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BUILDING THE FUTURE

A look at the
innovative company
bringing humanoid
robots to life. **14**



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The industry's
hottest trending technology solutions.

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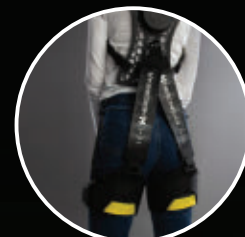
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of Small Loads

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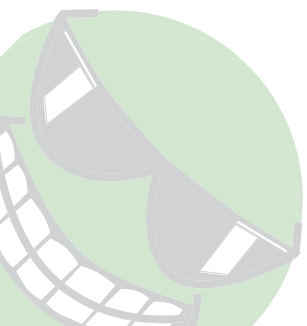
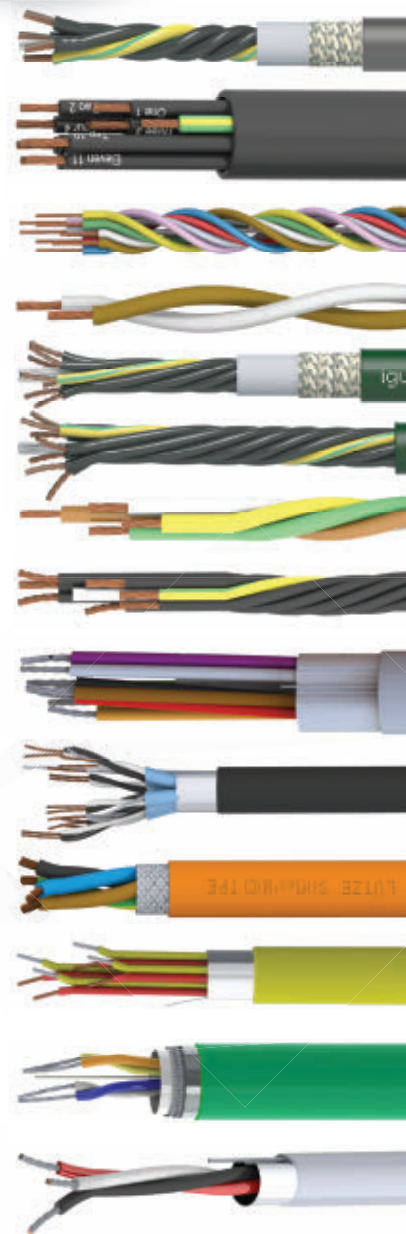
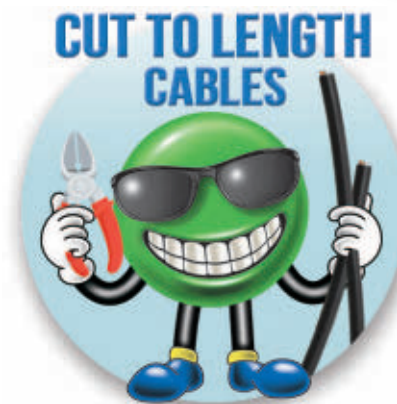
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Advanced Energy Industries' TEGAM 947A and 948A handheld temperature calibrators offer Bluetooth connection for precise data in hazardous environments.



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Epson's Mobilink wireless and portable receipt printers are ruggedly designed for any indoor or outdoor application.



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CaPow's Genesis system is a perpetual motion platform for AMRs that removes batteries and charging time to allow fleets to run 24/7.



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9 Years

100% virgin urethane (no regrind waste) makes stonger, longer lasting belts.

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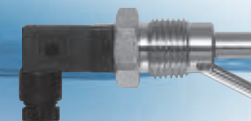
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No-Code Robotic Programming Software

Fuzzy Studio, the no-code industrial robot programming and simulation software allows non-experts to simulate and program industrial robots enabling them to robotize their production at an affordable price. It's universal and compatible with most robot brands on the market and allows even those who lack expertise in robotics or programming to create, program, and simulate their own robotic cell. Previously reserved for a select few, it's now available online for a wider audience and comes with informative documentation and tutorials.

Fuzzy Logic



More online: newequipment.com/21265056

Extreme Ergonomic Exoskeleton

MATE-XT features a slim, lightweight carbon fiber structure and an intuitive regulation system along with a water, dust, UV-light, and temperature-resistant design that can be quickly adjusted to fit virtually any body frame. It replicates the user's physiological shoulder movements to provide upper-body support without batteries or motors. It's the only commercially-available exoskeleton with Ergonomic Assessment Work-Sheet certification which means it reduces biomechanical loads during strenuous tasks.

Comau



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Rugged Case Enhances Protection, Productivity

The rugged **xCase** for the Microsoft Surface Pro 9 enables workers to take their device into more industries and applications than ever before. The case adds protection with sealed ports, shock-absorbing rubber corner bumpers, and a rigid shell. It's engineered to meet MIL-STD-810H passing a 5-ft (1.5 m) drop test from every side. xCase allows mounting anywhere and features an ergonomic, glove-fitting backhand strap for holding the device with the palm of the hand.

MobileDemand



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Women's Spring Work Shoes

An addition to CAT Footwear's lineup, these four shoe styles are designed to take you from active work to after work. The **Intruder, Invader, Streamline, and the Intruder Supercharged** all provide excellent grip, EVA foam midsoles for comfort, and Nylon-mesh for breathability. The Intruder is a unisex shoe and the Supercharged version offers a waterproof outer. The Invader is a woman's steel-toe work shoe with slip-resistant soles and protects against up to 600V of electrical charge. Lastly, the Streamline is a woman's shoe with a composite toe for protection against impact and compression.

CAT Footwear

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Mark Rough Surfaces Easily

Gravity-Fed Lead Holders are designed for the toughest job sites for marking rough surfaces. The triangular barrel and textured grip make them easy to use while wearing gloves. They feature a clip for easy access on your tool belt and use a clutch mechanism at the top of the pencil to advance the lead. The extra thick 5.6-mm lead boldly marks paper, lumber, and other rough surfaces.

Rite in the Rain

More online: newequipment.com/21261737

Electric Tuggers With Swappable Batteries

The **Pony Express 1061 LITHIUM** and **1061-HD LITHIUM** electric tuggers are able to pull or push a load of up to 1,500 and 2,000 lb. (680 and 907 kg), respectively. They feature lithium iron phosphate swappable battery packs that allow for 24/7 operation. The battery pack alerts users when the charge is low and its Bluetooth compatibility and smartphone monitoring app monitors the status as well.

Electro Kinetic Technologies



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Designed specifically for the trades, the **SHK-1** safety helmet uses cutting-edge head protection components traditionally used in gravity sports to create an industry-first hard hat with maximum safety. It features maximum force absorption to protect from direct and angled impacts, replaceable helmet pads to reduce compression on impact, integrated NFC technology that stores critical emergency information, and vented breathability for Type II, Class C applications.

Studson

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Exponential Power, Inc.

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Central Research Laboratories (CRL)

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Transforming sensing in the automotive sector, the **Spectrum Enhanced Detection and Ranging (SEDAR)** platform leverages Short-Wave Infrared (SWIR) to offer 2D imaging and 3D determinative depth sensing at a lower cost. The platform delivers a step-change in the level and quality of information provided to enable vehicles to understand their surroundings in any condition and lighting. The system can be integrated with existing ISP and AI algorithms, removing the barriers of training, and is unaffected by other illumination sources, including sunlight and light from other devices and oncoming vehicles.

TriEye Ltd.

More online: newequipment.com/21265146

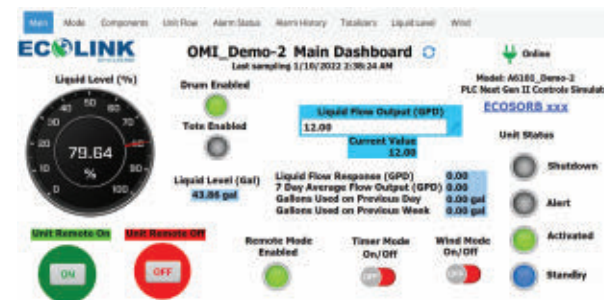
Cloud-Based Odor Management

tracks and trends flow rates, energy use, and downtime

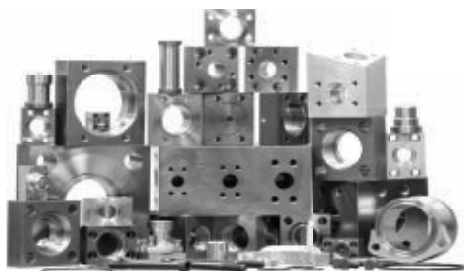
EcoLink, an online portal for remote monitoring and control of odor neutralization systems, allows users to manage their equipment from anywhere with any device capable of hosting a web browser such as a smartphone, tablet or PC. Users can monitor live data on customized dashboards, make operational adjustments in real time, and review historical performance statistics with tailored KPIs.

Ecosorb

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FORGING®



Technologies and Opportunities at Forge Fair 2023

The biennial exhibition and conference will also be a gathering for those interested in forging processes and the future of forging operations.

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Servo-Hydraulic
Ejector Makes
Hot Forming More
Flexible and Efficient
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Multi-Furnace
Upgrade
Project for
Steel Forger
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Scanning-and
Growing-for
Forging and
Machining
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Lucchini Adding New Open-Die Press

A new, 7,000-mt forging press will process steel ingots up to 60 mt, for power-gen and energy-sector programs.

