Rue concludes. For OMI Cranes and its customers alike, having a reliable drive system supplier isn't just about convenience—it's about keeping material moving efficiently and without fail. "We've enjoyed very steady growth over the years. I attribute most of this to our employees—our engineering team, the sales and quoting people and our team on the production floor. That said, Nord deserves at least some of the credit. They've been great to work with and have an equally solid product line. We're quite pleased with the partnership."

nord.com

ZERO-MAX

Expands Line of ETP Keyless Shaft Locking Devices

The latest model ETP Shaft Locking Devices from Zero-Max work via a self-contained hydraulic system and provide more key benefits than traditional mechanical wedge-style shaft locking devices, ensuring high performance, accuracy, and durability in today's motion systems. They

provide far superior timing, synchronization and adjustability features. Here's how:

Zero-Max's ETP keyless locking devices are designed to provide specific phasing and timing solutions to synchronize machine components. The hydraulic mounting principle of the ETP Keyless shaft bushings expands inward on the shaft and outward to the hub, eliminating any axial movement during installation. In contrast, mechanical shaft locking devices utilize a tapered wedge principle that can cause the mounted component to "walk" along the shaft as the wedge is drawn in during installation. This movement can complicate accurate positioning of the mounted component. Use of the ETP ensures that accurate phasing, timing, and positioning requirements are met throughout the machine, resulting in smooth machine operation and precise processes being performed.

ETP Keyless shaft bushings can be fastened, adjusted and removed with only a few actuating screws (or a single screw in some ETP models), and can be mounted/adjusted/removed hundreds to thousands of times (depending on size/model) making them ideal for applications where mountings and adjustments are frequent. Mechanical Shaft Locking Bushings are more limited in the number of mountings for the life of the bushing. The innovative hydraulic principle of the ETP results in high durability and long lifetime, with no loss of accuracy after repeated mountings.

The ETP's hydraulic design establishes a concentric mounting of the machine component to the shaft, meaning it has ultra-low runout (as low as 0.0002" TIR in some models), and allows for higher accuracy, better balance, and operation at higher speeds. This hydraulic design also provides a thinner wall thickness (ID/OD) of the bushing, meaning hubs do not have to be oversized to fit the application.

The ETP is infinitely adjustable to time and can synchronize machine components to one another allowing for timing adjustments between various processes or stations on a machine. The ETP bushing locks securely into position, making it a verifiable installation position for high product quality, and can also allow for higher machine operating speeds due to the accurate timing of components.

For the accurate mounting of the ETP, one mounting screw equals one torque value, and the hydraulic mounting principle means consistent mounting pressure throughout the bushing. By comparison, most mechanical bushings require torquing at multiple locations. With multiple screw mechanical bushings, torquing at one screw location easily changes the result at an adjacent location with a loss of concentricity and accuracy.

ETP hydraulic-based keyless bushings precisely mount and dismount in seconds and offer hundreds to thousands of mounting cycles. The ETP shaft connection is infinitely phase adjustable for applications such as machine tools that require ultra-precise rotary timing and linear positioning, along with extremely low run-out.

The single screw (or minimal mounting screws) of the ETP allows for fast, easy assembly, rapid repositioning for phase adjustments for timing or product size changes, and saves time when machine changeovers are necessary, all which minimize costly downtime.

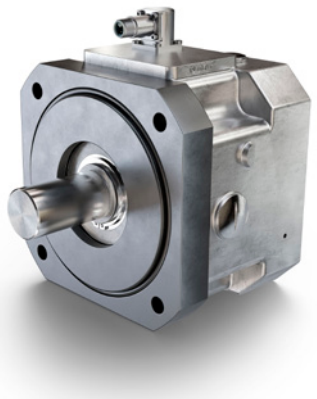
The accuracy of the ETP is micrometer-level repeatable, ensuring high concentricity which is critical in automated machinery and slitter knife holders, as examples.

Another ETP advantage is the elimination of keyways. Keyways

can weaken shafts and experience wear on the keyways and keyseats, which can be a source of lost motion. The ETP shaft connections are a keyless design, providing a more robust, reliable, and precise connection.

zero-max.com

MAYR
Introduces New Generation of ROBA Topstop



Gravity-loaded axes in robotics applications must be safe. At the SPS 2025 in Nuremberg, Germany, Mayr Power Transmission showed the new generation of ROBA topstop safety brakes make this possible in smart environments. The compatible ROBA brake-checker module enables permanent brake monitoring. Combined with the ROBA gateway, the system delivers valuable data for proactive machine maintenance, a digital twin and smart production environments. In addition, a practical checklist supports brake validation.

For production facilities or robots with gravity-loaded axes, the protection of people and material is of the essence. Safety brakes built according to the fail-safe principle—i.e., applied in de-energized condition—provide the foundation here. The ROBA topstop from Mayr Power Transmission holds the loads in position reliably and prevents uncontrolled movements in case of power outages or emergency stops. As they are placed between the motor and the output, the brakes can be retrofitted in existing constructions—a solution that reduces effort and costs.

For day-to-day industrial operations, the ROBA topstop braking system is equipped as an independent, compact module. O-rings at the interfaces ensure reliable sealing against dust and moisture—the brakes achieve IP66 protection as standard. The vertical axes remain secured even when the drive is dismantled, which is advantageous during maintenance and transport. Thanks to the adaptable flange dimensions, the system can be easily integrated into existing constructions.

With the ROBA brake-checker, Mayr offers a module that monitors the safety brakes without the need for additional sensors. It recognizes the brake's condition based on current and voltage trends, enabling proactive maintenance. Critical parameters—such as switching time, coil temperature, and functional reserves—are reliably detected. The additional ROBA gateway module renders the solution network compatible so that the collected data can be integrated into existing remote maintenance systems or digital twins can be created, for example, thus ensuring smart production and more transparency in the drive line.

mayr.com

ABB
Baldor Motor Offers Variable-Speed Solution for Vector-Duty Applications

ABB launched the Baldor-Reliance V*S Master RS to give operators a cost-competitive, variable-speed solution for vector-duty applications. The rolled-steel frame provides dependable durability in a lightweight, economical design.

An advanced insulation system supports reliable performance across a wide speed range. The V*S Master RS delivers an efficient motor platform that is ideal for applications that require constant torque or a wide speed range, including extruders, conveyors, cranes and hoist, winders, web processing, process control, test stands and centrifugal pumps and fans.

The V*S Master RS, available from ½ to 5 hp, uses a rugged rolled-steel frame and Class H insulation to deliver 1000:1 constant-torque and full vector-duty performance. Its compact, lightweight design fits conveyors, fans, pumps and other variable-speed, constant-torque applications, especially where cast-iron frames do not fit.

The motor supports a broad range of speeds, reducing the need for mechanical speed reducers or multiple motor sizes. Its high overload torque handles heavy startup loads, jams and sudden load spikes without stalling or tripping the drive, which improves uptime and process stability.

The V*S Master RS uses Class H insulation, internal shaft grounding and three thermostats—one per phase—to protect against thermal overload. The motor exceeds NEMA MG1 Part 31 requirements for inverter-fed applications and prevents corona discharge that shortens insulation life. These features help extend service life in demanding environments.

abb.com

QUAKER HOUGHTON
Launches New Automation Technologies to Transform Fluid Management in Manufacturing Operations

Quaker Houghton has announced the launch of three new hardware systems within its QH Fluid Intelligence platform, significantly expanding the company's portfolio of automated fluid management solutions. The new QH Fluidcontrol

XMS 100 & 200 systems deliver automated monitoring and control of fluid parameters with accuracy that far exceeds traditional hardware, while the QH Fluidmonitor GQ provides precision monitoring for demanding grinding applications. This hardware is designed to enhance operations across the metals, automotive, aerospace, defense and general manufacturing industries, delivering fluid management while significantly reducing operational costs and environmental impact.

The QH Fluidcontrol XMS 200 system utilizes advanced spectroscopy-based sensor technology. More accurate than traditional sensor technology, it measures direct carbon content of water-dilutable fluids and also offers a new indicator of "fluid health", important for predicting when a fluid is nearing its useful life. QH Fluidcontrol XMS 100 delivers similar continuous, automated monitoring and control capability using traditional sensor technology. Both units are ideal for operations with centralized or non-centralized, multi-sump fluid systems. Use of these systems eliminates the need for manual sampling and laboratory analysis, improves labor efficiency, and reduces EHS risks while also providing real-time data and immediate actionable insights.

QH Fluidmonitor GQ introduces a durable 3-in-1 sensor specifically engineered to withstand the demanding conditions of grinding applications utilizing fast-flowing, abrasive media. When used in conjunction with QH Grindaix Nozzles, the system ensures precise coolant delivery at exactly the right time, right speed, and right quantity, minimizing fluid consumption and waste while reducing maintenance requirements.

"These innovative solutions represent a significant leap forward in more accurate and more flexible options for automating fluid management," said Nozi Hamidi, global strategy director, fluid intelligence at Quaker Houghton. "Our customers are facing increasing pressure to optimize operations, reduce total costs, and meet sustainability goals. The QH Fluidcontrol XMS series and QH Fluidmonitor GQ directly address these challenges by providing real-time intelligence that transforms how manufacturers manage their fluid systems."

All three technologies integrate seamlessly with *QH Fluidtrend* software, providing manufacturers with real-time data and alerts, analytics and actionable insights. This connectivity enables predictive maintenance strategies and supports continuous improvement initiatives across manufacturing operations. The Quaker Houghton QH Fluid Intelligence automated fluid management platform will become essential for maintaining competitive advantage as manufacturers face growing pressure to optimize operations while meeting stringent environmental regulations.

`quakerhoughton.com`

NEUGART
Introduces New Rack-and-Pinion Drive Systems

With a new fully integrated gearbox-pinion-rack combination, Neugart expands its portfolio with a high-performance solution for maximum precision and efficiency in rack applications. The new concept combines optimally matched components that enable powerful, dynamic, and precise power transmission.

The three components mesh seamlessly and ensuring smooth running, maximum feed force, and precise positioning accurately—crucial properties for modern automation and drive systems.

The racks are available with either straight or helical gearing and are made of induction-hardened, quenched and tempered steel. They cover a module range from 1.5 to 5 mm and comply with quality level 6. Subsequent heat treatment and precision grinding of the gearing ensure high surface quality and a long service life. In addition to standard lengths of 1,000 mm and 2,000 mm, customer-specific lengths are also available.

Thanks to its high precision and flexibility, the integrated drive unit can be used in a wide variety of applications. Matching pinions are available for gearboxes of frame size 060 to 200. These include coaxial and right-angle gearboxes in both shaft or flange designs. The Precision Line offers maximum positioning accuracy, while the Economy Line provides robust and economical solutions for standard applications.

A special feature is the gearbox's heavy-duty output shaft bearing. It reliably transmits high radial and axial forces, even under dynamic cycles and heavy loads. This results in smooth, low-noise power transmission, improved process quality, and stable system acoustics.

With the integrated gearbox-pinion-rack combination, Neugart offers a readily available system solution from a single source. It enables simple integration, high power density, and maximum flexibility, setting new standards for precise and efficient rack-and-pinion drives in modern machine and automation applications.

neugart.com

SCHAEFFLER
Presents Planetary Gear Actuator for Humanoid Robots

Schaeffler introduced a planetary gear actuator developed specifically for humanoid robots at CES 2026 in Las Vegas. Actuators transmit torque with high precision and minimal compliance and are essential for enabling humanoid robots to move accurately and efficiently. On average, 25 to 30 actuators are required in total for joints such as the shoulders, knees, and hips. While conventional actuators often offer limited or no backdriveability—that is, the ability to move the drive in reverse—Schaeffler's planetary gear actuator enables smooth backdriving and high precision thanks to its innovative design. In addition, Schaeffler manufactures all components entirely in-house, ensuring the highest levels of quality and reliability. Humanoid robots will play a key role in the industry of tomorrow, as they can be seamlessly integrated into existing work environments, relieve employees of repetitive and ergonomically demanding tasks, and significantly increase productivity as a result.

Andreas Schick, chief operating officer of Schaeffler AG and responsible on the executive board for humanoid activities, says: "Schaeffler aims to secure a key position in the rapidly growing humanoid robotics market. Thanks to our decades of manufacturing expertise, we are able to deliver the highest quality in large volumes and within the shortest possible production times. The innovative planetary gear actuator is a production-ready key product within our portfolio and will make humanoid robots even more capable and powerful."

Schaeffler deploys humanoid robots across its entire value chain and therefore understands market requirements and customer needs firsthand. This enables Schaeffler to successfully transfer scalable solutions from the automotive and industrial sectors to humanoid robotics and to develop tailor-made products that address the challenges of the future. With a comprehensive portfolio spanning eight product families, Schaeffler covers the full spectrum of requirements for humanoid robots. Integrated linear and rotary actuators—one of Schaeffler's core competencies—account for around half of all components in a humanoid robot.

One of the product highlights of this year's CES trade show was the planetary gear actuator, a highly efficient drive system designed and manufactured entirely by Schaeffler. The compact yet powerful system combines a two-stage planetary gearbox, an electric motor, as well as an encoder and controller in a space-optimized unit. Thanks to its high thermal stability, a torque range of 60 to 250 Nm, and particularly low back-driveability, the planetary gear actuator withstands external forces and prevents unintended reverse rotation of the drive component. The result is precise, energy-efficient motion sequences with high torque transparency ideal for continuous-duty operation in humanoid robots.

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Shaping the Skies of Tomorrow

Advancements in drone innovation

Matthew Jaster, Director, Editorial Content

Drones are tasked with providing state-of-the-art autonomous capabilities, unique movements, automated inspection, urban delivery solutions and advanced military operations. They upgrade agricultural farming technology, provide safety and logistic solutions and report key disaster and engineering mapping. PT components such as motors, controllers, and sensors are an integral part of their core structure.

Brushless motors spin the propellers, electronic speed controllers regulate the power based on control signals and the sensors are utilized for flight control, navigation and obstacle avoidance. In short, mechanical power transmission components help pave the way for these devices to transform into intelligent autonomous tools.

Nearthlab's Drone First Responder (DFR) station, for example, is a leap forward in autonomous emergency response, seamlessly integrating with law enforcement systems to launch drones, obtain flight authorization, and respond in real-time to incidents. The company has also received recognition for its high-speed military interceptor drone.

WEFLO's Verti-Pit Mini offers an AI-powered, non-contact drone inspection system that eliminates manual checks, enabling predictive maintenance and fault detection through advanced diagnostics, streamlining operations and enhancing drone reliability across industries.

Sky Flight/Hanseo University's advanced underground drone uses 360-degree LiDAR to navigate GPS-deprived environments, capturing detailed 3D maps and transmitting critical data for infrastructure inspection, mine exploration, and disaster response.

AIRUS/Hanseo University's bladeless drone provides a quieter, safer, and smarter urban delivery solution with AI-powered systems, real-time monitoring, and the ability to carry up to 10 kg of sensitive cargo, offering a glimpse into the future of sustainable city logistics.

Here's a larger breakdown of the technologies:

Upgraded Military Drone Technology

Nearthlab recently won an award in the Robotics and Aerial Integration for Defense (RAID) Challenge in the tactical UAV category. Hosted by the Ministry of National Defense of Korea, the challenge examined the military potential of drone technology and provided a pathway for high-performing drones to be considered for military procurement.

The competition assessed drones in two areas: their ability to track and neutralize a fixed-wing target over a 1 km distance, and the effectiveness of swarm operations, in which a single operator managed at least five drones working together to identify and engage a target.

Nearthlab's Kaiden, a high-speed kinetic interceptor drone, reached a top speed of 150 mph (250 km/h) as it closed in on a target equipped with obstacle avoidance technology. Guided by advanced autopilot algorithms, Kaiden executed precise maneuvers to track the target even as it engaged in sudden evasive attempts. The demonstration highlighted the drone's ability to carry out all necessary actions to neutralize the target with speed and precision. Meanwhile, Nearthlab's autonomous drone, Aiden, excelled in swarm operations, seamlessly coordinating with other drones to locate targets.

"Drones are rapidly becoming a cornerstone of modern warfare," said Jay Choi, co-founder and CEO of Nearthlab. "This competition was a great opportunity to showcase what our drones can do, and we're excited about the role technologies like Aiden and Kaiden could play in shaping the future of defense."

"It's deeply meaningful to see Korean-built autonomous flight technology recognized at a national level," said Youngsuk Chung, chief technology officer at Nearthlab. "We'll keep driving the convergence of AI and robotics to deliver technologies that make industries more resilient."

Drone Maintenance and Health

In 2025, WEFLO introduced the AI-based smart drone quality management equipment Verti-Pit QC at CES in Las Vegas. The Verti-Pit QC can automatically check mechanical defects within seconds without flying drones directly during the end-of-line (EoL) process in the production stage, dramatically increasing production efficiency compared to conventional flying test methods. It is evaluated as an essential solution for drone manufacturers trying to establish a mass production system.

Since spinning off from Hanwha Systems in 2022, WEFLO has been developing solutions capable of diagnosing the health of electric mobility—starting with drones and expanding to air taxis (UAM) and electric vehicles—using AI non-contact methods. WEFLO's AI diagnostic solution is being continuously advanced through deployment to mobility manufacturers and operators. The scope of diagnosis is expanding beyond the conventional areas of propulsion and structural components to include batteries, geomagnetic accelerometers and gyro sensors. WEFLO has recently achieved recognition for its technological prowess by being selected for a KITIA (Korea Information and Communications Technology Association) project.

Additionally, the Verti-Pit Mini won the Innovation Award in the drone category at CES 2025. The Verti-Pit Mini is a portable inspection solution that quickly and accurately diagnoses the condition of small drones in a non-contact manner through a multi-modal sensor developed by itself. Recently, demand has been confirmed in the defense field, where drones must be used in the field based on missions, and it is expected to be used in various fields.

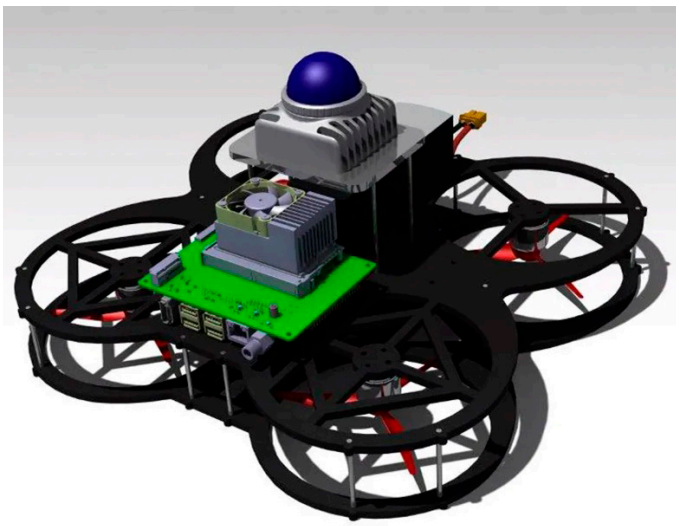
WEFLO CEO, Yee Jung Kim, stated, "We will continue to maximize customer operating efficiency through tightly integrated AI and hardware solutions, set the predictive maintenance standards for the future mobility industry, including drones, and actively target the global market."

The Underground Advantage

Sky Flight/Hanseo University's underground drone can perform autonomous flight by utilizing LiDAR in environments where GPS signals are unavailable, creating real-time 3D maps of the surroundings and estimating their position. In irregular underground environments, the drone uses 360-degree LiDAR to comprehensively capture the entire surroundings, detecting obstacles and preventing collisions.

The underground drone is equipped with AI-based imaging capabilities, enabling it to transmit essential exploration data for mining or detect structural defects in underground infrastructure to the ground station in real-time. This technology mitigates risks during dangerous tasks and supports real-time terrain analysis and rescue operations in GPS-unavailable disaster scenarios.

In a technical article, "Signal-Based Self-Organization of a Chain of UAVs for Subterranean Exploration," written by Laclau P., Tempez V., Ruffier F., Natalizio E. and Mouret J-B in 2021, the authors explored how thousands of subterranean networks permeate the underground: caves, utility tunnels, abandoned mines, underground quarries, sewers, etc. These voids often need to be mapped and inspected, typically to ensure the safety of new buildings or tunnels, but also in case of obstruction or intrusions. Drones are a promising alternative as they can move through these subterranean networks faster and more efficiently than humans or ground robots.



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New Propulsion Technology

The Bladeless Drone by Airus and Hanseo University is an innovative unmanned aerial vehicle that enhances safety and quietness through its bladeless propulsion technology. Its design eliminates propellers, reducing noise by over 40 percent, making it ideal for urban environments. Capable of carrying up to 10 kg of cargo, it utilizes an AI-based smart flight system and smart air cargo system to safely and accurately deliver sensitive items like food and medicine in complex urban settings. Equipped with real-time monitoring, it tracks delivery routes and status. The Bladeless Drone presents a key solution for future logistics innovation and provides more advanced robotic functionality and AI integration.

Rewriting the Technology Rules

Per Cornell University Press, *The Remote Revolution: Drones and Modern Statecraft* by Erik Lin-Greenberg shows that drones are rewriting the rules of international security. Emerging technologies like drones are often believed to increase the likelihood of crises and war. By lowering the potential risks and human costs of military operations, they encourage decision-makers to deploy military force. Yet as Lin-Greenberg contends, operations involving drones are in fact less likely to evolve into broader, more intense conflicts than similar operations involving traditionally crewed assets. Even as drones increase the frequency of conflict, the decreased costs of their operations reduce the likelihood of conflict escalation.

Leveraging diverse types of evidence from original wargames, survey experiments, and cases of US and Israeli drone operations, Lin-Greenberg explores how drone operations lower risks of escalation. First, they enable states to gather more or better intelligence that may avert or reduce the chances of high-stakes conflict. Second, drone attacks are less likely to affront a target state's honor and therefore less likely to provoke aggressive responses. Lastly, leaders are less likely to take escalatory actions when drones are attacked than they are with incidents involving inhabited assets.

It's a fascinating read if you have an opportunity to check it out. With the use of unmanned technologies growing rapidly, *The Remote Revolution* looks at modern and future warfare from a different point of view and hints at ways to rethink military strategy in the future.

On the Horizon

Drone technology was again front and center this January at CES in Las Vegas. Military operations and the recent FCC ban of the sale of drones from Chinese firm DJI added some political intrigue to the technology show.

This ban could affect drone maintenance and repair operations and make it difficult to obtain critical drone components. If you're working on drone technology here in the United States, we'd love to hear your story and discuss the prospects of the commercial drone and air mobility ecosystem.

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The Future of Medical Manufacturing

New technology trends in medical devices

Matthew Jaster, Director, Editorial Content

Humanoids and cobots are rapidly serving the needs of the warehouse, logistics, material handling and packaging sectors allowing skilled workers to turn their attention to more pressing matters on the shop floor. According to MasterControl (matercontrol.com) digital transformation is revolutionizing life sciences manufacturing, driving key trends in the pharmaceutical and medical device industries.

As consumer demand for personalized therapies and greater control over health choices grows, manufacturers are embracing paperless manufacturing and advanced manufacturing execution systems to enhance agility and compliance. These digital solutions, often cloud-based and AI-supported, enable companies to streamline operations, accelerate innovation, and bring life-changing products to market faster.

Kuka Robotics Introduces Two Advanced Medical Innovations

Kuka Robotics recently announced two advanced medical innovations designed to reduce work-related injury for healthcare workers and cut time-to-market for medical device OEMs.

Sonographers and ultrasound technicians commonly experience musculoskeletal disorders such as tendonitis and rotator cuff injury due to the repetitive nature of their work that requires them to apply pressure with abnormal arm and shoulder positioning. Using robot technology such as Kuka's LBR iisy cobot, however, can take the strain off technicians by precisely conducting these repetitive exams autonomously. Equipped with a Haply Inverse3 Hapatic Feedback Teleop Device and an OptoForce FT Sensor, the LBR iisy robotic arm can be controlled and manipulated to apply the proper amount of force to the imaging head for a proper reading.

The FT sensor accurately measures the forces applied by the six-axis LBR iisy cobot to the ultrasound probe

and relays a scaled down force reading to the haptic feedback device. As a result, the ultrasound tech receives a sense of touch input while avoiding unnatural pressure and strain on their arm, hands and shoulders.

Kuka's Robot Development Kit, a collaborative effort between Kuka, Northern Digital, Inc. (NDI) and custom medical device cart manufacturer MPE. The development kit allows OEMs to streamline development of unique medical device solutions, one being a robot-assisted brain tumor biopsy demo cell using a Kuka LBR MED cobot. Equipped with NDI optical cameras and trackers, the Kuka LBR MED assists in the deployment of the biopsy needle while making any necessary adjustments via dynamic tracking for safe, precise operation.

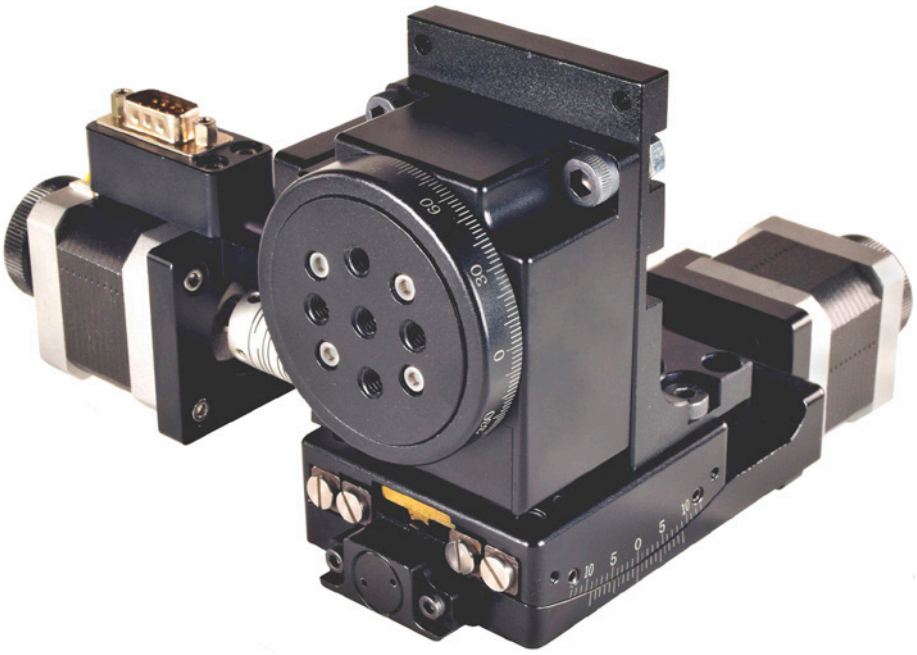
Based on the sensitive Kuka LBR iiwa robot, the LBR MED is HRC-compliant with redundant integrated torque sensors, giving it robust haptic capabilities, the ability to perceive external influences and safe collision detection. The seven-axis lightweight robot is flexible and easily integrated into a variety of medical solutions and activities.

kuka.com

Medical Motors and Encoders

Optimal Engineering Systems (OES) has introduced the AK110-10-60V Series of Dual-axis Goniometer and Rotary Stages. This series of motorized, dual-axis goniometers and vertically mounted rotary stages can measure angles, identify crystals, position an object for inspection, and point a camera or laser. The lower goniometer stage features ±10 degrees of rotation, and the upper vertical rotary stage features a 60 mm table with 360 degrees of continuous rotation in clockwise and counterclockwise directions.

The resolution for the goniometer (lower) stage of the AK110-10-60V dual-axis stage is 0.0007 degrees, repeatability is ± 0.01 degrees, and accuracy is 0.05 degrees, and the resolution for the rotary stage is 0.002 degrees, repeatability is ± 0.01 degrees, and accuracy is 0.05 degrees with a 10 steps-per-step microstepping motor driver. They are ideal for: Examining cutting edges of medical instruments, measure of radiation patterns of LEDs, estimating hyperspectral bidirectional reflectance and gloss measurements, directing lasers, aligning mirrors, and manufacturing quartz oscillator plates using quartz cutting X-rays.



oesincorp.com

Electromate adds the Netzer Precision VLP-13 to its catalog—a miniature, absolute rotary encoder engineered for space-constrained motion systems where size, precision, and reliability are essential.

As demand grows for smaller, lighter, and more precise motion control systems across robotics, aerospace, medical, and automation sectors, the VLP-13 fills a critical gap. Its ultra-compact design and high-resolution absolute feedback enable engineers to embed reliable position sensing where previously only larger encoders could fit. The contactless capacitive technology ensures durability and long-term stability, ideal for mission-critical or long-service-life applications. The features and benefits include:

- **Ultra-compact footprint:** Outer diameter 13.5 mm, height 10.9 mm, total weight only 2g (including 250 mm cable).
- **High-resolution absolute feedback:** Up to 19-bit resolution (single-turn), providing fine positional granularity.
- **Contactless capacitive sensing:** Eliminates wear-prone mechanical components, immune to magnetic interference, shock, and vibration—offering long-term reliability.
- **Standard digital interfaces:** Supports SSI and BiSS-C outputs over differential RS-422 communication.
- **Robust environmental performance:** Rated for industrial conditions (shock, vibration, EMC), suitable for demanding applications in robotics, aerospace, and automation.