Lucchini RS—an Italian manufacturer of forgings and castings for power-generation projects, oil-and-gas and exploration, offshore platforms, shipbuilding, among other industrial sectors—placed an order with Danieli for a new open-die forging press to be installed at Lovere, Bergamo, Italy, to expand its product portfolio.



A Danieli open-die forging press. [Danieli]

With a 7,000-metric ton force, the new forging press will form ingots weighing up to 60 metric tons, for energy, oil-and-gas, and automotive industry applications. It will be the most powerful and energy-efficient forging press among those in operation for Lucchini Group.

The machine frame—with four pre-stressed polygonal casings and flat guides on the moving crosshead—will be sized for a long service life, ensuring machine rigidity and consequent final product accuracy.

The hydraulic equipment will feature the most advanced solutions to reduce energy consumption and optimize plant layout and electrical infrastructure configuration.

Process control will be integrated with plant enterprise management system according to Industry 4.0 standards.

The new equipment will be engineered and built by Danieli at its workshops in Italy, and the new line will start operation by early 2024.

New Counterblow Hammer for Siderforgerossi

Schuler is set to replace a Bêché machine installed more than 50 years ago.

For over 50 years a counterblow hammer mill designed by Bêché (now a Schuler brand) had been in operation for Siderforgerossi Group at Busano Canavese, site near Turin, Italy. Now, there is a plan to replace it with a Schuler DG50h counterblow hammer, to produce large-dimension steel and aluminum forgings for oil-and-gas, automotive, mining, or aerospace manufacturing products.

Schuler's scope of supply also includes a control system developed by Schuler for work-bound forging units. Functions include various impact programs, monitoring of impact energy, part thickness or temperature, and documentation of die and production data.

As explained by Schuler managing director Frank Klingemann: "Air-powered counterblow hammers are characterized by high availability, as can be seen, after all, from the long service life of the predecessor model."

Because the mill's pneumatic drive components are not in the vibration range, there are low downtimes as well as maintenance times and thus a high degree of utilization. The drive also allows a high number of consecutive strokes without a drop in stroke frequency; for the DG50h, stroke frequency will up to 36 per minute.

The energy-efficient expansion of the drive medium during the impact stroke results in an almost unchanged working capacity of 500 kilojoules at different die heights, up to a maximum of 900 mm.

Commissioning of the new, 355-mt CBH mill is scheduled for late 2023.



The new hammer mill will achieve an energy-efficient stroke frequency of up to 36 per minute. [Schuler AG]

SMS Supplying Press for Aluminum Auto Parts

China's Pacific Precision Forging adding 31.5-MN closed-die machine.

A Chinese forger, Jiangsu Pacific Precision Forging Co., placed an order with SMS group for a fully automatic MP 3150 eccentric closed-die forging press. While Pacific Precision is mainly a steel forging operation, supplying gears and gear shafts, the new 31.5-MN press will forge aluminum chassis components, targeting lightweight automotive manufacturing.

SMS' closed-die forging press will be outfitted with a fully automatic walking-beam system and spraying technology for die cooling and lubrication. A harmonious motion sequence of the automatic walking beam is

managed by servo-electric drives for each axis of movement. Sensors continuously monitor the ram position to achieve fully synchronized operation, and the electrohydraulic clutch-brake system ensures precise switching.

The developer's eccentric-drive design for closed-die forging presses offer rigidity in longitudinal and transverse directions, supporting precision forging. The rapid-adjustment system for the ram makes any necessary corrections during ongoing production fast and simple.

"Against the background of CO₂-reduction measures, the demand for lighter vehicle components is growing worldwide," observed SMS' closed-die forging team member Bernhard Kaminski. "This is where forgings made of aluminum have tremendous potential: in addition to their

lighter weight, they boast high material strength and a long life cycle. For aluminum forging, SMS has not only the proven press concepts but also the necessary process expertise. Our tools are designed to suit the special material flow for the aluminum forming process and enable narrow temperature ranges to be adhered to."

Commissioning for the new eccentric press is scheduled for Q2 2024.

The fully automatic closed-die press with an eccentric drive will produce lightweight suspension components. [SMS group]



Aerospace Manufacturer Starts Forging Cell

LISI Aerospace is producing turbine blades with its new, 2,100-mt screw press.



A new, Schuler screw press is the centerpiece of a new forging cell in Bologne, France. [Schuler AG]

multi-pole, three-phase asynchronous motor is designed for high switching frequency for operation in both directions of rotation, thereby allowing variably adjustable forging sequences.

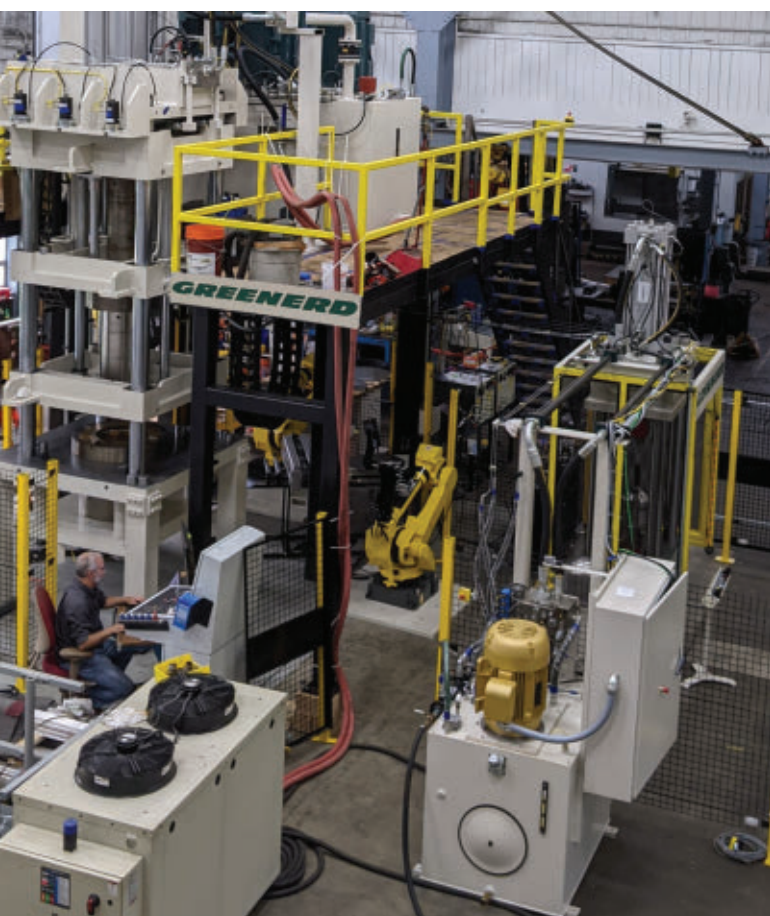
Turbofan engine designs require maximum precision for every component. For that reason, the French manufacturer LISI Aerospace has installed and started a new 2,100-mt screw press and a 250-mt trimming press to produce turbine blades. Both units are designed and built by Schuler AG and now comprise a new forging cell at the plant in Bologne, France, between Nancy and Dijon.

LISI Aerospace—part of an industrial group that also specializes in precision parts for automotive and medical device manufacturing—produces engine and structural components for major aerospace OEMs.

Screw presses operated from a direct drive that transmits torque to a spindle without intermediate links, wear parts or losses, which reduces energy requirements. The

New, Two-Press Cell for Lights-Out Operation

Two hydraulic presses are served by two robots and a centralized control system.



An automated production cell produces large aluminum pressure vessels. [Greenerd Press & Machine]

Greenerd Press & Machine Co. reported it designed and installed an automated two-press, two-robot production cell for unattended production of large aluminum pressure vessels. The site of the new operation was not announced.

Using sensors to locate pallets of blanks, a FANUC robot picks a blank, detects and rejects any double-blanks, and transfers the blank to a fully integrated and automated blank lube station. The robot then picks a lubricated blank and loads it into a Greenerd deep-draw press with a 76-inch stroke.

A second FANUC robot then catches the formed parts and transfers them to a second Greenerd press, for a punching operation.

The two-press cell uses a centralized control station that sets the operating parameters of both presses and controls the action sequences of both FANUC robots.

All equipment in the cell is automatically updated with new process parameters when changing between products.

“Increasingly, our customers are seeking turn-key, state-of-the-art robotics and other product handling solutions. To meet the demands of today’s challenging applications, we are providing manufacturers with automated press solutions that are flexible, productive and reliable,” explained Greenerd Press & Machine president and CEO Jerry Letendre.