The compact size and robust design of the VLP-13 make it suitable for miniature motors and small-form-factor servo systems, articulated robotic joints where space and weight are constrained, precision motion control in automation equipment and small industrial machinery, aerospace or harsh-environment systems requiring high reliability and immunity to EMI, aerospace actuators, UAV servos and space-constrained mechanisms, medical equipment and surgical robots and high-precision automation in tight-factor devices.

electromate.com

The Evolution of Laboratory Automation

Laboratory automation integrates automated technologies to streamline and enhance lab processes, significantly improving efficiency, reproducibility, and throughput; this automation is also transforming how research is conducted and how quickly patients receive care. Portescap offers several components in medical devices used in lab automation:

- **Point-of-Care Devices:** Located in clinics or urgent care centers, these devices perform rapid tests near the patient, enabling quicker diagnosis and treatment. This rapid turnaround enables healthcare providers to make immediate decisions about treatment, improving patient outcomes.
- **Stand-Alone Automation:** These systems automate a single process or a group of processes within one machine, such as sample preparation or fluid transfer. They're typically used in mid-sized labs where full automation may not be feasible, but efficiency is needed.
- **Total Lab Automation (TLA):** TLA systems use software and robotics to automate the entire sample evaluation workflow, from intake to results. These systems are commonly found in large testing labs and research institutions where high throughput, traceability, and data integrity are critical. They reduce manual handling, improve consistency, and allow labs to operate 24/7 with minimal human intervention.

Implementing automation in laboratories offers a wide range of benefits:

- **Increased productivity:** Automation handles repetitive and time-consuming tasks, freeing lab personnel to focus on higher-value activities like data interpretation, troubleshooting, and innovation.
- **Improved data quality:** Human error is a major source of variability in lab results. Automated systems ensure consistent sample handling, analysis, and timing—leading

to more reliable and reproducible data.

- **Reduced costs:** Automation reduces reagent waste, minimizes the need for repeat tests, and optimizes labor costs. It also extends the operational hours of the lab without requiring additional staff.
- **Enhanced safety:** Automation reduces the need for human interaction with hazardous chemicals, infectious samples, or repetitive manual tasks that can lead to injury. This creates a safer working environment and helps labs comply with occupational health and safety regulations.
- **Faster turnaround times:** Automated systems can process samples continuously and in parallel, significantly reducing the time from sample receipt to result delivery. This speed is critical in clinical settings where timely diagnosis can directly impact patient care and outcomes.

Motion control is the backbone of lab automation, enabling precise, reliable, and efficient operation of automated systems, understanding the different motion technologies is key to optimizing performance.

With the increasing demand for higher throughput, BLDC motors stand out due to their high-speed capabilities and precise speed control. These motors facilitate rapid sample movement throughout the process. The slotless design offers low inertia, enabling quick acceleration and stopping, which is crucial for efficient sample transfer. Portescap's 16ECP motors, available in various lengths and coil options, provide an ideal solution for such applications.

Minimizing the overall footprint of workstations is vital in lab environments. Coreless DC motors are practical due to their high-power density, allowing for compact and efficient designs. Various diameter options enable the customization of each workstation axis to perform tasks within the smallest possible space. Portescap's 16DCT and 22DCT series offer multiple coil options and mechanical customizations, making them versatile choices for different lab automation needs.

Precise positioning is critical as samples move through automated processes. Stepper motors excel in this area, providing the necessary accuracy and control. Their mechanical construction and ease of control make them suitable for both horizontal and vertical movements. Portescap's 26M can stack and 20DAM linear stepper motors offer robust rotary and linear solutions to meet high accuracy demands.

portescap.com

Digital Health

OTO Fertility, a digital health platform developed by OTO Coach, is redefining reproductive care with patented biometric and AI-powered technology designed to bring clarity, precision, and confidence to fertility treatment. At the Consumer Electronic Show (CES) 2026 in Las Vegas, OTO has debuted Cira, its newest wrist-worn fertility biosensor, marking a major advancement in how patients and clinics understand and support reproductive readiness.

Built to support every path to parenthood, from natural conception to IVF and IUI, the OTO Fertility solution combines real-time physiological data with precise guidance that help patients and fertility care teams make better-informed decisions at the moments that matter most.

OTO's technology is rooted in more than 40 years of bioscience and space medicine, originally developed by NASA for astronauts and later refined for elite human performance. With the launch of Cira, this level of physiological precision is now delivered through a comfortable, wristband paired with OTO's FDA-approved app. Together, they monitor more than fifty biometric markers in just minutes, including heart rate variability, nervous system regulation, and stress response, translating complex biology into a clear, actionable OTO Fertility Index.

This index identifies when the body is in an optimized "Fertility Zone," offering insight that goes beyond traditional fertility measures such as age, BMI, or AMH. For the first time, women can clearly see when their body is truly ready to conceive, restoring autonomy, confidence, and control in a process that has historically been defined by uncertainty.

"Until now, fertility care has existed without visibility into the most fundamental factor: how the body is responding to and recovering from stress in real time," said Caleb Evans, founder and CEO of OTO. "With Cira and the OTO Fertility platform app, patients gain clarity and agency, while clinicians gain a critical new layer of physiological context to guide care. We don't replace existing fertility protocols, we make them smarter, safer, and proactive."

Globally, one in six women experiences infertility, and despite decades of innovation, fertility treatment success rates have plateaued. In fertility care, time is the one resource that cannot be replaced. Every cycle, every intervention, and every decision carries emotional, physical, and financial weight. OTO Fertility is the first platform built to help reduce avoidable loss, poorly timed interventions, and the risk of proceeding without understanding whether the body is truly prepared, bringing a new standard of care to reproductive medicine.

otofertility.com

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Electrification Upgrade

ABB servomotor actuation system assists Australian melt shop

ABB

When Australian steelmaker InfraBuild needed two new circuit breakers to provide backup for its main electric arc furnace, ABB had the solution—its VD4-AF vacuum circuit breaker with an innovative servomotor actuation system that delivers more than five times the operations of a standard breaker, supporting greater reliability and safety as well as lower operational costs.

But because this high-performance equipment was based on electronic technology rather than the spring-actuated mechanism of InfraBuild's aged circuit breaker, the company was cautious.

"Even though it sounded great, we felt things could go wrong because there are a lot of electronics involved, compared to the old mechanical-linkage style of construction, and we needed to hear from others who had already applied the technology," said Jorge Aguilar, electrical project engineer at InfraBuild in Laverton, Victoria.

InfraBuild recycles, manufactures and distributes steel long products. They are a fully vertically integrated steel manufacturer spanning scrap metal recycling, steel manufacturing and downstream distribution. Steel products include reinforcing bar, reinforcing mesh, tubular and hollow sections, merchant bar and wire products. Internationally, the company owns and operates recycling centers in Poland, the United States and Hong Kong. In addition, they have global scrap metal traders working in India, South Africa, Netherlands, Spain and the UK. They also have a manufacturing facility in Dalian, China.

With a global installed base of more than two million units of the well-known ABB VD4 vacuum circuit breaker product family, ABB had no difficulty finding two similar customers who were able to reassure the Australian steelmaker of the VD4-AF circuit breaker's performance. "We were pleased with their responses and experience with ABB's technology and felt reassured that they were very satisfied with the technology," said Aguilar.

InfraBuild proceeded with orders for two VD4-AF vacuum circuit breakers specifically designed for protecting steel furnaces. The circuit breaker is integrated with the air-insulated single panel UniGear ZS3.2 switchgear, which fits within the footprint of the original equipment.

"Power reliability for this panel was critical," says Henry Lin, project manager for electrification service at ABB Australia.

VD4-AF is based on servomotor actuators that increase circuit breaker performance up to 10 times compared to standard solutions and reduce operational costs up to 50 percent by ensuring zero downtime for breaker overhaul.

Advanced circuit breaker technology engineered for power reliability and uptime

ABB developed the VD4-AF circuit breaker specifically to provide a high-quality, reliable solution for electric arc furnaces. It can provide up to 150,000 mechanical operations, including switching the furnace on and off, without refurbishment, and offers rapid replacement with a roll-in and roll-out solution when overhaul is required.

InfraBuild recycles scrap metal to produce steel "long products" such as reinforcing bar, merchant bar and rod for mesh. Aguilar describes the electricity-powered arc furnace as being "like a giant welder that creates a lot of heat and melts the steel". With this sustainable

process—the circular economy in steel, and the potential to be powered entirely by renewable energy, compared to coal-fired and catalyzed steel production—it supplies a variety of industries, from civil and commercial construction to residential and rural sectors.

At InfraBuild's Laverton "melt shop", scrap metals are loaded into the furnace for melting, and molten steel is poured into a ladle which moves it on for further processing. "The full cycle takes 40 minutes," explained Aguilar. "On either side of melting, power to the furnace has to be stopped." The melt shop operates 24/6, allowing one day for what he calls "housekeeping." Continuous, dependable operation of the circuit breaker, a sophisticated, designed-for-safety, remotely operated device is essential.

Aguilar and his project team are responsible for capital projects at InfraBuild's Laverton plant. In recent years these have included upgrades of the medium-voltage transformers supplying the melt shop and powering of a new electric arc furnace.

The circuit breaker was the final component of electrical infrastructure to be upgraded. Having carried out a significant number of operations, its risk of unreliability was growing and its age meant it became increasingly difficult to repair as spare parts were no longer available. "We got to the point where even our spare just couldn't be replaced if it showed signs of approaching failure," said Aguilar.

Circuit breaker technology

ABB's medium voltage vacuum circuit breakers for primary distribution—as well as secondary distribution—protect the evolving grid by safely interrupting the power flow when a grid anomality happens and then re-establishing it once it is fixed. Grid anomalies can be caused by over currents—the overload through lightning or malfunctioning electric equipment or a short circuit in the system. ABB's medium voltage vacuum circuit breakers are key components, in a medium-voltage switchgear, to ensure continuous and safe power flow to industrial, commercial, and residential users.

ABB's circuit breakers have been a market benchmark for over 35 years. ABB's vacuum interrupters, within the circuit breakers, are embedded in poles for protection against humidity, shocks and dust. ABB's circuit breakers are available for original equipment manufacturers (OEM), panel builders and engineering, procurement and construction (EPCs) partners to incorporate in their own installations or for use in repair, retrofit and upgrade projects.

ABB supports customers and partners in staying ahead of increasing electrification needs, technology, and regulatory changes, providing the power to adapt to a rapidly evolving energy landscape.

The main purpose of a protection and control relay is to recognize any abnormal power system conditions or

The switch to the ABB VD4-AF circuit breaker has the potential to increase power to the furnace and increase efficiency.

InfraBuild recycles, manufactures and distributes steel long products including reinforcing bar, reinforcing mesh, tubular and hollow sections, merchant bar and wire products.

abnormally operating system components. Grid anomalies can be caused by over currents—the overload through lightning or malfunctioning electric equipment or a short circuit in the system. Based on the information gathered, the protection and control relay will initiate corrective actions that return the power distribution system to its normal operating state providing a safe environment for personnel and equipment.

Selecting the right protection and control functions and methods, that meet local legislation, safety requirements and engineering practice, improves the performance and the reliability of the power protection system, thus minimizing the effects of network faults and preventing the disturbance from spreading to healthy parts of the network.

An underlying, future-proofing bonus

The need for increased reliability drove this upgrade project. "Just knowing that we've got something that will run for another 10 or 20 years and with greatly reduced maintenance requirements," said Aguilar, "are the greatest outcomes of the system which has now been operating since early 2022." But there are additional benefits to the VD4 technology and its 2,500 amp rating compared to the previous circuit breakers' 2,000 amps.

"The potential is for the circuit breaker to increase power to the furnace, reducing melt shop cycles from 40 minutes to a *hypothetical 35 minutes*," said Aguilar. "So, you could maybe save five minutes on each cycle, which gives you greater productivity."

Lin said, "Whenever any upgrades have been carried out at InfraBuild, there has been an element of 'future proofing' involved. In this case it allows for a higher power input to the electric arc furnace if needed in future."

"This project demonstrates how ABB Electrification Service combines deep expertise in complex upgrades, extensions and retrofits with cutting-edge technology like the VD4-AF circuit breaker, delivering major gains in efficiency and reliability, and ensuring InfraBuild's melt shop is ready for the future."

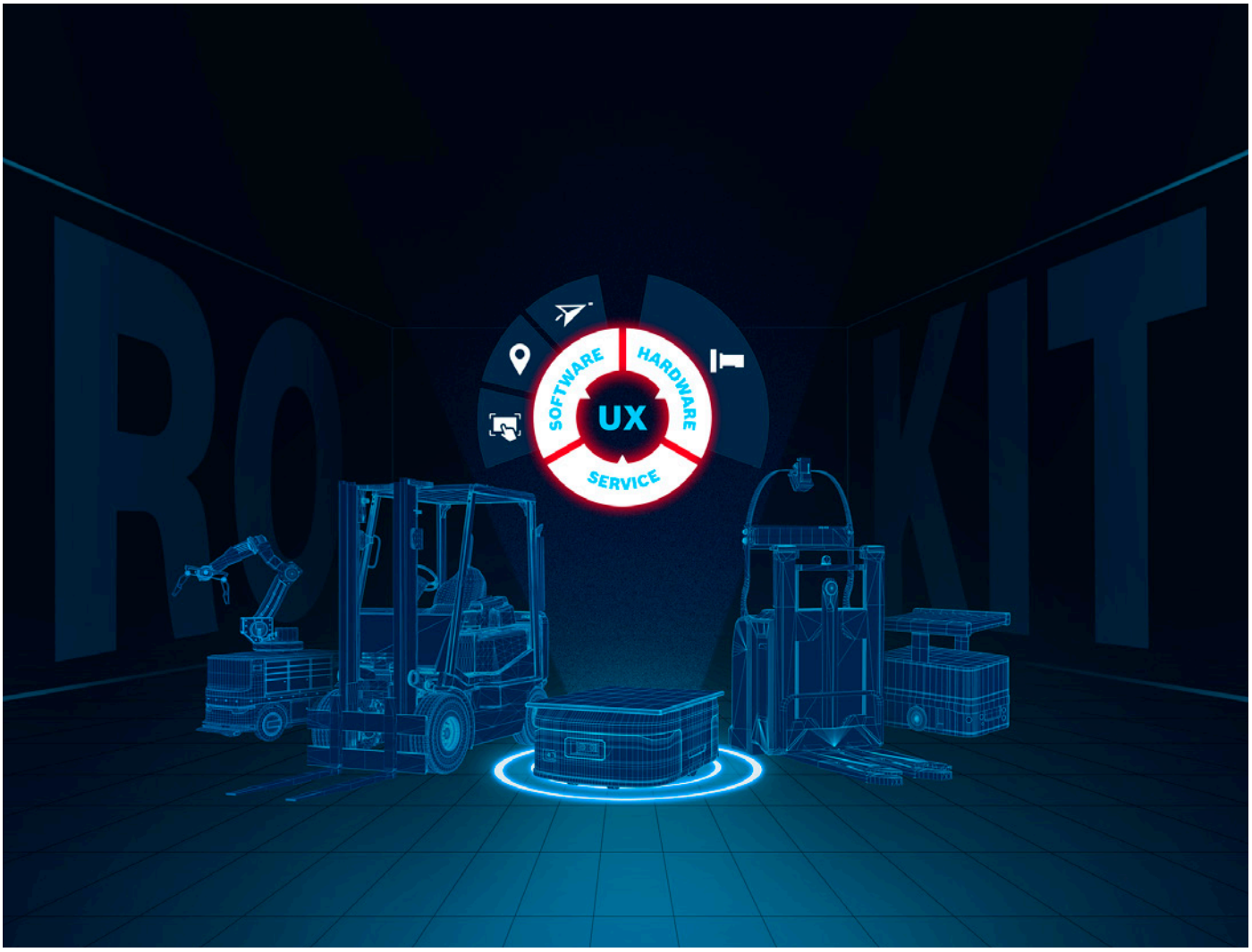
Despite having to crane the new 1.9-tonne panel through the roof of the facility to position it in the switchgear room which is at four-story level, and almost five days of painstaking connection work, Aguilar and his team received well-earned recognition when the circuit breaker fired up the furnace. "It's always great to see the result of a project, when it's in place and working!" he concluded.

abb.com
infrabuild.com

Implementing Mobile Robotics with Bosch Rexroth

Examining innovations for warehouse and intralogistics applications

Matthew Jaster, Director, Editorial Content



Bosch Rexroth continues to expand the ctrlX platform with new capabilities and automation enhancements. The control platform ctrlX COREplus is now available with AI functions on all performance levels. In the area of motion and drives, Bosch Rexroth is presenting compact, energy-efficient, and cabinet-free drives from the ctrlX DRIVE portfolio, which cover virtually all performance ranges. These are complemented by the Motion, CNC, and Robotics software ctrlX MOTION, which is ideal solution for automating production machines and systems. *PTE* recently had a great conversation with Garrett Wagg, product manager, controls at Bosch Rexroth on new developments in mobile robotics.

PTE: What are the greatest challenges and obstacles facing companies in warehouse/intralogistics today regarding mobile robot technologies?

GW: There are quite a few challenges and obstacles warehouse/intralogistics companies may deal with when implementing mobile robotic technologies into their business. The first and most important in my opinion is the challenge of providing safety to the company's employees. When implementing mobile robotics, a company must design safe zones and deploy controlled functional safety features into their mobile robotics that share work zones with humans. Another obstacle includes the growing need for cybersecurity. Mobile robotics connected to a network are vulnerable to cyber-attacks that could disrupt operations, steal data or even harm a human. Other challenges include scalability and flexibility. As a business grows and evolves how easy is it to scale your mobile robotic platform to add additional robots to your fleet and add additional features and technology like Ai or advanced collision avoidance.

PTE: How are Bosch Rexroth's latest products and solutions geared toward improving mobile robots?

GW: One of Bosch Rexroth's latest products recently launched that was designed for improving the mobile robotics market is the "ROKIT." The ROKIT is an "a le carte" mobile robotic solution set allowing a company of any size to design their own mobile robot that tailor fits their business. Whether a business is looking for a simple AGV or an advanced AMR the ROKIT kit gives that flexibility. This solution set is made up of an integrated 6 in 1 motor that combines a wheel, servo drive, motor, gearbox, brake and certified functional safety in one package that is easy to install into an AMR or AGV. This solution set also consist of a navigation software & localization software that can be run on Bosch Rexroth's ctrlX CORE or packaged in a container to be run on a 3rd party controller or IPC. This solution set also gives the user easy integration with a variety of sensors and lidars giving the user freedom of choice. The ROKIT solution is truly flexible, and a user can choose to implement just the motor and use their own software package or could keep their mobile robot design and implement the navigation and localization software on their own hardware.

PTE: What highlights of the latest version of ctrlX provide customers with the tools they need to build mobile robots?

GW: Aside from the ctrlX ROKIT mentioned, the ctrlX platform offers a variety of tools for the mobile robotics industry. When it comes to implementing safety into a mobile robot, Bosch Rexroth has the ctrlX safety controller that can implement functional safety features into a mobile robot like safe limited speed, safe stop functions and many other safety functions protecting humans and important machinery a mobile robot may work around. Other tools like the Hailo Ai extension on the ctrlx CORE & NIVIDIA extension on the ctrlX IPC can help with vision and inspection tools on a mobile robot.

Garrett Wagg

PTE: Outside of warehouse and intralogistics, does Bosch Rexroth provide mobile robotic solutions for precision-focused areas such as aerospace or medical applications?

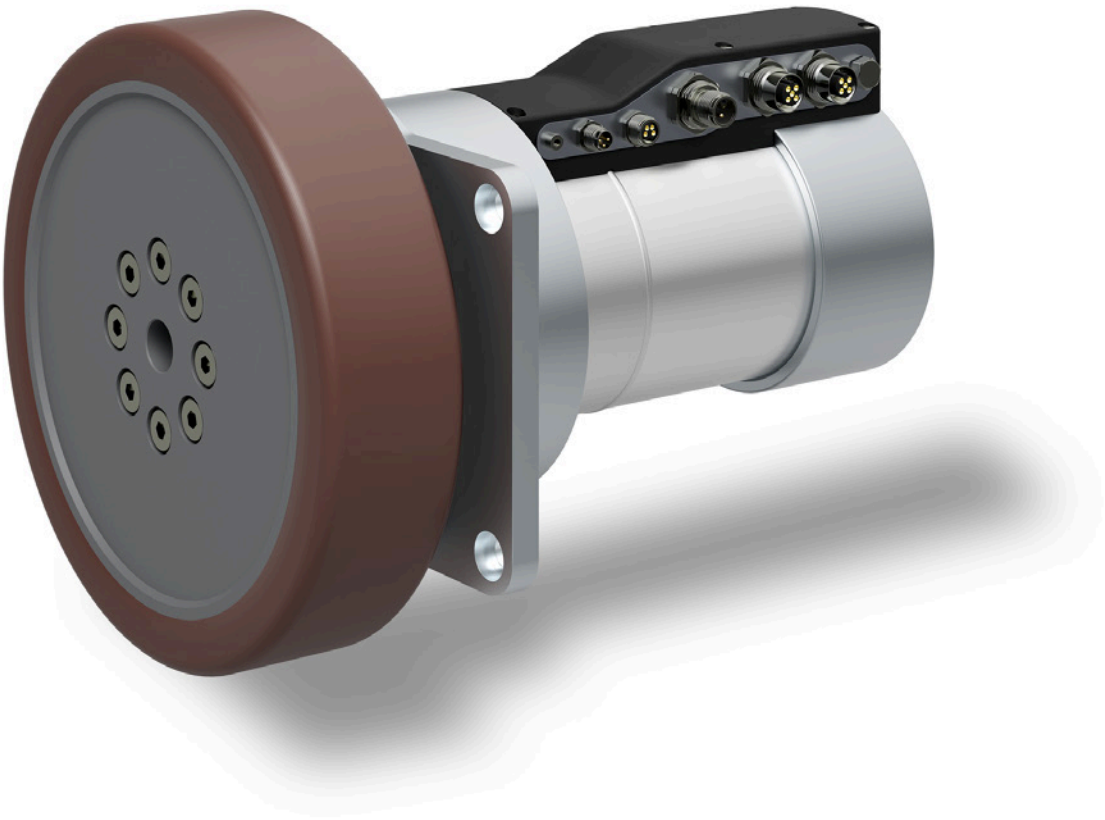
GW: Bosch Rexroth does not provide mobile robotic solutions in these industries currently, however one of Bosch's recent acquisitions, Elmo Motion Control, provides servo drive technology for mobile robotics in all these markets and more.

PTE: What role is AI playing in these technologies as we head into 2026?

GW: AI is playing an increasingly central and transformative role in mobile robotics, moving them from programmable machines to truly intelligent, autonomous, and adaptive systems. AI is no longer a peripheral component but the brain and nervous system enabling advanced capabilities. Some of the capabilities include enhanced perception and understanding of its environment like object recognition and classification. Another key capability is intelligent navigation and path planning. Instead of a programmed route an Ai capable mobile robot can generate an optimal path in real time based on obstacles, congestion and efficiency.

PTE: Explain the idea of "mixed fleets" in warehouse operations and the integration of manual vehicles into a fleet management system to make efficiency gains.

GW: A "mixed fleet" in warehouse operations refers to the simultaneous use and coordination of multiple types of automated vehicles (AMRs, AGVs, etc.) alongside traditional manually operated equipment (forklifts, pallet jacks, tuggers) and human workers within the same operational space. A fully automated warehouse is often not



practical or economically viable for many companies. Instead, a hybrid approach leverages the strengths of both human and machine resources. Humans excel at handling highly variable tasks, problem-solving, and dealing with unexpected situations. Automated vehicles excel at repetitive, predictable tasks. A mixed fleet provides the best of both worlds.

PTE: How do your software tools help customers get the most out of their modular automation needs today?

GW: Bosch Rexroth's software tools are the backbone of the ctrlX ecosystem and what makes ctrlx such a powerful platform. With over 100 different software apps, the ctrlX app store gives the user ability to integrate a variety of software tools into whatever automation task they need accomplished. Some of these tools include apps for software development kits allowing a programmer to code in a variety of different coding languages, dashboard tools to create HMI interfaces, data collection & historian tools, security tools like VPNs and additional firewalls and so many more. With ctrlX OS a user can choose which of these software apps will benefit them and allow them to easily test and add tools to their controls configuration.

PTE: How will the mobile robotics sector look in the next five to ten years? What do you think will stand out in the future? What might surprise manufacturers in this market?

GW: The mobile robotics sector is poised for explosive growth over the next five to ten years. I think with evolving technology and AI it will make mobile robotic solutions much more common and practical. Some evolving features to look forward to that may surprise manufacturers include advanced cognitive autonomy to truly understand its environment, flexibility to change tasks on the fly, more advanced AI features to interact with human works in a safer and more efficient manner and lastly advancements in battery technology, wireless charging and autonomous energy harvesting.

PTE will continue to cover new component, automation and motion control trends from Bosch Rexroth in upcoming issues of the magazine and on the website.

PTE

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Battle-Tested Tech for Aerospace and Defense Operations

Matthew Jaster, Director, Editorial Content

According to a recent study by Deloitte, the aerospace and defense industry stands at a pivotal crossroads as it enters the latter half of the decade. Forces that have shaped the sector in recent years—digital transformation, supply chain volatility, talent constraints, and geopolitical events—are converging with new catalysts such as agentic AI, emerging vehicles and the rapid evolution of autonomous systems. On the defense side, budgets are a key focus, with a growing emphasis on enhancing mission readiness. At the same time, defense priorities are shifting to accelerate the fielding of AI-enabled systems and collaborative combat aircraft. "Speed to field" is becoming the unifying metric across portfolios. (*deloitte.com*)

Northrop Grumman Expands Autonomous Portfolio

Northrop Grumman recently unveiled Project Talon, an autonomous aircraft built to fly alongside crewed fighters. As the latest addition to the company's elite autonomous portfolio, Project Talon represents a paradigm shift in air dominance as an adaptive, collaborative teammate for combat missions.

Project Talon represents a paradigm shift in air dominance and showcases Northrop Grumman's ability to quickly deliver mission-ready autonomy with streamlined manufacturing capabilities and innovative production processes. From the beginning, it has been designed for manufacturing. Its modular design exemplifies how efficient and adaptable manufacturing can meet the rapidly changing requirements of modern military operations, broadening appeal and effectiveness with domestic and international markets.

Additionally, Northrop Grumman successfully tested the first of two new solid rocket motors—SMASH!22 and BAMM!29 2.0—designed and manufactured in 2025 under the SMART Demo program. This milestone marks a key achievement in the project's most ambitious year by delivering both motors in under 12 months.

The static test fire of SMASH!22, the 22-inch diameter Solid Motor Adaptable, Scalable, Half Time/Cost solid rocket motor configuration, evaluated several innovative incorporations such as advanced manufacturing and new materials that could speed development and production, boost performance and lower costs.

The test generated a comprehensive suite of data that will further the team's understanding of the demonstrated technologies.

The second motor, the 29-inch diameter Bombardment Attack Missile Motor called BAMM!29 2.0, is slated for static testing in early 2026, continuing the momentum of the SMART Demo initiative.

The SMART Demo program is designed to tailor solid rocket motor designs to meet specific industry needs. Northrop Grumman developed both the SMASH and BAMM motors leveraging knowledge from previous projects while integrating advanced tooling, additively manufactured components, and a diversified supplier base.

In October, the Integrated Battle Command System, built by Northrop Grumman for the U.S. Army, completed a pivotal flight test at White Sands Missile Range. This test was part of Follow-on Operational Test & Evaluation (FOT&E) to assess IBCS operational effectiveness in a tactical environment.

During the test, Army Air Defenders used IBCS in a complex environment that mimicked real-world operations, identifying and engaging targets via multiple interceptors. The flight test intercept of two surrogate cruise missile targets demonstrated IBCS's capability to defeat realistic threats in operational environments and highlighted its ability to enhance joint missions, as it integrated with U.S. Navy participants.

Under FOT&E, IBCS is being assessed for its ability to defeat new threats and meet operational needs. The results of the FOT&E and this operational flight test will inform future IBCS development and fielding to the Army. IBCS's modular open systems design enables IBCS to evolve and adapt to changing requirements and threats.

Northrop Grumman is manufacturing IBCS under a full-rate production contract in a new, state-of-the-art manufacturing center in Madison, AL. The new facility has the capability to double the company's manufacturing capacity in Huntsville and scale IBCS to meet growing demand for integrated fires, command and control in the U.S. and globally.

northropgrumman.com

Laser-Based Data Communication

Lithuanian space and defense tech company Astrolight has successfully demonstrated undetectable and unjammable laser-based communication and data transmission with its POLARIS terminal during NATO's latest exercise. It was held in Latvia, on NATO's Eastern flank, highlighting how the latest technologies can enhance battlefield capabilities in the region.

The exercise, called Digital Backbone Experimentation (DiBaX), took place from October 27 to November 7, at a Latvian Ādaži military base and virtually across the Alliance.

Astrolight placed two POLARIS laser terminals on land, operating continuously throughout all 9 days of the exercise, including in rain and fog. During the tests, POLARIS successfully demonstrated interoperability with military communication infrastructure, connecting a military base to an ad-hoc remote command post.

"As GPS-jamming and interference cases are rising in NATO territories, military communication is becoming a full-scale battlefield. DiBaX demonstrated that our technology can provide the speed, volume, and security of data transmission needed for modern tactical operations on land, which traditional communication methods struggle to support," said Laurynas Mačiulis, the CEO of Astrolight.

astrolightspace.com

Manufacturing Partnership for Automated Machining and Inspection Technology

Lockheed Martin and Hadrian have entered into a Memorandum of Understanding to accelerate the pace and value of advanced American manufacturing at Lockheed Martin, building a more resilient and scalable industrial base.