FORGING NEWS IN BRIEF

- **FORGED SOLUTIONS GROUP**—an Arlington Capital Partners portfolio business with four forging operations in the U.K., plus Continental Forge in Compton, Calif.—recently acquired Steel Industries Inc., Redford, Mich. Steel industries is an open-die forging and seamless ring rolling manufacturers supplying aerospace, defense, space, and industrial markets. The acquisition price was not announced.
- **ANCHOR HARVEY**, the closed-die aluminum forging company in Freeport, Ill., is celebrating its centennial year in 2023.
- **SHEFFIELD FORGEMASTERS** welcomed Sir Tim Fraser as its new chairman and non-executive director, replacing Colin Smith, CBE. Fraser is a former senior official in the U.K. Ministry of Defence, most recently as the Vice Chief of Defence Staff, and he has completed 40 years of service in the Royal Navy.
- A holding company formed and co-owned by **AIRBUS**, **SAFRAN**, and **TIKEHAU CAPITAL** has purchased aerospace parts manufacturer **AUBERT & DUVAL** from Eramet for an undisclosed price. Aubert & Duval produces materials (specialty steel, superalloys, aluminum, titanium) and high-precision parts (including forgings) for aerospace, defense, nuclear, and medical device manufacturing.
- **L&L SPECIAL FURNACE** recently delivered to an unnamed customer a heated, oil-quench tank for heat-treated tools used in forging. The quench tank holds 65 gallons of oil for quenching parts from 50 to 75 lbs., is agitated by an impeller, and heated with a 4.5-kW immersion heater to maintain the oil at an elevated temperature, and has a safety lid that closes automatically to prevent any potential fire.

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Stamping, forming, and fabricating have always been hard work. Supply chain disruptions only make it harder. Since 1949, we've built strong relationships with a network of mill sources and suppliers to provide the carbon and alloy steel products you rely on. We know how important every order is to your business, and we have the resolve to help you get what you need.

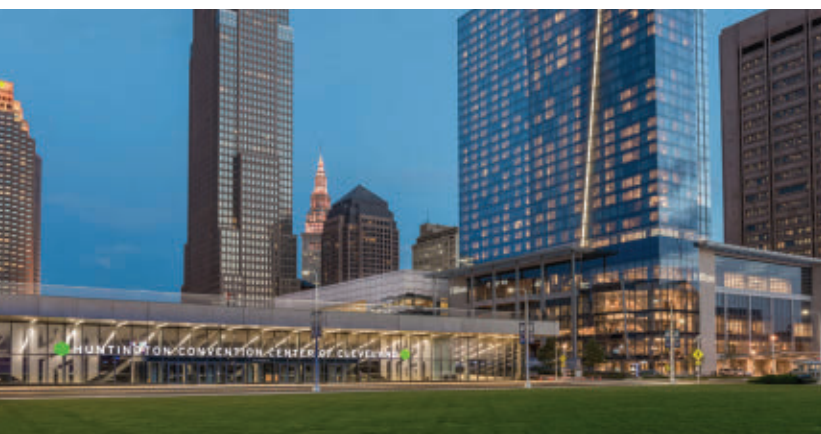
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Technologies and Opportunities at Forge Fair 2023

The biennial exhibition and conference will also be a gathering for those interested in forging processes and the future of forging operations.



Huntington Convention Center, Cleveland, site of Forge Fair 2023, May 23-25. [HCC/FIA]

North American forgers and their suppliers will draw together for their biannual gathering in Cleveland, May 23-25, focusing their attention on technologies and opportunities. Forge Fair, organized by the Forging Industry Assn., is expected to attract over 2,000 professionals from around the world with specialties in forging processes, product design and testing, industrial heating, handling, and other specialties. According to the developers, Forge Fair will be a venue for new technologies and successful applications of heating, tooling, forging equipment, testing, and automation, as well as resource-conservation technologies, and forging process and plant improvements.

The three-day event will also present networking and career opportunities, including for students preparing for a professional future in the forging sector.

The focus of the event will be the exhibit hall, where dozens of builders of forging machinery, material handling systems, and furnaces; process engineers and developers; and material and equipment suppliers, will be displaying examples of their work and detailing their capabilities. The exhibit hall will be open:

- Tuesday May 23 – 11:00 a.m.-4:20 p.m.
- Wednesday May 24 – 9:00 a.m.-4:30 p.m.
- Thursday May 25 – 9:00 a.m.-1:00 p.m.

Attendees will be provided breakfast and lunch in the hall during exhibit hours, and cocktail receptions are set for the early evening periods on Tuesday and Wednesday.

HITTING THE RIGHT NOTES

Two keynote presentations are set for the Tuesday and Wednesday agendas. At 8:00 a.m. on Tuesday May 23, Dr. Christopher Kuehl will offer an economic overview for the forging industry and its downstream markets.

Chris Kuehl is the author of Quick Read Economic Update and the managing director of Armada Corporate Intelligence. A co-founder of that company, he has been Armada's economic analyst and worked with a wide variety of private clients and professional associations over the last 18 years. He is the chief economist for the National Association for Credit Management (NACM), and the author of the NACM's monthly Credit Managers Index.

At 8:00 a.m. on Wednesday, May 23, Ben Abbott will speak about individual craftsmanship and the forging process, and his own experience as a nine-time *Forged in Fire* champion. Abbott began crafting blades at the age of 13, and he has been developing his understanding of their design and manufacture since that time. Ben has firsthand experience with the pressure and challenges faced by competitors, and the dedication needed to succeed in those competitions. From 2000 to 2018, Abbott was an electronics engineer at the California Institute of Technology, working on the "LIGO project to directly detect gravitational wave radiation from massive collisions in space—a project that won the Nobel Prize for Physics in 2015.

GETTING ON TRACK

Topics pertinent to forging technology and forging operations will be addressed in a series of presentations organized over the three-day schedule. Different subject tracks will emphasize forging press design, performance, and repair; die design and maintenance, including topics in welding and additive manufacturing; and heating processes and furnace design and repair. Other presentations will address a wide range of management issues pertinent to forging operations, as well as marketing, product design and development, and leadership strategies.

The Thursday program will include two agenda items relevant to the future of the forging industry: a student forging competition and a job/career fair.

The FIERF Forging Competition, organized by the Forging Industry Education and Research Foundation, will present college/university teams of up to four students (and a faculty advisor) to develop two tuning forks and forging those designs as finished parts that achieve an assigned frequency. Teams from 10 universities will compete for cash prizes, as well as recognition for their design and production skills.

Another forward-looking detail on the Thursday



The schdude includes presentations and discussions on all types of forging operations. [Danieli Group photo]



10 teams of students will compete to design and forge two tuning forks to a designated frequency.

[15559068 © Penwise | Dreamstime.com]

schedule is the Forge Fair Career Day. Students and educators are eligible to register with a discounted academic rate to attend the exhibits and "explore" the forging industry, the opportunities it offers and the businesses and individuals active in it, and the opportunities there. They will be able to learn about co-op programs and internships, and to meet with potential employers. Students are encouraged to bring resumes with them to leave with potential employers exhibiting at Forge Fair—and FIA will provide a list of students with contact information to all FIA member exhibitors. 🗨

More details about Forge Fair 2023 and registration are available at www.forging.org

Servo-Hydraulic Ejector Makes Hot Forming More Flexible and Efficient

A new function is available for installation at each forming step to vacate parts from the dies quickly and reliably, saving material and energy in production of roller bearings or auto parts.

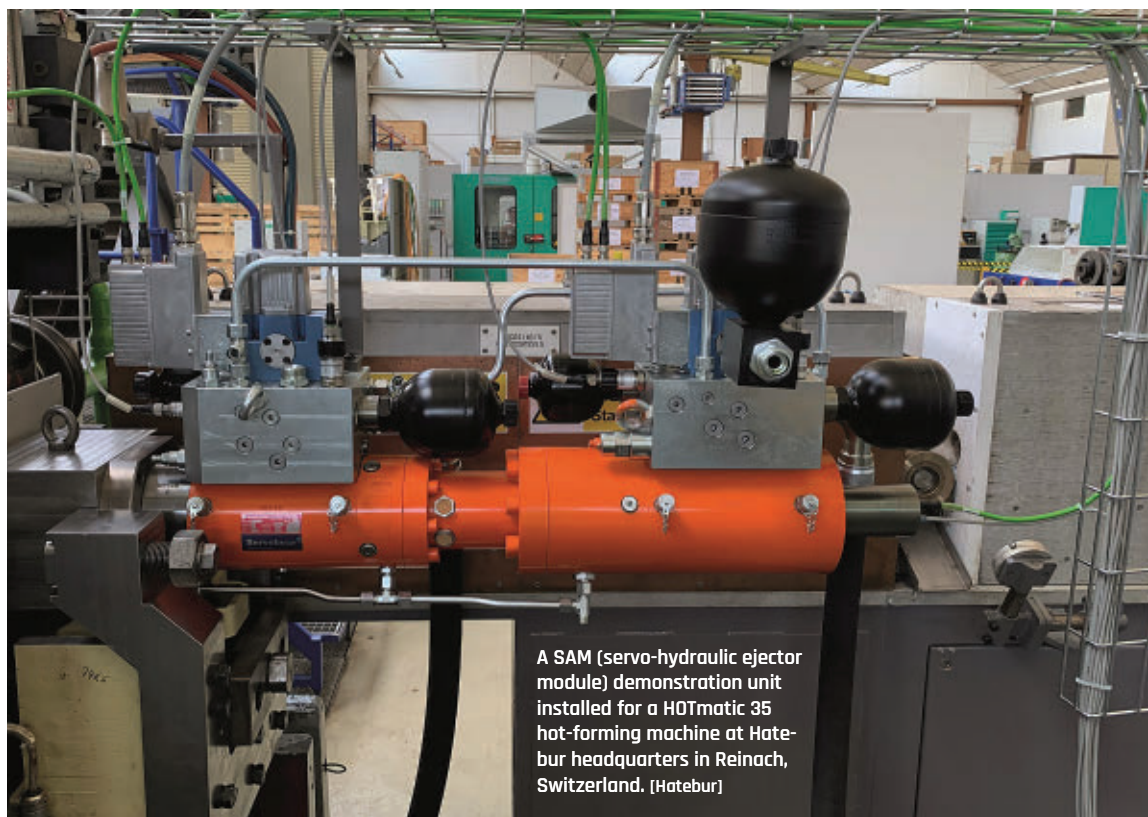
Hatebur—the Swiss developer of hot- and cold-forming process technologies—is introducing a servo-hydraulic ejector module for its “ultra-fast” HOTmatic HM 35 hot-forming machines. The new application has been tested through multiple trial runs on a prototype installation, and follows an earlier development of a servo-hydraulic bar-stop system for the HM 35.

The HOTmatic HM 35 system combines induction heating and four hot-forming steps to process bar stock (18-44 mm diam.) into parts up to 75 mm diameter. According to Hatebur, the new ejector module will extend the system’s versatility and productivity for manufactures of roller bearings or automotive components.

The servo-hydraulic ejector drive is designed to replace a mechanical device now in place for the HOTmatic process. The modules, which can be installed at each forming station, can be controlled individually and optimally adjusted via touchscreen. “This leads to noticeably shorter retooling times because the manual tasks are no longer needed,” explained Carsten Sieber, Hatebur product manager. “The SAM technology does not only improve the efficiency of the users. Thanks to the innovative additional functionalities, which can be added and adjusted based on the customers’ needs, the technology unlocks completely new processing possibilities and is a real game changer.”

The process of ejecting the forging takes place in two phases, loosening the part and then pushing it out from the die. The ejector module has an integrated pressure- and position-measuring system, with which the movement and the ejector force can be exactly determined.

With the SAM technology, energy consumed by the ejection step was reduced to a minimum thanks to an advanced cylinder design. The integrated, wear-free braking function prevents the parts from falling down and improves process security.



A SAM (servo-hydraulic ejector module) demonstration unit installed for a HOTmatic 35 hot-forming machine at Hatebur headquarters in Reinach, Switzerland. [Hatebur]

NEW PROCESSING POSSIBILITIES. One new function available with the servo-hydraulic module is the combination of descaling and in-die forming. Those two process steps can be handled in one operation: First, the scale in front of the die is removed during an upsetting process; then, the blank is inserted into the die and formed into the required shape. As a result, the manufacturer benefits from improved tool life.

Handling two process steps in one operation also allows the HOTmatic 35 to produce more complex parts.

MINIMIZED MATERIAL, POWER CONSUMPTION. Another highlight for the new ejector process is the slim slug process, which the Hatebur development team uses. Because the slug thickness is formed in an intermediate position between the ejector and the punch, the SAM innovation achieves a reduced slug thickness. Depending on the slug configuration, the thickness can even be reduced to almost half of the original.

“With a combination ring 6008 blank, which has the ideal conditions for savings, we can save 25 grams of raw material—this is equivalent to 8% of the weight,” according to Carsten Sieber. “This generates an incredible saving of 250 metric tons for an annual volume of 10 million parts.”

Because the raw material is one of the greatest cost drivers in the manufacturing of forged parts, such saving potentials are critical to manufacturers’ productivity.

Additionally, raw material savings are collateral with reduced CO₂ emissions and reduced energy consumption, Hatebur noted.

Another new possibility with the technology is combining the piercing and separating of the rings. Thanks to the SAM servo-hydraulic drives this procedure is more controlled and has an increased process reliability, the developers report. The controlled movement of the module is made possible by the integrated position measurement system, facilitating the accurate piercing of the parts. The inner ring can be ejected in a slow, gentle way because the empty stroke is eliminated. Furthermore, both rings can be discharged on two separate tracks.

The SAM technology is available now for installation on HOTmatic HM35 hot forming systems. In the future the Hatebur developers plan to adapt the technology for integration in other machines models, too. 🛠️

“

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game changer.”

CARSTEN SIEBER

Hatebur product manager



The slim slug process allows for reduction of the slug thickness. In the production of a combination ring 6008 blank, 25 grams of raw material can be saved. [Hatebur]



The "lift-up" heat-treating furnace design from Nutec Bickley.

Multi-Furnace Upgrade Project for Steel Forger

A new function is available for installation at each forming step to vacate parts from the dies quickly and reliably, saving material and energy in production of roller bearings or auto parts.

Heat treating is almost always a critical finishing process for alloy- and carbon-steel parts, and a project getting underway now will modernize the heat-treating operation for a closed-die forger while minimizing disruption to its workflow. Nutec Bickley will install five new furnaces and a fully modernized combustion over eight months from May through December, one furnace at a time so that no more than one furnace will be out-of-service and production schedules will remain on track.

This contract covers installation of five new "lift up" furnaces, two for tempering and three for austenitizing. Each furnace will be outfitted with a comprehensively modernized combustion system (including replacement fans), advanced control systems, complete fiber flues, and new exhaust and pressure control systems, along with newly insulated casings.

The new combustion packages will be fully compliant with NFPA 86 standards, and the installations will include the complete supply of materials and instrumentation for the furnace combustion systems, plus new sets of air and gas piping.

Furnace operation will be based on a fuel-only control system (fixed air-modulating gas) to maximize temperature

uniformity potential for all cycles. The retrofitted furnaces will adopt high-velocity nozzle-mixing burners fitted with high-temperature burner blocks. These burners fire with a constant air volume while the control system regulates the gas input by modulating an impulse-bleed valve.

The new combustion systems will have automatic air-control valves on the main air manifolds that will allow operators to adjust the maximum air volume and lower the air supply to the burners, to ensure proper burner ignition conditions.

All controls and instrumentation will be mounted in a NEMA 12-rated console, arranged for simple and logical operation. Alarms will signal burner flame failure, loss of air, loss of fuel, and over temperature.

A new control panel will be installed next to the existing furnace panels, prewired and positioned before the furnace replacements begin. They will be wired across the quench pit to the local furnace areas prior to the first furnace being converted. This system will be designed in accordance with the NFPA 70 standard.

To achieve a completely coordinated command structure, a master PLC will integrate control for the five furnaces and

communication with the two existing quench tanks, manipulator/charging machine, the two panel views, the SCADA system, two recording units, and the central hydraulic system. The master PLC will be mounted in a separate NEMA 12-rated cabinet.

Each of the new units (9-in./23-cm-thick ceramic-fiber modules) will work to operational temperature ranges of 900°-1,950°F (480°-1,065°C) for the austenitizing furnaces, and 840°-1,600°F (450°-1,065°C) for the tempering furnaces. Installed thermal capacities will be 8 million Btu/h (2,345 kW) for the austenitizing furnaces, and 5.5 million Btu/h (1,612 kW) for the tempering furnaces.

As with all projects of this type, and noting the demanding schedule, careful teamwork between customer and supplier will be prioritized.

"We have long recognized the value of this approach, and we are committed to constant communication and status updates with our customers. In turn, they reciprocate with the same level of engagement in the process, resulting in a dynamic and mutually beneficial project result," according to Nutec Bickley vice president Rodrigo González. 🏆

Scanning—and Growing—for Forging and Machining

A specialty tool-and-die manufacturer is embracing the full potential of dimensional inspection technology for its large-dimension products.

Strohwig Industries is a family-owned tool-and-die manufacturer—and injection molding operation, and custom machining shop—founded 45 years ago, and now grown to cover 225,000 sq.ft. of working space in Richfield, Wis., with 180 employees. With 56 CNC machines and able to handle workpieces weighing over 100 tons, Strohwig is ready to handle large machining projects.

Brad Bucholtz, quality technician, explained Strohwig's mission as, "The design, manufacture, and repair of medium to large forging dies, plastic injection molds, and metal die casts, as well as the manufacture of custom contract parts and/or components." They machine various steel alloys (e.g., H-13, stainless grades) forgings and castings, and aluminum components too. Strohwig provides tooling and dies for manufacturers across a range of industries. That's why it approached Exact Metrology for dimensional inspection technology.

Bucholtz said the operation has been working with Exact Metrology, a division of In-Place Machining Co., for over a decade, initially for metrology services.

Exact Metrology is a metrology services provider, offering 3D and CT scanning, reverse engineering, quality inspection, product development, and 2D drawings.

Working with Exact Metrology, Strohwig bought a Hexagon Romer Arm in 2016 and Leica Tracker in 2019 - and later upgraded to a Romer RS6 scanner. The productivity increase easily justified the investment of the new arm/scanner.

And that new arm came in handy when Strohwig drew an order from a long-standing customer, a Midwestern open-die forger.

The new job required precise measurability of a large, forged part with complex geometry. Dean Solberg, Exact Metrology co-president suggested to Strohwig that they invest in scanning technology. That led them to purchase a Leica Tracker and adopting PolyWorks software.