Under this agreement, Hadrian will deploy its factory-as-a-service model, which includes embedding a scalable machining manufacturing and inspection cell, to produce parts at a Lockheed Martin Missiles and Fire Control site. This flexible production cell is comprised of computer numerical control (CNC) machines, advanced robotics and Hadrian's manufacturing execution platform, which will enable Lockheed Martin and Hadrian to increase rate for a variety of machined parts quickly and efficiently for products like PAC-3 MSE, THAAD, PrSM and GMLRS.

Tom Carrubba (right), vice president of production operations at Lockheed Martin, and Chris Power (left), chief executive officer of Hadrian, agree to a Memorandum of Understanding at Hadrian's headquarters in Los Angeles.

"We are excited to collaborate with Hadrian to deploy their automated machining and inspection technology to strengthen our manufacturing capabilities and supply chain," said Tom Carrubba, vice president, production operations at Lockheed Martin Missiles and Fire Control. "This project is a key enabler for Lockheed Martin to increase production output capacity, ensuring we can meet the high demand for our customers' munitions needs."

"This partnership is a model for how emerging and established players can work together to build faster, more resilient defense production," said Chris Power, CEO of Hadrian. "By combining Hadrian's advanced manufacturing capabilities with Lockheed Martin's expertise, we're streamlining production for current and future critical programs and laying the groundwork for more collaborations like this across the industry."

By uniting advanced manufacturing with proven defense capabilities, this partnership aims to create a more resilient and responsive production ecosystem, one that becomes more capable as demands grow and challenges emerge.

lockheedmartin.com
hadrian.co

Input Shaft Tradeoff Options for Single Speed Gear Reducers

EV work continues despite reduction in volume

Norm Parker, technical fellow, Stellantis

Greetings 2026! As expected, EV demand has waned following some deregulation and tax credits being dropped as of September 2025. For us industry folks, this is simply reality catching up with the narrative. On the plus side, 2025 was a very good year for global vehicle sales–the best since 2019 (Ref. 1). A good economy can forgive many blunders. As gearbox designers, our work continues as our EV offerings are likely a permanent part of our product lineup, even if at a reduced volume. When it comes to single speed offset gearboxes, many OE's have a similar 3 parallel shaft design, running ratios typically between 7:1 to 15:1. Some higher speed boxes are going above 20:1 ratio now, but the basic architecture is unchanged. The Tesla design shown here is a common baseline design:

Figure 1—Photo courtesy of Munro Live on Instagram: "Partial Dissemble of the 2018 Tesla Model 3 Helical Gearbox." Instagram, 2017, **www.instagram.com/p/COiQJ1rniM1**

There is a lot of discussion around the nuances of bearing type and placement. Here, we will look at the rotor and input shaft and discuss and compare the common alternatives.

To summarize the option we will be reviewing, we have:

1. Four-bearing integrated input pinion gear (machined on shaft).
2. Four-bearing splined input pinion gear.
3. Three-bearing, fixed motor shaft.
4. Three-bearing, fixed input gear.
5. Three-bearing, single shaft.
6. Two-bearing, single shaft.

For this study, we will use a nominal driving load of 100 Nm for a realistic evaluation case. All results are based on nominal fits and clearances. We will only focus on the input gear (Gear A) for misalignment since we are not evaluating any intermediate shaft effects.

1. **Four-bearing, integrated input pinion gear**
   Pro–Minimum misalignment. Able to optimize motor bearings. Easy to electrically insulate.
   Con–High scrap cost on integrated pinion.
2. **Four-bearing splined input pinion gear**
   Pro–Reduced scrap cost.
   Con–Added part assembly. Higher pinion misalignment.
3. **Three-bearing, fixed motor shaft**
   Pro–Eliminate 1 bearing. Reduced axial space.
   Con–Much higher pinion misalignment.
4. **Three-bearing, fixed pinion shaft**
   Pro–Eliminate 1 bearing. Reduced axial space. Good pinion support.
   Con–higher rotor misalignment.
5. **Three-bearing, single shaft**
   Pro–Eliminate any potential lash in spline connection.
   Con–Indeterminate loading on bearings. Cannot optimize bearings with loading uncertainty. Gear deflection can change based on loading and tolerances.

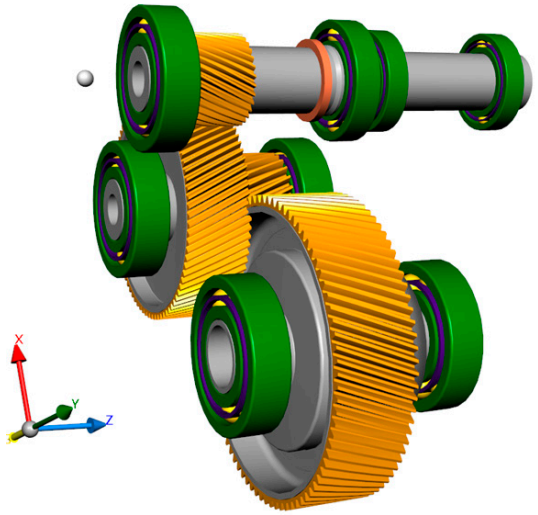

Figure 2—A simple design is modeled in Masta *for comparison study.*

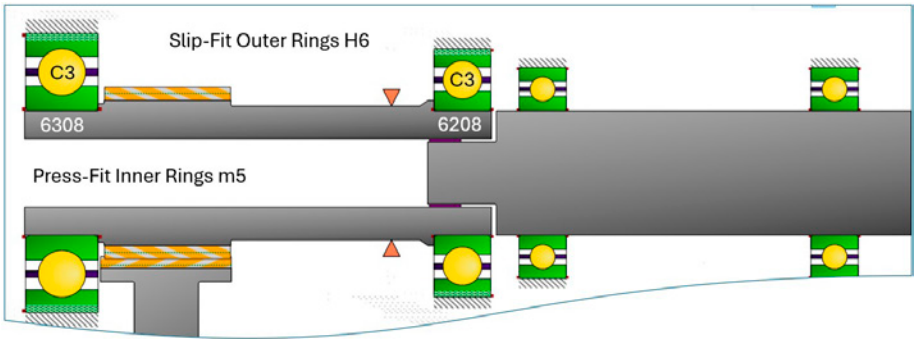

Figure 3—Four-bearing, machined pinion design.

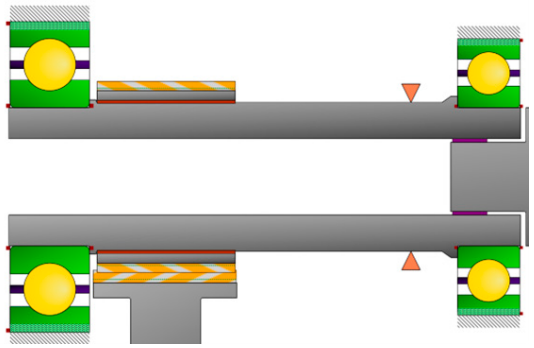

Figure 4—Four-bearing, splined input pinion.

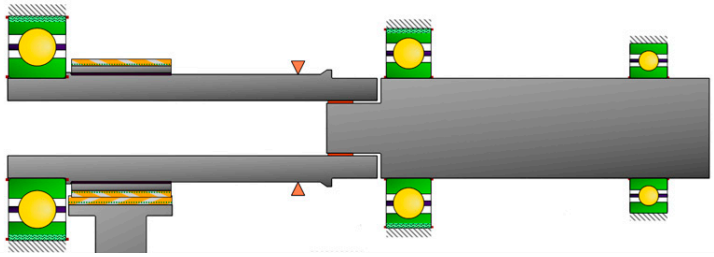

Figure 5—Three-bearing, fixed motor shaft.

6. Two-bearing, single shaft
Pro–Eliminate spline lash.
Predictable gear deflection.
Reduced parts and assembly.
Con–Cost.

Conclusion

In addition to this simple comparison, cylindrical bearings can also be reviewed in different locations. For these ball bearing designs, we are assuming all bearings have equivalent quality and performance standards. When all options are considered along with housing type and capability, the tradeoff study becomes substantially more involved. For a quick, high-level pass, take a look at the table below to see how these options rank.

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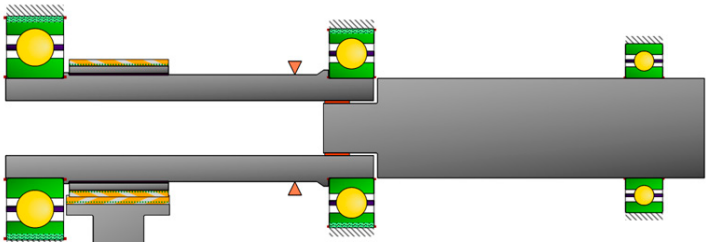

Figure 6—Three-bearing, fixed pinion shaft.

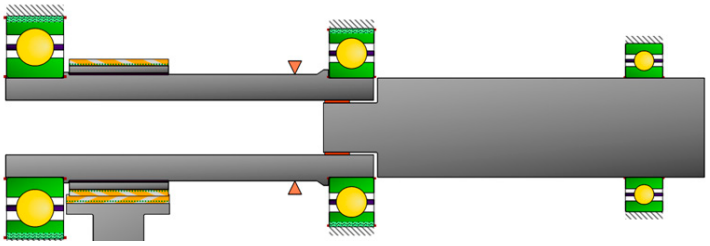

Figure 7—Three-bearing, single shaft.

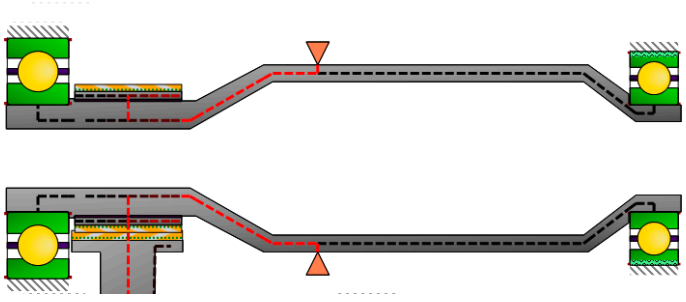

Figure 8—Two-bearing, single shaft.

Arrangements Studied	Gear Alignment	Efficiency	Cost	Other Considerations
1. Four-bearing integrated pin-ion	++	+	//	
2. Four-bearing splined pinion	+	+	//	Potential benefit of reduced scrap input shafts
3. Three-bearing, fixed motor shaft	--	//	+	
4. Three-bearing, fixed input gear	+	//	+	Grounding ring likely needed
5. Three-bearing, single shaft	-	//	+	Three premium bearings can outweigh 4-bearing design
6. Two-bearing, single shaft	+	++	-	Cost of non-uniform shaft

Best ++
Good +
Neutral //
Poor -
Worst --

Table 1—Rotor and input shaft rankings.

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Leveraging Software for Advanced Gearbox and Drivetrain Development

Lovro Lončar Kocijan and Bruno Ban

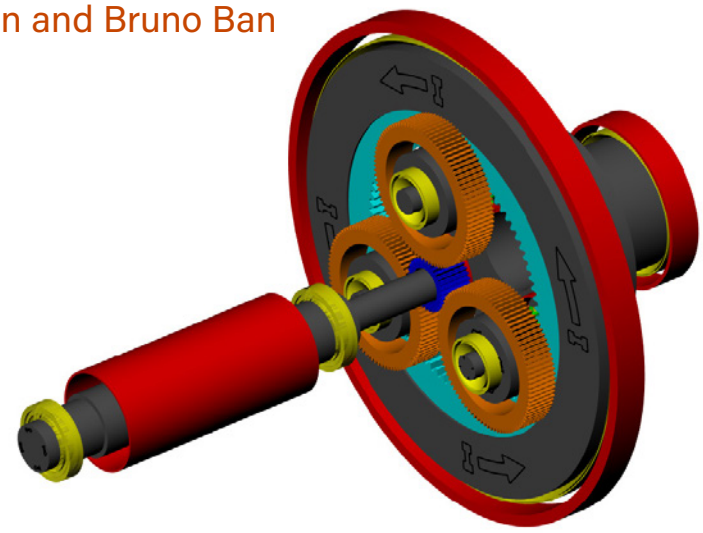

Figure 1—Gearbox model.

Due to the need for mass reduction, tight packaging, and overall car performance, it is necessary to reduce the weight and dimensions of every component of the car, including the gearbox and other drivetrain components. It is also very important to ensure that gears, bearings, and shafts can withstand the whole racing season and have the necessary safety factor. Using *KISSsoft* software, FSB Racing Team was able to develop a new gearbox for the AWD Formula Student car, which can easily fit inside upright and withstand 50 hours of racing.

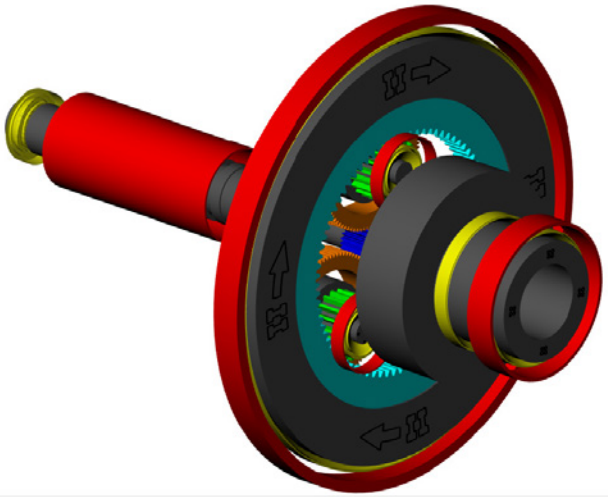

Figure 2—Gearbox model 2.

Input Data

For all calculations, the load spectrum was used. The team got the information from the Vehicle Simulations module, and then we modified it to suit the input for the KISSsoft software. Figure 3 shows how the load spectrum looks for one electric motor.

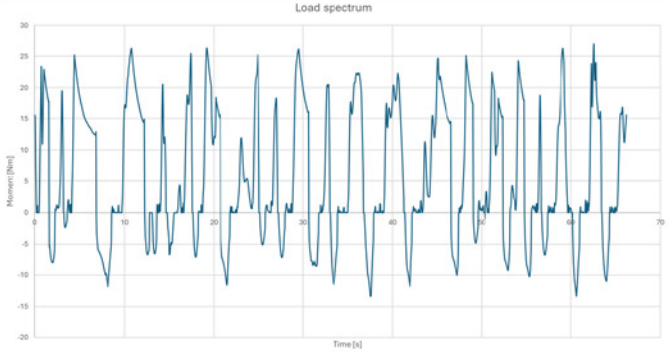

Figure 3—Load spectrum.

Peak torque from electrical motors is 29 Nm, and maximum speed is 20,000 rpm.