The Leica Absolute Tracker AT960 has an "all-in-one integrated" single-box probing system with "smart" connectivity. Additional

features include continuous measurement, entry-level probing with T-probe, and two handheld laser scanners: an 8-in. line scan device and

a 24-in. line scan unit, to capture huge amounts of data quickly. The system is IP54-certified for protection against dust and other contaminants.

PolyWorks | Inspector™ was used to verify the quality of the part through of high-density point clouds and contact-probe datasets. ➔



The Leica Absolute Scanner is a handheld device for 3D scanning where high productivity is a priority. Working with the Leica Absolute Tracker AT960 range of high-end laser trackers, it makes possible previously infeasible large-scale 3D digitization. [Exact Metrology]

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MATERIALS HANDLING IS GETTING SAFER, MORE ACCURATE, AND MORE EFFICIENT

By Sheila Kennedy, CMRP

How products and materials are moved and controlled in manufacturing, warehousing, and logistics operations continues to improve. Robots, drones, and supporting software are getting more intelligent. Solutions are safer with greater environmental awareness and more efficient in their capabilities and performance.

Warehousing and Distribution Control

Preventing forklifts from colliding with pedestrians or other vehicles is the goal of iWAREHOUSE FieldSense (iW.FieldSense) from The Raymond Corporation. It's a new proximity notification system that warehouse managers can customize to fit their specific operations without significant infrastructure change, says Steve Gorr, Raymond's application manager for iWAREHOUSE Solutions.



Ware's inventory drone solution using a Skydio drone.
Image courtesy of Ware.

Compatible with virtually any forklift or vehicle, iW.FieldSense's magnetic field generation (MFG) technology sees through and around most objects and produces audible and visual alerts when a properly equipped pedestrian or vehicle comes within a predefined range. Also available are access controls and an infrastructure option that alerts vehicle operators to their proximity to protected structures.

The combination of Ware's warehouse inventory automation software and its partner Skydio's fully autonomous drones simplifies inventory data capture and reporting. Using drones to track inventory increases safety, accuracy, and efficiency. Leveraging AI-powered inventory reporting software that integrates into any warehouse management system (WMS) enables proactive control.

"The drones fly on a schedule defined in our software, Ware Cloud, which means warehouse operators can review inventory data provided for them, rather than having to cycle count manually themselves," explains Ian Smith, CEO at Ware. "We're also providing more detailed insights—enabling operators to locate misplaced pallets faster and increase accuracy—saving businesses time and money compared to manual inventory tracking."

Honeywell Track & Trace enables the monitoring and tracking of goods moving within the supply chain and logistics operations, including products within assets such as a vehicle, container, pallet or packaging box. In highly regulated industries such as pharmaceuticals, chemicals, and tobacco, having a reliable, accurate, and customizable tracking solution is critical. Honeywell Track & Trace offers serialization and tracking for real-time visibility and reporting at the micro-level.

According to Nitesh Rauniyar, general manager of Honeywell Connected Logistics, "Honeywell Track & Trace brings end-to-end traceability throughout the supply chain via a SaaS solution that organizations can scale to their business needs in order to operate more efficiently, drive more sustainable business processes, and achieve regulatory compliance."

Robotic Handling

A new IP69K-rated food handling robot meets USDA and FDA food safety standards. The DR-3iB/6 Stainless delta robot from FANUC, designed for picking and packing primary foods, operates with FANUC's R-30iB Plus industrial robot controller. With iRVision, an intelligent integrated vision system, and functions such as Force Sensing, Collision Guard, and Zero Down Time (ZDT), it helps food companies address increasing production demands while overcoming labor shortages.

"We paid close attention to our customers' request for a stainless robot that's able to withstand very stringent cleaning methods," observes Jessica Juhasz, staff engineer at FANUC America. "Cleanliness in food processing prevents outbreaks which can cost companies millions of dollars to recover."

The Guardian XT dexterous robotic system from Sarcos Technology and Robotics Corporation supports a wide variety of tasks, such as at-height pick and pack and operational maintenance and repair, through teleoperated or semi-autonomous operation.

The anthropomorphic robot's end effectors can "grab and operate a variety of off-the-shelf trade tools while working at height or on the ground, removing a human worker from dangerous scenarios and helping to combat fatigue-related downtime and occupational injuries," explains Jorgen Pedersen, chief operating officer at Sarcos. "It's also compatible with Sarcos perception software and autonomy algorithms for autonomous mobile manipulation in both structured and unstructured environments."



Sarcos' Guardian XT teleoperated dexterous robot.
Image courtesy of Sarcos Technology and Robotics Corp.

The OnRobot Palletizer, an automated palletizing hardware and software solution, comes with D:PLOY, OnRobot's new software platform for robotic deployment. "D:PLOY completely eliminates the need to create logic and program flow as well as program testing, debugging, and checking/measuring cell performance metrics. That cuts the time to deployment by up to 90%," says Kristian Hulgard, general manager of OnRobot's Americas division.

D:PLOY works with any robot arm and auto-detects and auto-configures all of the components in the palletizing cell, adds Hulgard. Users only need to define the box parameters, pick and slip-sheet positions, pallet size and pattern definition (which drives a lot of time in manual setups), and any obstacles in the cell. **NED**

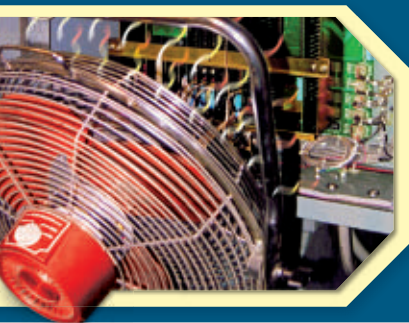
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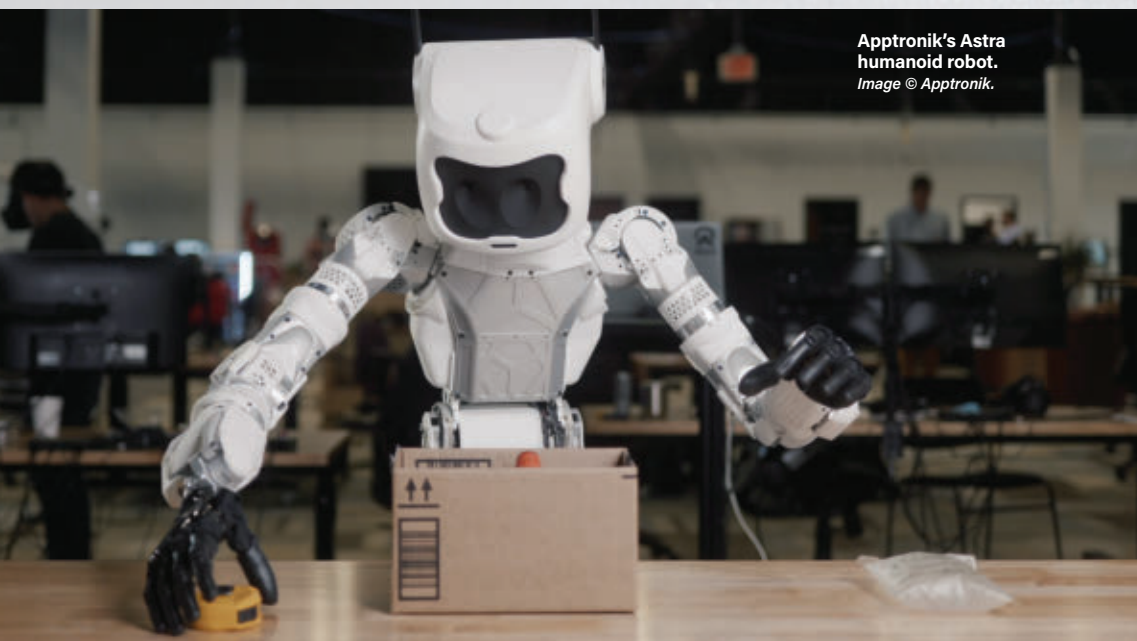
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BUILDING THE FUTURE



Apptronik's Astra humanoid robot.
Image © Apptronik.

By Laura Davis

Around six to seven years ago—give or take a few—there was a fervor in the industry and commercial markets about robots. Not just any robots—humanoid and mobile helper robots. There was the little robot Jibo developed at MIT by Cynthia Breazeal, the founder and director of the Personal Robots group at the Media Lab. It was this adorable three-axis bot that looked like a flightless, armless Eve from “WALL-E” and acted as a personal assistant for the home. Then Sophia, the social humanoid robot, was activated in 2016, which gives a much more uncanny valley feeling with her eerily-like human qualities—but not far off from what was presented in the movie *Ex Machina*. If you haven’t seen it, I suggest you do so soon. There were many, many others that have come and gone over the years, but ultimately, the fervor died down, and with it, so did these types of robots in favor of more practical and known robotic technology.

The Gartner Hype Cycle details where certain technologies are at in their evolution, and what we were likely seeing then is the excitement that the technology existed—the future was here. And that’s exactly what it was. Looking back at previous hype cycles, smart robots were just hitting their peak of inflated expectations around 2016 before dropping down into the trough of disillusionment; where we realized that we didn’t quite have the technology to support this just yet. We had all the pieces and parts certainly, but when combined together, it was clear that there was still a lot of work that needed to be done to make these robots tried-and-true.

As the editor of a product-focused publication, I see a lot of what’s new and the latest research and development coming out in the industry, and over the past six years, I haven’t noticed a whole ton of humanoid, legged or facial-featured robotics. Most of the robots in the past few years have been your standard industrial robots and cobots and we’ve of course seen a huge surge in automated mobile robots. What used to be only for warehouse transport applications has now become automated storage/retrieval systems, machining tooling transport, heavy-duty transport, picking, and more. So we’ve certainly seen the technology evolve, but there hasn’t been much going on in the public eye for humanoid robots. Sure, we’ve got Spot from Boston Dynamics, but the dog-like robot is only one of the very few humanoids on the market; it’s not where we thought we would be. I think we all thought we would have flying cars by now—at least I did.

But don’t fear. In the past year or so, I’ve started to see more and more coming out about new robots that can walk on two legs and take on dangerous tasks, strenuous tasks, undesirable tasks, and so on.

For example, igus, the plastic bearing specialist, recently presented a prototype at Hannover Messe in 2022. Simply referred to as the igus motion plastics bot, it’s designed to be a helper for such things as mowing the lawn, grocery shopping, or even laundry. And while it doesn’t have legs, it does have a fixed base with arms and can move around as AMRs do. Agility Robotics recently launched its warehouse robot Digit which is a bipedal robot designed to take on the strenuous activities workers routinely injure themselves with such as bending and lifting. Sarcos Robotics launched its Guardian XT robot that, while it doesn’t operate entirely on its own, can be manipulated remotely or semi-autonomously to take on jobs that are at height; anything from welding to pick-and-place.

But then I found out about a company named Apptronik, which has been in the game of researching, prototyping, and developing general-purpose, humanoid robots for years. I spoke with Jeff Cardenas, co-founder and CEO of Apptronik, to get insight into this next generation of robots that will change how we live and work.

The Beginnings

Jeff Cardenas always knew that he wanted to be an entrepreneur, especially in the area of high technology with hopes of building the future. “I had seen computers and then the internet. Then when I was in school, mobile was the big thing. So my lens was like, what’s the next big thing?” says Cardenas.

He ended up graduating with a degree in technology commercialization and became interested in the way the U.S. government was continually funding billions of dollars into research and development of core technologies that we see come to market—or more commonly, don’t end up really going anywhere.

This led him to start working in the Innovation Center at the University of Texas, scouting out what the next big thing in technology might be. This is where he met the other two co-founders of Appttronik: Dr. Luis Sentis and Dr. Nick Paine.

Dr. Sentis was running the Human Centered Robotics Lab (HCRL) at the University of Texas—and still is today—and Dr. Paine, who is now the CTO, was one of Dr. Sentis' first graduate students. Both of them were coming off of the DARPA Robotics Challenge (DRC) in 2012, having worked on the NASA Johnson Space Center Valkyrie team.

During the Fukushima nuclear disaster in 2011, the U.S. government started the DRC as a call to get people working on the technology we needed for disaster relief and recovery. Engineers and researchers went to town creating robots to do these extremely dangerous jobs not only so humans wouldn't have to put themselves in harm's way, but also so that we could respond in a timely and effective manner. The primary goal was to "develop human-supervised ground robots capable of executing complex tasks in dangerous, degraded, human-engineered environments". Competitors in the DRC developed robots that could use standard tools and equipment commonly available, ranging from hand tools to vehicles.

"From the moment I saw the Valkyrie I thought, that's it. That's the next big thing. And I was taken by this idea that I thought the more I learned about robotics, that, of course, robots are going to become more versatile just by the fact that they're so limited today. It's just a byproduct of where the technology is at that they're definitely going to become more versatile and ubiquitous," says Cardenas.

In addition to his interest in Valkyrie and what it could do, he realized that even though the industrial robot was invented here in the U.S., 100%

of all industrial robots were being produced in foreign countries. "And so I thought, robots are going to become more versatile and there's no one making them, especially here in the U.S. So I thought that it was worth pursuing. And that's our goal: to build one of the greatest robotics companies in the world," explains Cardenas.

After working with his co-founders through grad school, Appttronik became a reality in 2016 as a spin-off from the HCRL. It's clear that the full-stack robotics company is made up of engineers who truly love what they do, focusing on building general-purpose robots that are versatile and designed to work with and for humans.

The DRC spurred much interest and projects around these new robots, which led to the frenzy I talked about before around the mid-2010s. The DRC had its finals in 2015. However, these robots cost millions of dollars at the time, and were limited in what they could do. The biggest challenges they seemed to have were holding and grabbing objects, not to mention falling over, having trouble going up and down stairs, opening doors, etc.

So this is why Appttronik was founded: to set out to commercialize general-purpose robots and solve a lot of the technology challenges that were needed to bring them to market.

Over the past seven years, the company has built all sorts of different robots from humanoids to robotic arms to robotic exoskeletons and even robotic prosthetics. It's not just that they've been creating these robots and perfecting them, but they've spent a lot of time advancing the performance of these robots as well as the way that they're built, focusing on making them more affordable, flexible, lightweight, and easy for mass production and customization.

Over the past seven years, the company has built all sorts of different robots from humanoids to robotic arms to robotic exoskeletons and even robotic prosthetics.

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NASA's Valkyrie
bipedal robot.
Image © NASA.

"A humanoid has 30 plus motors in it compared to just a standard industrial arm. So you have to rethink the way you build it so that it's not four or five times more expensive than an industrial arm. And then you've had advances in edge computing and the underlying algorithms, both in perception and walking. A ton of technological advancement has happened since the DARPA Robotics Challenge to really kind of make these viable," explains Cardenas.

He goes on to equate that where we are right now with robotic technology is similar to the early 1980s and the rise of personal computers. They were great for their time, novel and exciting, but just the start of what's to come. And think about that, if someone put a 1980s Dell PC in your lap to use for work, you would laugh at them. While it's funny, it's also amazing how far we really have come. Those PCs turned into the phones we now have glued to us at all times.

It's a Spectrum

While at Stanford, Dr. Sentsis was one of the inventors of Whole Body Control, a seminal control theory for how you control something like a humanoid robot. He also worked on Honda Motor's Asimo robot while he was there, which appeared in 2000. The robot was renowned for its balance which allowed it to walk like a human with its seventh and last iteration walking at a speed of around 6 mph (9 kph). It maintained balance through the use of multiple sensors that analyzed its surroundings. In 2018, Honda announced that Asimo would be put to rest with its underlying technology now being used for physical therapy advances and self-driving vehicles. He also worked on one of the more commercial general-purpose robots, PR2 from Willow Garage.

Some members of the Appttronik team also worked on Boston Dynamic's Atlas robot, which was also a part of the DRC. And as I mentioned above, they worked on NASA's Valkyrie.

According to Cardenas, Valkyrie was the start of the industry—and Appttronik—really focusing on the building blocks to build these robots for unstructured applications. The company has worked on and helped create almost 40

completely unique electric actuators iterating on a core principle and properties for how you build a high-performance affordable system. And because of this, they've come up with new ways of architecting these robots which has helped to change the game.

Appttronik even took a crack at Iron Man for the U.S. Special Forces, which wanted a superhuman, full-body exosuit. So they created two different powered exoskeletons that could augment the human body. They've worked with two large automakers on their humanoid robot programs as well as with a range of different commercial and government customers. If you head on over to Appttronik's website, www.appttronik.com, you can see a snippet of some of their robotic builds and projects, which is not an exhaustive list by any means.

Then came Astra. The upper-body humanoid robot is designed for manipulation rather than dynamic movement as it doesn't have legs. It has state-of-the-art actuation packed into a small form factor and can be put on any mobility platform. It's force controlled, with series-elastic torque-controlled actuators, giving it the compliance necessary to work in dynamic environments and particularly around humans. It can lift roughly what a human can lift and has the same dexterity.

Appttronik has stated that they were "trying to approach and achieve the human-level capability in terms of manipulation workspace and payload. This robot taught us a lot about manipulation and actually doing useful work in the world, so that's why it's where we wanted to start."

Going Forward

The company is now focused on creating its first foray into a commercialized, general-purpose robot. Teaming back up with NASA, Appttronik is set to release the new robot this summer, stated to be sort of a continuation or second iteration of the Valkyrie robot. Cardenas says that general-purpose robots basically need two things: manipulation and the ability to be movable in an open world.

This means it needs dynamic walking like a human, strong balance, and the ability to handle different terrains.

"We've had a range of robots that we built over time that we've learned from and have basically taken all of that learning and now have put it into our next robot. I think it has taken decades for it to be the right time. After many, many iterations as a company, we've gotten to the point where we've said, 'Okay, we see all the pieces to where we believe we can build a robust, capable, affordable system that can really go out and do work'. It's still the beginning, but we're now at an inflection point where there's demand from the market, and we can get these out into the world," says Cardenas.

He goes on to say that the biggest challenge of humanoid robotics is the fact that a lot of different pieces have to come together. This means starting with building these robots in a way that makes them affordable. It requires a lot of iteration to truly learn how to



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“

In my opinion, it's really delivering on what robotics has always promised: this idea of highly versatile robots that can both be mobile and also manipulate the world around them. The stuff from the movies is now becoming more and more possible.”