Other input data:

- Maximum ring gear circumference = 110 mm
- Maximum spline for sun gear and shaft connection = 15 mm
- Gearbox ratio—[11.5, 12.5]

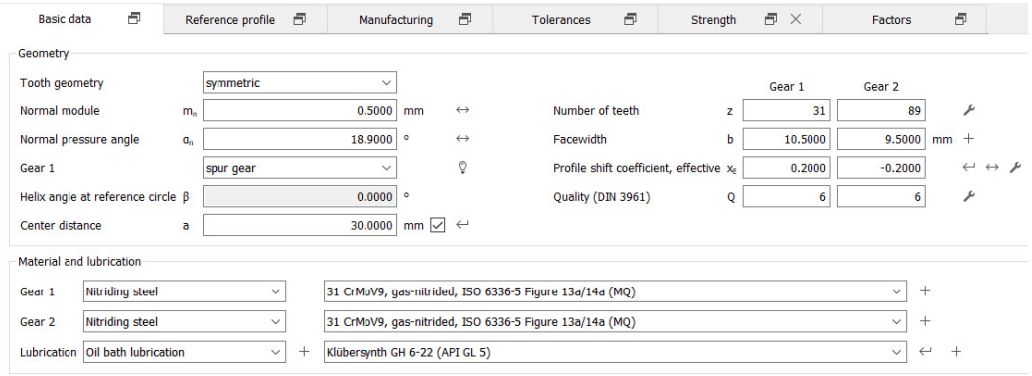

Figure 4—First stage of geometry.

Calculation with load spectrum, Own input

Contact ratios	[$\varepsilon_{\alpha m}/\varepsilon_{\beta}/\varepsilon_{\gamma m}$]	1.643 / 0.000/1.643	
		Gear 1	**Gear 2**
Actual tip circle (mm)	[d_{ae}]	16.700	45.200
Root safety	[S_F]	1.186	1.203
Flank safety	[S_H]	0.686	0.761
Safety against scuffing (integral temperature)	[S_{intS}]	2.829	
Safety against scuffing (flash temperature)	[S_B]	5.878	

Figure 5—First stage achieved safeties.

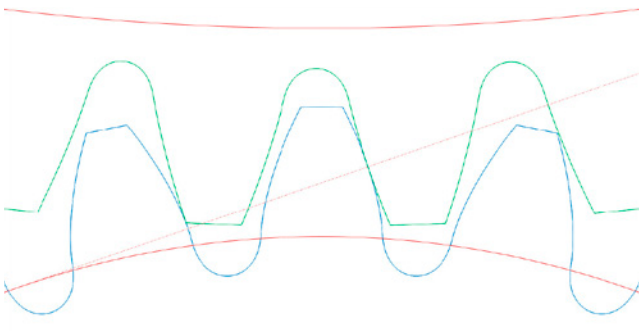

Figure 6—First stage achieved service life.

First Stage Gear Design and Calculation

During gear design, it was important to contact the manufacturer to get information on what tooth cutter tools they have in stock, since new custom tools are expensive and take weeks to manufacture. Considering other manufacturing constraints, it was decided to make the sun and planets for the first stage out of nitriding steel.

Considering high loads on the car wheel and, at the time of designing, unknown wheel hub and upright stiffness, gears had to be as thin as possible. The inner diameter of the sun gear dictated a higher number of teeth, too, and therefore planets with a greater diameter.

Using the data from the manufacturer's tool, the number of teeth for the sun and the planet is determined. General gear geometry data can be seen in Figure 3.

After determining gear geometry, the strength calculation was carried out. Calculation was done according to the newest standard ISO 6336:2019 and considering the load spectrum prepared by the Vehicle dynamics module. To ensure that gears will withstand, safety factors for the tooth root of 1,1 and 0,65 for the tooth flank were set. The reason for such a small tooth flank safety is that pitting develops after 50x106 cycles according to the norm, and the gearbox will never achieve this number of cycles. Additionally, the gearbox on the previous car had also tooth flank safety below 1, and it has endured more than its required service life without signs of pitting. The required service life was also 50h.

After calculation, it was determined that safety factors are higher than required (Figures 4 and 5), and the gearbox can withstand longer than is necessary. That is desirable considering the unpredictability of real racing conditions.

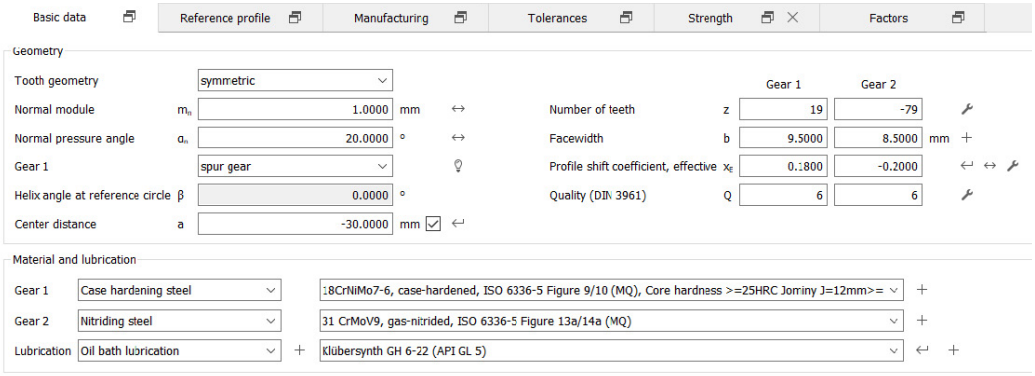

Figure 7—Sun-planet contact.

Calculation with load spectrum, Own input

Contact ratios	$[\varepsilon_{\alpha n}/\varepsilon_\beta/\varepsilon_{\gamma n}]$	1.519 / 0.000 / 1.519	
		Gear 1	**Gear 2**
Actual tip circle (mm)	$[d_{ae}]$	21.360	-77.800
Root safety	$[S_F]$	1.108	1.033
Flank safety	$[S_H]$	1.251	0.868
Safety against scuffing (integral temperature)	$[S_{intS}]$	3.299	
Safety against scuffing (flash temperature)	$[S_B]$	6.960	

Figure 8—Second stage gear geometry.

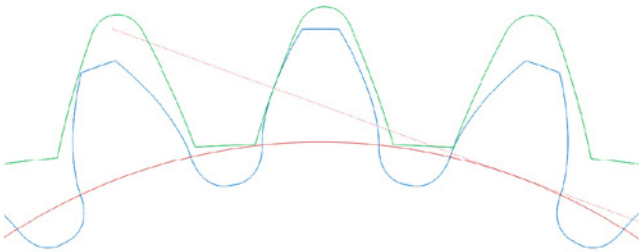

Figure 9—Second stage achieved safeties.

Second Stage Gear Design and Calculation

Since the second stage module is going to be 1 mm, the standard gear profile 1.25 / 0.38 / 1.0 ISO 53:1998 Profile A is going to be used. The planet is going to be made of case-hardening steel, but the ring gear will be made of nitriding steel, considering manufacturing challenges. Gear geometry data can be seen in Figure 7.

As for the first stage, calculation was carried out according to the newest standard ISO 6336:2019, considering the load spectrum. Required safety factors and service time are the same as for the first stage, too. In Figure 8, the achieved safety factors can be seen.

Planet Bearing Calculation

Choosing a planet bearing was challenging, considering various design constraints. The inner diameter of planets was limited by tooth root strength and the diameter of pin-by-pin bending. Since the pitch diameter of the planet is very small, a high bearing load was expected.

It was decided to use two needle roller bearings. They are light, have small dimensions and can withstand high revolutions. The planet assembly model can be seen in the figure.

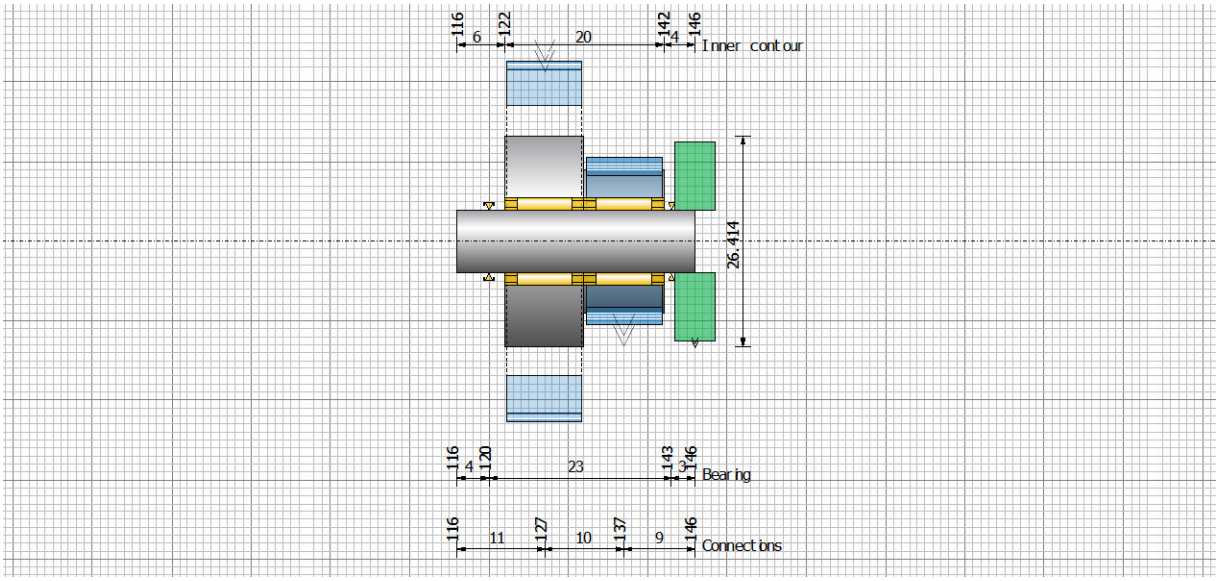

Figure 10—Planet-ring contact.

Calculation according to ISO 76, ISO 281, ISO/TS 16281

Results	S0	L10h
CB1 (SKF K 8X11X10 TN)	1.23	519 h
CB2 (SKF K 8X11X10 TN)	2.90	9069 h

Figure 11—Planet bearing model.

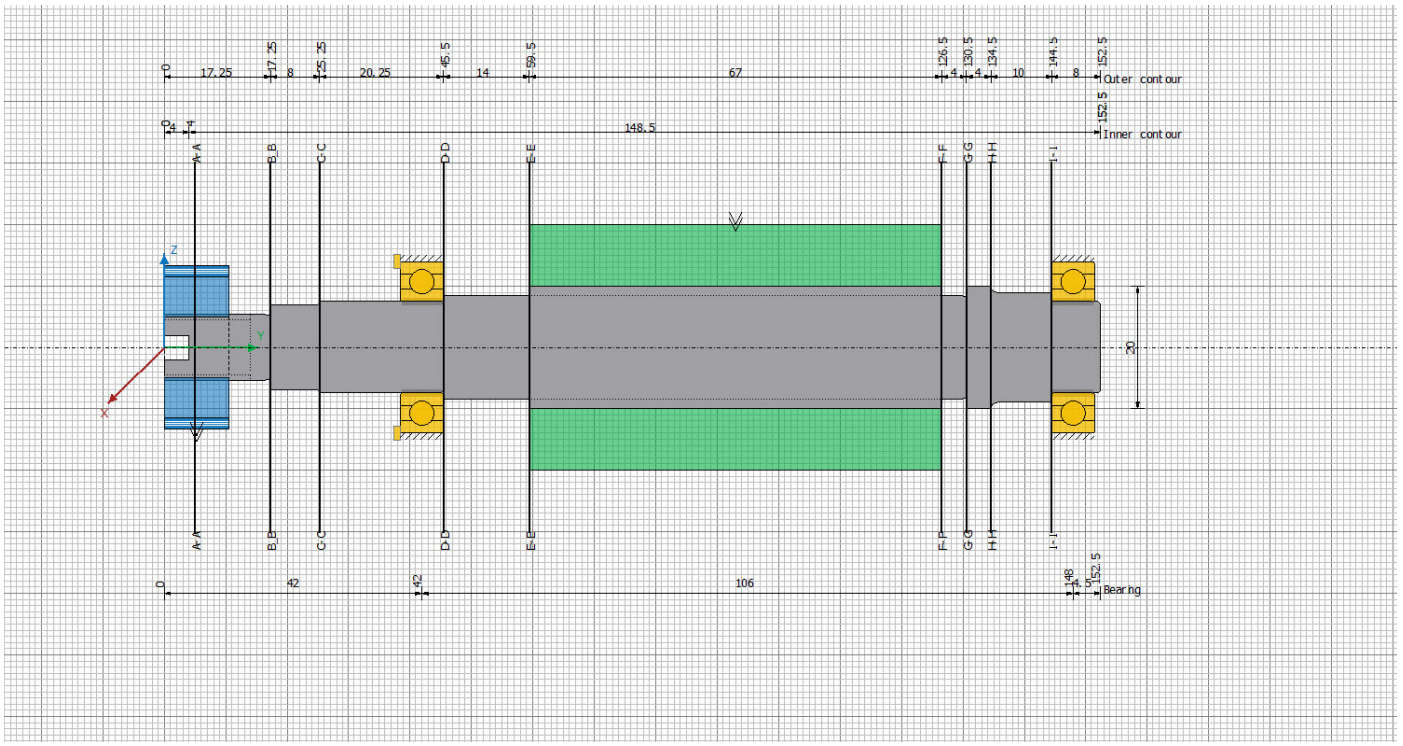

Figure 12—Achieved bearing service life.

KISSsoft bearing database was of great use, since there was a large number of bearings and a lot of parameters could be adjusted. Since the gearbox is to be driven at high revolutions and loads, it was necessary to take into account the influence of higher temperatures on the lubricant. As for the other parts of the gearbox, the required service time for the bearings is 50h. They are calculated according to modified life (ISO 281) to simulate real conditions as well as possible. Results can be seen in Figure 11.

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Lovro Lončar Kocijan is a master's student at the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, currently writing his master's thesis. He is an FSB Racing Team member (subteam Mechanical), working on the development of the transmission for the Formula Student car. The primary focus of his work is optimizing gear geometry for better efficiency.

Bruno Ban is a final-year student at the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb. Now in his fourth year with the FSB Racing Team, he served as Head of the Mechanical subteam for the 2024/25 season, focusing on component design and subteam coordination.

TERADYNE ROBOTICS

Announces New Operations Hub in Michigan

Teradyne Robotics will open a new U.S. Operations Hub in Wixom, MI, in 2026. This strategic expansion reflects Teradyne Robotics' commitment to operating close to its customers and meeting the growing manufacturing demand in the U.S. and the Americas.

The new facility will manufacture Universal Robots (UR) industrial collaborative robots (cobots), with future potential to include MiR autonomous mobile robots (AMRs). It will also serve as a regional customer training center, service hub, and visitor experience center.

The new U.S. Operations Hub will support the re-industrialization of America with advanced robotics. The company seeks to support the evolving needs of American industry, including productivity, reshoring, upskilling, and increased automation to address workforce challenges and enhance global competitiveness.