JEFF CARDENAS
CEO and co-founder of Apptronik

build these types of actuators, drive trains, motor technology, and all other different components involved.

“When you build a robot in a new way, that means you have to control it in a new way. Because we have new architectures for these robots, the traditional architectures that have been used for industrial robots don't apply anymore. So then you have to rebuild entirely new ways of controlling these robots. And so that's a challenge. You have your own electronics, your own motor controllers, your own power electronics, batteries, computers, etc. With things like humanoids, the way you build it affects the way you control it. The way you control it affects the way you build it, creating this kind of feedback loop.”

Because of the complexity of this systems integration, Apptronik uses its own off-the-shelf components where it can. It leverages concepts and ideas from outside of robotics and brings them into robotics. Traditional robots were basically built for high precision over a long period of time, doing specific tasks and jobs. So, when trying to create a general-purpose robot that does many different tasks and jobs, it fundamentally changes the game for how it can be built.

This is why Apptronik and other robotics companies have to go more full-stack instead of relying on OEMs for components; there's no one that is able to fully control these robots at this time. But with the new advances in AI and the new ways of controlling these robots are allowing Apptronik to start on this next generation of robotics. They're able to bring in many different tried-and-true ideas, machines, and technology to make them a reality. And this is what he says is really going to accelerate the rate of innovation and change the game in the next five to 10 years. It will be a really fun and amazing time going forward and I for one can't wait to see what it brings. **NED**

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TECHNOLOGY



Universal Gripping Pad for Flexible Production

The **FORMHAND universal gripper** replaces product-specific solutions, making production and logistics more flexible. A freely deformable gripping cushion filled with granulate nestles close to the surfaces of the goods forming a sealed system; as soon as a vacuum is applied, it becomes firm and fixes the gripped object. This enables it to gently pick up objects with varied shapes without changing grippers.

The combination of the FIPALIFTpro tube lifter and the FORMHAND gripping pad creates an innovative gripping solution that safely picks up goods weighing up to 55 lb. (25 kg). Objects include ones without a flat surface and flexible goods, such as shrink-wrapped PET bottles or tinned food.

FIPA GmbH

More online: newequipment.com/21264631



AR Glasses Provide Fast Maintenance

CVision AR glasses enable Cimcorp's services team to assist customers remotely in real time for any maintenance issues. Backed by 24/7 support from Cimcorp experts, the glasses power two-way communication letting support see the problem firsthand through a live video feed from the customer's site—removing miscommunications and misunderstandings. Support also has the ability to add hand-drawn marks to the image to provide further directions or clarification. In addition, the glasses can translate over 100 languages, feature noise-canceling technology, and work by voice command.

Cimcorp

More online: newequipment.com/21264506

Unified Warehouse Automation Software

SnapControl is a multi-agent platform within the SnapFulfil WMS that creates a device-agnostic, uniform approach to automation. The software prioritizes the work for you, automatically assigning tasks and workflows, evaluating which devices or equipment best match specific operations, and capturing data to assess the value of each device. It connects to all types of devices in any possible transport method; if one type stops working, you can easily switch over to another device without stopping operations.

Synergy Logistics North America, Inc.

More online: newequipment.com/21262303



Mass Production of Metal Parts

Designed for mass production, the **Metal Jet S100** 3D printing solution is comprised of four different build stations allowing users to run production at scale for metal parts.

The four build stations include a powder management station, a 3D printer, a curing station, and a powder removal station. The thermal Inkjet printhead improves printing speed, part quality, and repeatability and HP's latex chemistries enable stronger green parts, eliminating the need for de-binding.

Binder jetting can boost productivity tenfold, allowing for processing layer by layer versus point process. Isotropic properties also require no post-processing and no support removal.

HP, Inc.

More online: newequipment.com/21264677

Wearable Android Scanner

The **HaloRing** all-in-one wearable Android scanner is an ergonomic solution that promotes wrist neutrality and only requires users to use their thumbs for operations. With a powerful processor, integrated connectivity, and a multi-color high-resolution display, it can be quickly deployed and managed in real time with the Quantum IQ device management platform.

At 2.6 oz. it increases productivity, reduces fatigue, prevents repetitive stress injuries, and works for right or left-handed workers. With its own OS, HaloRing isn't tethered or restricted to pairing with a nearby computer. Hands-free 1D/2D scanning allows workers to use both hands freely, maximizing efficiency and productivity.

IPCMobile

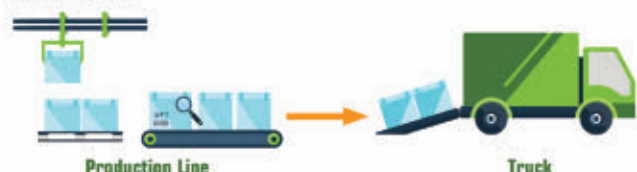
More online: newequipment.com/21264684



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Warehouse Production Scheduler

Make-n-Ship warehouse optimization platform optimizes loading products straight off the production line to better orchestrate production, warehousing, and transportation plans. Moving production runs directly to a truck eliminates touches, helps with labor shortages, and reduces the need for storage space in a warehouse or distribution center located at the manufacturing site.

The platform creates transportation requirements days in advance, re-schedules transportation as production

changes, and creates a recommended transportation plan. Additionally, it updates hourly on the need and timing of trailers and inventory along with issuing alerts to relay warnings such as a future trailer shortage—days in advance.

Autoscheduler.AI

More online: newequipment.com/21265032



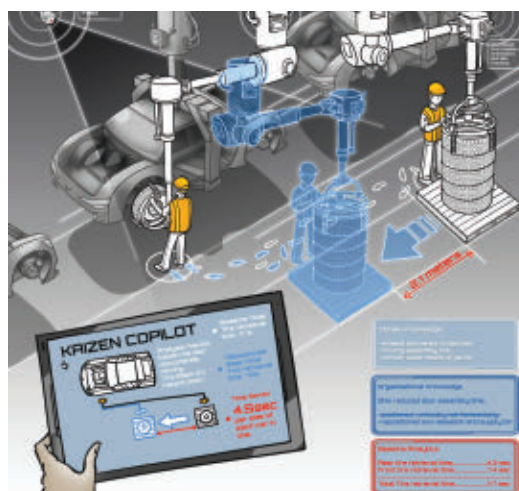
Full Productivity Platform for Frontline Professionals

RealWear App Marketplace is a platform that houses applications for professionals using RealWear devices. Users can choose from a host of purpose-built apps to enhance productivity and safety while giving management powerful tools to support their teams.

RealWear Connect, an app found exclusively within the marketplace, makes it easy to get help for workers and allows central operations teams to manage support requests more efficiently. When a support call is initiated by the frontline team wearing the RealWear device, the app triggers notifications within text or email, or in-app notifications in Teams or Zoom, connecting a worker to an expert in seconds. Once connected, the expert can see what the worker sees and guides them through trouble-shooting or maintenance.

RealWear

More online: newequipment.com/21265036



Industry-First Generative AI LeanGPT Solution

Kaizen Copilot, a LeanGPT application, assists engineers in designing and continuously improving manufacturing assembly processes and integrates Lean Six Sigma and Toyota Production Systems principles. LeanGPT is a proprietary foundation model specialized for the manufacturing domain.

The solution gathers LeanGPT foundation models, shop-floor analytics, and secure knowledge base training to generate valuable documentation, analyses, and ideas through a conversational interface. It also can connect to an organization's CI system, QMS, and MES in a secure manner. Kaizen Copilot autonomously accesses analytics through API calls to observe factory floor activity through computer vision and IoT sensors.

A tablet version will be released later this year to allow more freedom for engineers on the factory floor.

Retrocasual

More online: newequipment.com/21265039

The True Pioneer of Electric Actuators

RACO International, LP

RACO Electric Actuators provide a reliable solution for all of your linear and rotary motion needs. A variety of design configurations provide a multitude of thrust and speed ratings. RACO Electric Actuators are designed to be robust with virtually no maintenance while also being economical to operate and friendly to the environment.



RACO MA-Series

The modular design of RACO ACME and Ballscrew Electric Actuators allow for a variety of design configurations while offering a Linear Thrust range from 70lbs to 225,000lbs, Linear Rod Speeds from 0.2"/sec to 30"/sec and Linear Travel (stroke) up to 20 ft.

RACO LM-Series

The RACO LM-Series is designed for high speeds and long travel (stroke) with capabilities that are frequently found in today's automation processes. The LM can be used as a single axis system or can be combined to form a multiple axis system.



RACO Rotary-Series

The Rotary Actuator is designed to automate the operation of valves, gates, dampers, louvers and other positioning applications requiring partial or multi-turn rotational movement.



RACO International, LP

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Powerful, Secure Smart Glasses

Using the same form factor as the flagship **M400 smart glasses**, the M400C smart glasses come with an autofocus HD camera capable of streaming 1080p video at 60 fps, a crisp OLED display, a noise-canceling microphone, voice control, speaker, buttons, and touchpad, all built to IP67 standards. The glasses also mount to all M-Series mounting accessories.

The M400C is designed to function as a USB-C peripheral that can attach to a portable computer or smartphone supporting USB-C DisplayPort Alt Mode. The glasses remove IT overhead as they directly integrate into already approved mobile ecosystems and facilitate device consolidation.