This facility expands Teradyne Robotics' presence in the Detroit area, creating over 200 jobs over the coming years and an all-new robotics technology hub supporting advanced manufacturing in Michigan, the Midwest, and throughout America.

"This new U.S. Operations Hub is a pivotal step to support the growth of advanced robotics in America and demonstrates our commitment to customers in the United States," said Jean-Pierre Hathout, President of the Teradyne Robotics Group. "Our customers are looking to robotics not only to boost competitiveness, but also to make factory floors more attractive to the next generation of workers. With this facility, we're investing in both automation and education - scaling up deployment, service, and training capabilities to meet the evolving needs of U.S. manufacturing, logistics and warehousing."

A recent survey shows that 73 percent of North American manufacturers cite productivity improvement as their top reason for investing in automation. Of the companies already using cobots, the vast majority (87 percent) are already seeing double-digit productivity improvements. Eighty-three percent of all respondents reported positive employee sentiment towards robotics adoption.

Teradyne Robotics produces a range of robots designed to work alongside people, augmenting existing workforces and creating better workplace environments for employees. Its scalable, AI-enabled robotics platforms are built for agility, flexibility and future-proof performance.

Teradyne already has a large robotics customer base in North America and a regional robotics office in Novi, MI. The company is based in North Reading, MA, with its robotics R&D based in Denmark.

The location of the new Operations Hub was a strategic choice based on the area's strong manufacturing heritage and industrial future.

"Locating this hub in Metro Detroit puts us at the center of U.S. manufacturing and innovation," said Justin Brown, chief commercial officer of the Teradyne Robotics Group. "Being close to leading manufacturers allows us to deliver automation solutions to some of our biggest customers, enabling Teradyne Robotics to be even more agile and responsive. The region's industrial foundation, strong talent base, world-class universities, and growing aerospace sector make it an ideal base to support advanced manufacturing in the United States."

"We are pleased to support a new U.S. Operations Hub for Teradyne, whose products and solutions are an incredible complement to the innovative and valuable supply chain that is found in Michigan. The partnership between the company and the State of Michigan presents an incredible opportunity and competitive advantage for all involved," said Quentin L. Messer, Jr., CEO of the Michigan Economic Development Corporation. "Team Michigan stands ready to continue our work with the company for many years after this announcement. I wish the Teradyne team success and prosperity, and I look forward to celebrating their accomplishments in Michigan for years to come."

teradyne.com/robotics

PORTESCAP

Achieves AS9100 Certification Across All Global Manufacturing Facilities

Portescap has reached a major milestone in its aerospace journey: all three of its manufacturing facilities—West Chester, PA; Mahape, India; and Mumbai, India—are now AS9100 certified. This achievement underscores the company's alignment with the aerospace industry's highest standards for quality and safety.

"Achieving AS9100 certification across all our global manufacturing sites is a powerful validation of the discipline, innovation and customer focus that define our team," said Adrien Mettraux, aerospace and defense industry manager. "It's not only about meeting standards; it's about exceeding expectations and ensuring our motion solutions perform

flawlessly in the most demanding aerospace environments."

The accomplishment also contributes to a broader success within Regal Rexnord Aerospace Solutions, which now boasts 14 AS9100-certified facilities worldwide. This expanding global footprint reflects Regal Rexnord's commitment to delivering high-performance solutions that meet the complex demands of aerospace customers across continents.

Precision motors and accessories produced by the company play a vital role in a wide range of commercial aerospace and defense applications. By adhering to AS9100-compliant processes, Portescap's solutions are built to deliver consistent performance and reliability in challenging environments.

portescap.com

STLE
Opens Registration for 2026 Annual Meeting & Exhibition

The Society of Tribologists and Lubrication Engineers (STLE) announces that registration is now open for the 2026 STLE Annual Meeting & Exhibition: Innovating Through Tribology & Lubrication, May 17–21, 2026, at the Hyatt Regency New Orleans. The STLE community and global tribology and lubrication engineering experts will gather for five days of technical training, industry education and business networking at the meeting.

The meeting will feature over 400 technical presentations and posters, a trade show with nearly 100 exhibitors, over 30 Commercial Marketing Forum presentations, nine industry-specific education courses, discussion panels and more. Topic areas include electric vehicles, grease, metalworking fluids, rolling element bearings, sustainability in motion, power generation, hydraulics and ocean tribology, and more.

"The STLE Annual Meeting & Exhibition is a cornerstone event for the tribology and lubrication engineering community," said Rebecca Lintow, CAE, STLE executive director. "It provides an unparalleled opportunity for professionals to exchange knowledge, explore the latest technological advancements and network with industry leaders from around the world. Our goal is to foster collaboration and drive innovation within our field, ensuring that our members stay at the forefront of industry developments."

Annual Meeting registration and hotel reservations are now open. STLE members and non-members can save $100 on meeting registration by taking advantage of the early bird rate through March 20, 2026. The hotel room reservation deadline is April 17, 2026. Rooms are booked on a first-come, first-served basis, so attendees are encouraged to book their stay as soon as possible.

stle.org/annualmeeting

DBS CANADA
Carries Out Critical Service Delivery to Gold Mind

The team at DBS Canada recently carried out the successful delivery of a time-sensitive and complex service project for a valued, long-standing customer in the mining industry. This project supported operations at a gold mine located in one of the most remote regions of northern Canada, just below the Arctic Circle.

The project involved the routine maintenance of a 13,000 kg Main SAG Mill gearbox, a vital component driving the mine's grinding operations. While the maintenance itself was scheduled, the circumstances surrounding the job made it exceptionally critical. Due to the extreme climate, the region remains frozen for most of the year, with only a narrow window between June and September when the Arctic waters thaw enough to allow the transport of large equipment by way of a barge. This year the thaw was delayed, and the gearbox arrived at DBS's facilities in mid-July, leaving a very limited timeframe to complete the work before the final barge departure in mid-September. Missing this deadline would have meant the equipment could not be returned until the following summer—a delay that was simply not an option for the customer's operation.

Understanding the gravity of the situation, the DBS team responded with precision and commitment to ensure the project was completed on time. They had pre-purchased bearings and seals, scheduled the expert technicians in advance, and maintained a standby team ready to begin work immediately upon arrival of the unit. The gearbox was fully disassembled, inspected, and serviced—including bearing and seal replacement—alongside a comprehensive inspection report.

The gearbox was successfully reassembled and dispatched on schedule, ensuring it made the final barge north, ready to resume operation in the harsh Arctic environment.

dbsantasalo.com

SCHAEFFLER
Wins Siemens Mobility Supplier Award 2025

Siemens Mobility has awarded Schaeffler the 2025 Supplier Award in the 'Moving Beyond' category. The award was in recognition of the newly developed bearing for inboard-mounted powered wheelsets, which was optimized in collaboration with Siemens Mobility for use in high-speed trains. It will be used, for example, in the Siemens Velaro in Deutsche Bahn's ICE fleet.

"We are proud to have received this accolade in the shape of the

Siemens Mobility Supplier Award. It affirms our role as a technological leader in the field of axlebox bearing development for high-speed rail traffic," says Dr. Michael Holzapfel, global sector lead rail at Schaeffler. "With our technological system expertise from design to production, we support our customers with best-in-class products for their development of reliable and powerful high-speed trains."

The award also acknowledges the high level of commitment and consistent performance of the global Schaeffler team in its collaboration with Siemens Mobility to jointly drive the Siemens Mobility vision under the motto 'Moving Beyond'.

The bearings for inboard-mounted powered wheelsets are based on advanced bearing technology. They were designed with the help of the Schaeffler bearing design system Bearinx OptiKit specifically for extreme speeds of more than 360 km/h and for long maintenance intervals of over 1.2 million km.

The newly developed bearings also feature an optimized internal geometry, reduced operating temperatures, and robust reserve capacity at very high speeds. Thanks to their high efficiency and long service life, they are a significant factor in reducing the total cost of ownership (TCO) of high-speed trains.

In June 2025, the Siemens high-speed rail platform Velaro Novo reached top speeds of 405 km/h using these Schaeffler bearings during test runs on the Erfurt—Leipzig/Halle route (Link). Deutsche Bahn and Siemens Mobility confirmed the considerable importance of the test runs for future high-speed rail concepts.

Alongside their use in Siemens Velaro trains in Deutsche Bahn's ICE fleet, Schaeffler's axlebox bearings are also used in other Siemens vehicles.

schaeffler.us

AILOS ROBOTICS

Lands €3.5M Seed for Advanced Robot Gearboxes

AILOS Robotics has raised €3.5 million to industrialize a new class of robotic gearboxes that combine the agility of quasi-direct drives with a far higher torque density. This breakthrough enables robots that are lighter, safer, more affordable, and more energy-efficient.

The seed round is led by QBIC and High-Tech Gründerfonds (HTGF), with participation from Wallonie Entreprendre and finance&invest. brussels, reinforcing Europe's commitment to developing local, strategic component supply for the rapidly growing humanoid and collaborative robotics markets.

"Modern robots demand a new category of actuation," said Pablo López García, CEO and co-founder of AILOS Robotics. "We combine quasi-direct drive-like backdrivability with the high torque density of advanced gearing, finally removing one of the main barriers to agile, lightweight, and safe robots that can operate alongside humans."

AILOS is a spin-off from the Vrije Universiteit Brussel (VUB) and its BruBotics research powerhouse. After a decade of research supported by VLAIO (Flanders) and Innoviris (Brussels), the company has built and validated its Minimum Viable Product (MVP)—the R2poweR gearbox.

"AILOS addresses one of the biggest bottlenecks in humanoid and collaborative robotics," said Cédric Van Nevel, Partner at QBIC. "Europe needs strong hardware manufacturers, and this team has the technology, IP position, and industrial vision to deliver. We are happy to support the founding team in bringing years of academic research to the market."

ailos-robotics.com

ATLANTA GEAR WORKS

Earns Certification as Flender Service Partner

Flender, a global manufacturer specializing in mechanical and electrical drive technology, has certified Atlanta Gear Works as a Flender Service Partner.

A 125-year-old company headquartered in Bocholt, Germany, Flender offers a wide range of gear units, couplings and generators for various heavy industries, with a particular focus on the wind energy sector. Its services include installation, commissioning and maintenance.

Atlanta Gear Works is known to many Flender customers, having repaired and rebuilt numerous Flender gearboxes over the past 35 years.

"We are very familiar with what is required to rebuild a Flender gearbox having had many years of experience," said Craig Massa, Atlanta Gear Works, vice president-sales.

To become certified as a Flender Service Partner, the company underwent a rigorous two-day audit that covered everything from its environmental, health and safety plans to all of its manufacturing procedures and operations, including data control, training and even the cleanliness of the facility.

"Flender is highly regarded worldwide and is known for high quality and dependability," said Atlanta Gear Works President Jack Conway. "This partnership proves our expertise."

Photo above: Certification presentation at Atlanta Gear Works. Pictured left to right: From Flender, Germany: Auditor Klauss Kemper; from Atlanta Gear Works: VP-Sales Craig Massa; VP-Engineering Chris Dale; Operations Manager John Conway; Sr. Engineer Taylor Sims; Shop Manager Jeff Grizzle.

atlantagear.com

February 10–12

AIoT World Expo 2026

The AIoT World Expo (Fort Lauderdale, FL) is the premier event for exploring the convergence of Artificial Intelligence (AI) and the Internet of Things (IoT). This event serves as the gathering point for industry professionals to discover advancements, market opportunities, and understand the transformative power of AIoT across industries. Technologies include scalability, Edge, and AI data analytics, cloud solutions, machine learning (ML), and predictive analytics, cyber security and hybrid models. The show includes two key tracks AIoT Solutions and Services as well as AIoT Applications and Vertical Markets. Attendees will include corporate executives, IT, developers, engineers, data analysts, channel executives and more.

powertransmission.com/events/aiot-world-expo-2026

February 24–26

Additive Manufacturing Strategies – New York

This industry touchstone conference (New York, NY) brings together AM stakeholders from all over the world. AMS includes panels and keynotes on topics most critical in the fast-growing world of additive manufacturing. Bringing together the industry's leaders in a contained networking environment makes AMS the place for startups to access capital, for financial institutions and investors to sharpen their radars, and for the AM industry to focus on the business of AM. Topics include energy, medical devices, aerospace, defense, future forecast, software and more. MPMA's VP of Emerging Technology, Mary Ellen Doran, joins moderator Filippos Voulpiotis, managing director, 3Dnatives, Kevin Kassekert, chief executive officer, VulcanForms and Michael Corliss, vice president of technology, SBO/Knust Godwin for a panel on high-volume industrial part production at 9:55 am, Feb. 25, 2026.

powertransmission.com/events/additive-manufacturing-strategies-new-york

March 3–5

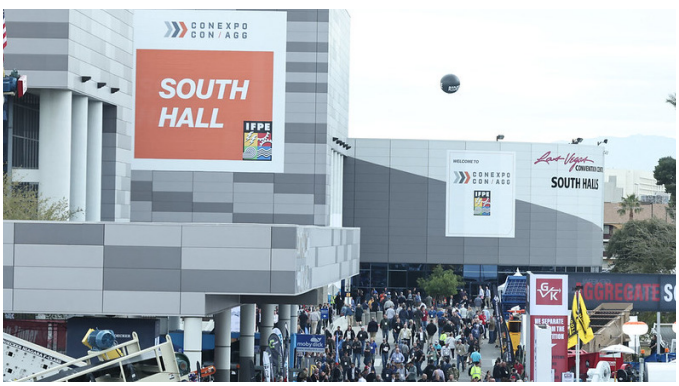
MDSM 2026

The MDSM Conference & Exhibition (Tallahassee, FL) brings together thought leaders focused on the latest technical advancements in motor, drive systems and motion control. Attendees will hear content in design, efficiency and application advancements in automation, robotics, manufacturing, utilities and automotive consumer and medical applications. Join leading engineers, manufacturers, system integrators, product developers, consultants and executives and discover how new technologies are improving performance and providing cost savings in a variety of applications. Tech tracks include topics on drive systems, industry trends, supply chain, motor performance, magnetics, test/simulation and more.

powertransmission.com/events/mdsm-2026

March 3–7

CONEXPO-CON/AGG 2026



CONEXPO-CON/AGG (Las Vegas) will feature 2,000 exhibitors across 2.9 million square feet of exhibit space and 50 first-class educational sessions designed to help construction and aggregate industry professionals stay ahead of the emerging technologies, workforce trends and sustainability practices shaping the industry's future. Debuting in 2026, The Ground Breakers Stage, is spotlighting the people, policies, and technologies driving the construction industry forward. Sessions include AI, sustainability strategies, workforce growth and mental health across the construction sector.

powertransmission.com/events/conexpo-con-agg-2026

March 17–19

The Bearing Show 2026

The Bearing Show (Detroit) connects the evolving needs of bearings end-users with the latest technologies serving, OEM development, maintenance professionals and R&D engineers. Meet visitors from OEM's, machine manufacturers, industrial plants, global distributors and more. Gain insights into emerging trends such as energy efficiency, sustainability and cost-effective maintenance strategies. The show is co-located with Lubricant Expo North America, a destination for connecting lubricant solution providers with end-user buyers and the entire supply chain. The Lubricant Expo brings together exhibitors and attendees from over 80 countries, covering everything from finished lubricants to formulation ingredients and equipment.

powertransmission.com/events/the-bearing-show-and-lubricant-expo-north-america-2026

AD INDEX

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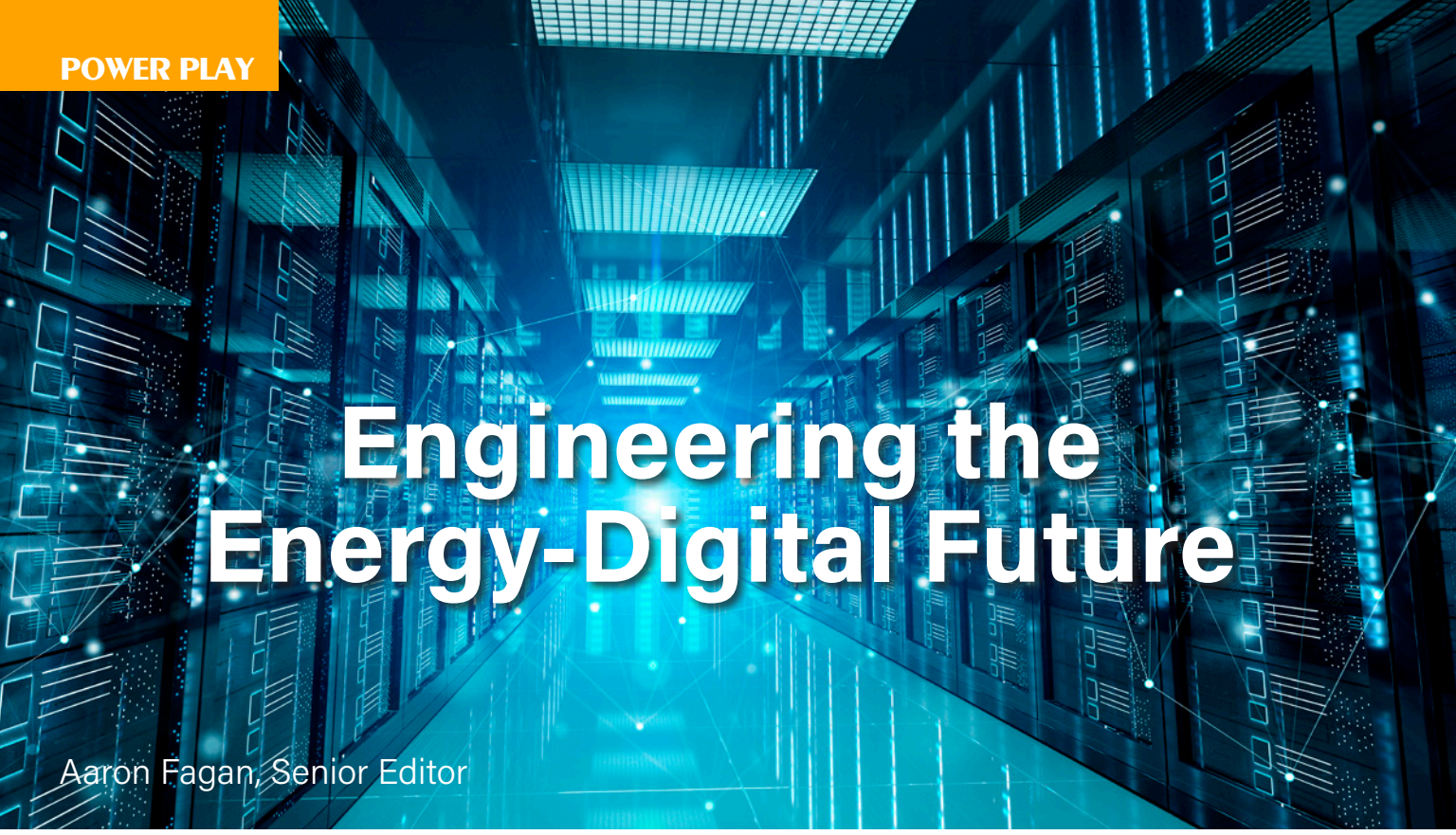

Engineering the Energy-Digital Future

Aaron Fagan, Senior Editor

For decades, motion power engineers have quietly driven the planet toward efficiency. High-performance motors, tighter tolerances, variable-frequency drives, predictive maintenance—incremental gains multiplied across millions of machines have reduced energy waste and carbon footprints. These advances were rarely celebrated, but they mattered.

Now, the rules are changing. Artificial intelligence is not a traditional industrial load. Large models train continuously, inference runs 24/7, and hyperscale data centers operate relentlessly. Global data centers already consume roughly 415 TWh/year, approximately 1.5 percent of global electricity, with AI workloads expected to account for 300–500 TWh by 2030. Blockchain and Web3 layers add 150–300 TWh, depending on adoption rates and node density. Combined, digital loads could approach 1,200 TWh/year by 2030—as much electricity as Japan currently uses annually.

The contrast with motion power is stark. A gearbox optimized to reduce losses by a few percentage points is dwarfed by the relentless, high-density electricity appetite of AI and blockchain. Efficiency gains that once bent the carbon curve are now minor ripples in a rising digital tide.

Renewables alone cannot absorb this growth. Solar and wind are intermittent; their output peaks when the sun shines and wind blows, not when massive data centers need constant power. Batteries can help, but scaling storage to reliably handle 1,200 TWh of continuous load is a decades-long endeavor. Fossil generation could fill the gaps, but doing so risks undoing decades of progress in decarbonization and faces rising political, environmental, and economic constraints.

This leaves nuclear power as the only scalable, carbon-neutral backbone capable of meeting the new demand. Nuclear plants provide always-on, high-density energy that can reliably serve AI, Web3 (decentralized digital networks), and industrial motion loads simultaneously. Without nuclear, engineers risk a future where digital growth and carbon targets conflict.

The challenge is systemic. Motion power engineers must no longer optimize in isolation; they must consider the entire electricity ecosystem: data centers, decentralized networks, grid constraints, and generation mix. Efficiency alone will no longer guarantee carbon reduction. Instead, the profession must engage at grid scale, integrating renewable variability, storage, and nuclear supply with industrial load management.

None of this diminishes the real benefits of AI and blockchain. These technologies are transformative. But they force a rethinking of what “efficiency” means in a world where computation and electrification are inseparable. Engineers now operate at the intersection of motion, electrons, and information—a space where systems thinking, grid design, and energy policy are as important as motor efficiency curves.

The motion power community has long been the quiet steward of energy. The rise of AI and Web3 demands that we step from the background into the center of the energy conversation. The task is to safeguard carbon gains, enable digital progress, and architect a resilient electricity system. Efficiency built the bridge; AI and Web3 show us how far we must now expand it.

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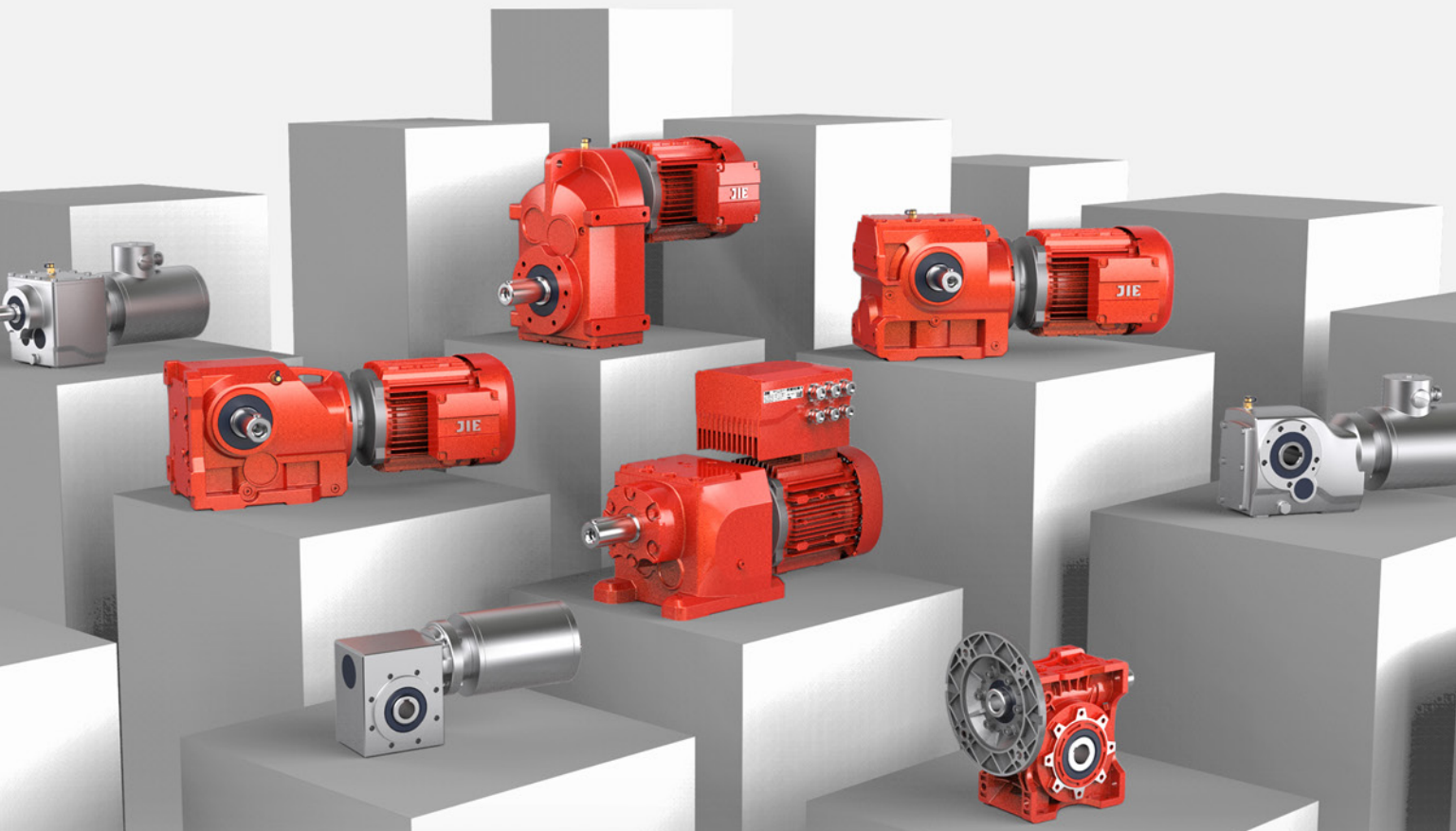

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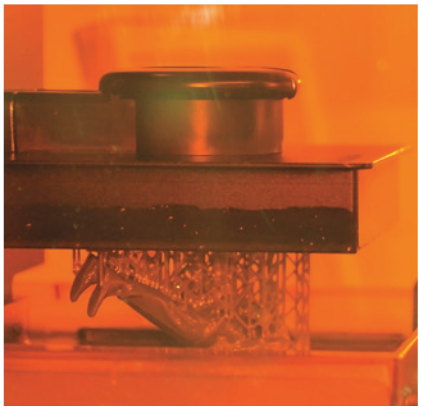

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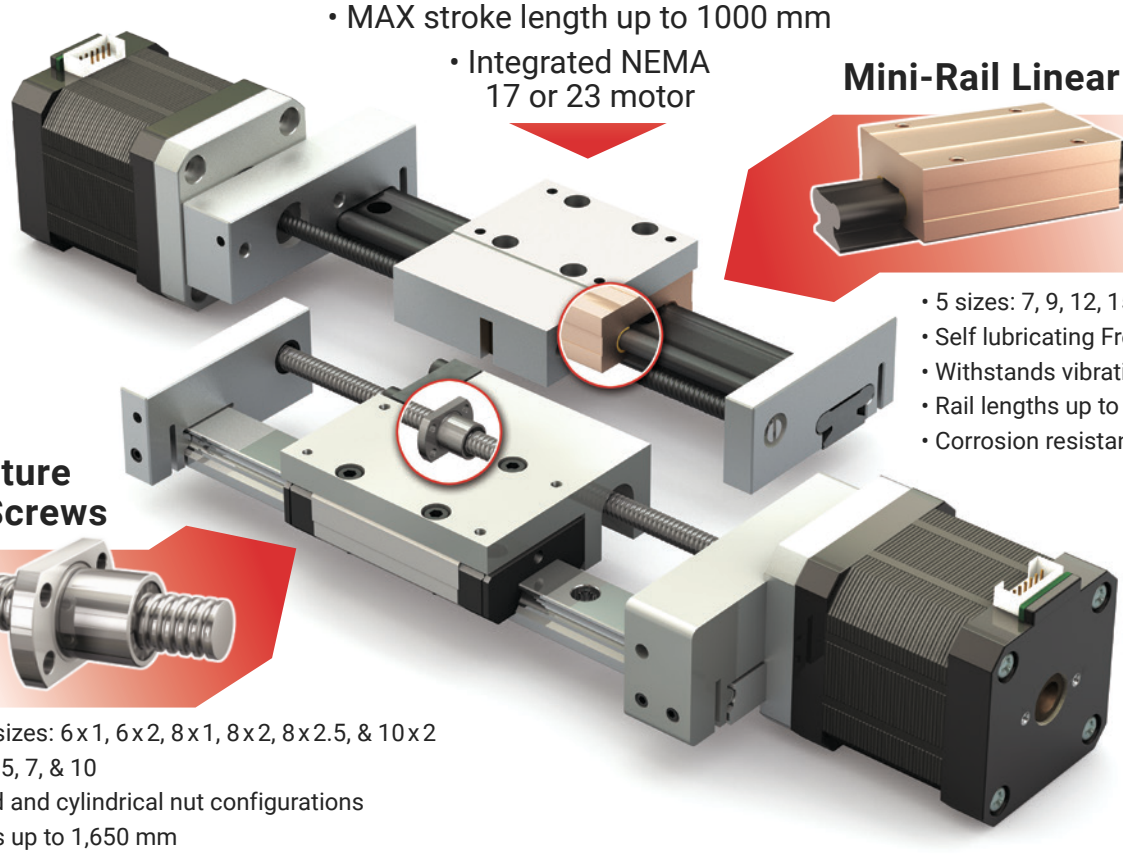

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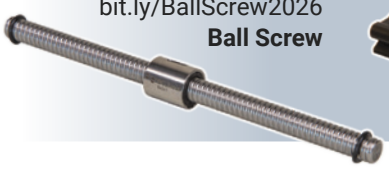

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