Vuzix Corporation

More online: newequipment.com/21264574

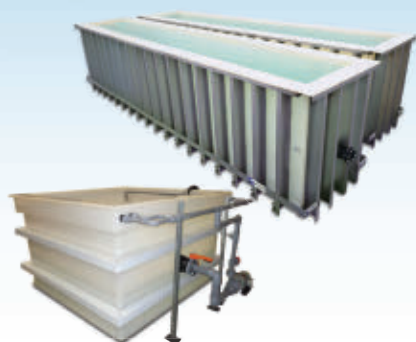
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Heads-Up, Hands-Free Maintenance

Moverio **BT-45C** and **BT-45CS** smart glasses are designed for troubleshooting, maintenance, inspection, and training, offering hands-free collaboration between on-site technicians and remote experts.

Both sets of glasses feature Si-OLED technology and a full HD display with a 34-deg. FoV to integrate digital content with the outside world. With the USB-C interface, the headsets work with a range of Android or Windows host devices. With high shock and dust resistance, the glasses withstand demanding environments and easily fit a variety of attire and helmet models.

The BT-45CS features everything the BT-45C does, except it combines the headset with an intelligent controller to help maximize ease of use while on the job.

Epson America, Inc.

More online: newequipment.com/21264621



Robotic Trim Press Handler

Enabling full automation of the entire thermoforming process—from resin to palletized product and for medium to high-volume production lines—the **Mantis Robotic Trim Press Handler** reliably handles the flow of parts ejected from any trim press.

The patent-pending Trim Press Receiver (TPR) uses a separating mechanism to count and contain stacks of product, followed by a raking mechanism to take the product into the receiver for transfer by the robot. The TPR presents the parts to a 6-axis robot that automatically transfers the product to a shuttle station, which integrates with downstream packaging functions.

The Mantis Robotic Trim Press Handler is compatible with all trim presses.

BMG

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Force-Controlled Parallel Robot

Moonlight is the world's first force-controlled parallel robot and is ideal for applications that require precise motion and force control such as screw fastening, ultra-accurate loading, and polishing. The robot can precisely measure force down to 0.1 N so that even delicate objects can be handled.

With high levels of repeatability and accuracy, the ability to be installed at any angle, and advanced AI integration, Moonlight is ideal for any application which demands flexibility, reliability, and adaptability.

Capable of completing tasks usually reserved for robot arms while maintaining the agility and speed of a parallel robot, Moonlight provides its operators with true operational versatility.

Flexiv

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Smarter, Connected Tires

To help OEMs improve vehicle safety and performance, the **Bluetooth Low Energy (BLE) Tire Pressure Monitoring System (TPMS)** enhances advanced driver assist systems (ADAS) and augments remote diagnostics support.

The tire pressure monitoring sensor replaces ultra-high frequency (UHF) radio with BLE radio to enable two-way communication, cyber security authentication, and adds a layer of protection from being hacked. These BLE TPMS solutions are available in clamp-in and snap-in configurations, have long battery life, and feature pressure, temperature, and auto-location capabilities.

With Over-the-Air updates, drivers can download tire-related features and software updates, enhancing their driving experience and avoiding a trip to the shop for service.

Sensata Technologies, Inc.

More online: newequipment.com/21264993



Make Every Second Count

Get Clear Signals

Visually, Audibly, Remotely.



World's First 5G Smartphone for Hazardous Areas

The **IS540.1** industrial 5G smartphone for hazardous areas helps companies further digitalize facilities and processes as well as fully utilize applications such as remote maintenance, IIoT, and AR.

The smartphone for ATEX and IECEx zone 1/21 features a Qualcomm QCM6490 chipset, a 6-in. display, a 48 MP camera, and standards such as Wi-Fi 6, Bluetooth 5.2, and NFC.

Peripheral devices such as a wired RSM (IS-HS2.1) for secure PTT/PoC communication, a high-performance barcode scanner (IS-TH2xx.1) or a thermal camera (IS-TC1A.1) can be connected via the 16-pin ISM interface.

i.safe MOBILE

More online: newequipment.com/21265027



Turn an iPad Into a Versatile Digital Readout

Offering machinists a new way to get Bluetooth-enabled digital readouts, the **ACU-RITE droPWR iOS app** is a first-of-its-kind to enable an iPad tablet to become a digital readout (DRO).

Bluetooth along with an IBT interface box in the system allows connection to multiple machine configurations in one tablet including for milling, turning, and grinding machines with up to 6 axes. Able to be moved and used with various machines, the app's split-screen functionality allows users to multitask and the dynamic zoom allows users to see the position value of the current moving axis from a distance.

The system includes software, an IBT interface box for the machine tool, and relevant encoders/brackets if needed.

ACU-RITE

More online: newequipment.com/21265002



5G "Router-on-the-Roof" for Vehicles, IoT

Built for vehicle and IoT networks, the **R2100 Series 5G Ruggedized Router** is an exterior-mounted solution that provides a high-bandwidth IoT or mobile router with the latest cellular performance in a flexible and simplified form factor.

Designed to be mounted on the rooftop of a vehicle or attached to IoT cabinet enclosures, the R2100 integrates the modem, antennas, and router into a single aerodynamic, IP67-rated casing that guards against weather, vibration, and shock. It's sold with or without Wi-Fi 6 and can be deployed as a self-contained router or to supplement an existing router as a 5G adapter.

Cradlepoint, Inc.

More online: newequipment.com/21264874



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Floor-Scrubbing Robot

automatically diverts debris, reducing clogs

Neo 2W is the first cleaning robot designed specifically for manufacturing environments to improve cleaning quality, efficiency, and productivity. Its Debris Driver, Bulk Navigator, and Advanced Obstacle Detection features combat debris found on the floor, navigate around small and large obstacles, and optimize the cleaning path. Additionally, swappable batteries deliver 6 hours of cleaning on a single charge.

Avidbots

More online: newequipment.com/21265042



Controllable Air Hammer

weighs in at 4.5 lb. (2 kg)

The **135MAX Heavy Duty Air Hammer** features a featherable trigger that allows technicians to maintain control and provide the accuracy needed for fine-tuned pin driving and sheering. The hammer makes quick work of tough tasks, including exhaust and front-end jobs, cutting stubborn bolts, and building or deconstructing control and knuckle assemblies. Ideal for vehicle, truck, bus, and heavy machinery repair, the tool is also well suited for maintenance, repair, and operations.

Ingersoll Rand

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Nimble Work Hiking Boot

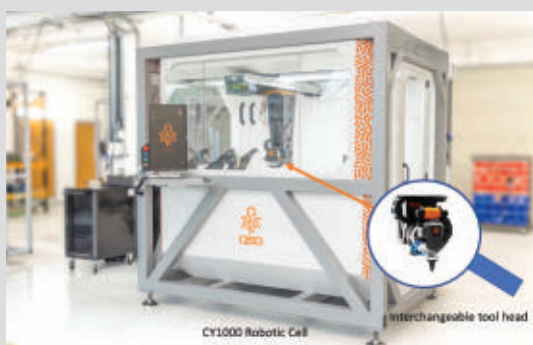
keeps you protected without the bulk

Available in two colors, the **Pittsburgh Energy** boot is a lightweight, medium-duty boot that features several comforts: a KEEN.ReGEN midsole that returns energy; a KEEN.DRY waterproof, breathable membrane; and a TPU shank for midfoot support. In addition to the cushioning and flexibility, safety features include asymmetrical carbon-fiber toes that are 15% lighter than steel and an oil and slip-resistant outsole.

KEEN Utility

More online: newequipment.com/21251157

FROM THE COVER



Robot Cell Automates Wiring Harness Production

creates 3D shapes, adds components, and connects them with precision

The **CY1000** is a 5-axis CNC additive manufacturing robotic cell that solves the most challenging automation issue: how to automate the addition of electrical connections in complex products.

The cell automatically adds components, connections, and conductors into products or components made of metal, ceramic or polymer through a unique process called 'Electrical Function Integration.' It eliminates the need for separate wiring harnesses, minimizes design constraints, improves reliability, and cuts costs.

Each machine can use a variety of specialized tools to add bare or insulated wire and extrude a wide range of polymers. Designed for either stand-alone use or integrated as part of a process line, parts can be formed by molding, stamping or other traditional methods before being loaded into the cell.

Q5D

More online: newequipment.com/21265052



PAC Light Curtains

offer 1 to 4-beam options

450L Perimeter Access Control (PAC) GuardShield safety light curtains are designed for whole-body detection. They eliminate the need for hard guarding and gates and allow safe access to hazardous areas. They allow each transceiver to be used as a transmitter or receiver via a plug-in module.

Rockwell Automation, Inc.

More online: newequipment.com/21250851

Precision Optical Instrument

scans and measures all points automatically

The **TurnCheck Series-14** shaft measurement system measures shafts, cylinders, and other turned, ground or extruded parts in demanding shop floor environments. The fully telecentric large field of view optics combined with highly collimated light at a constant wavelength results in a crisp, uniformly magnified image with no edge effects or exclusion zones.

Optical Gaging Products, Inc. (OGP)



More online: newequipment.com/21250619

Industrial Tire

features a wide footprint

The **MS700** tire is made with EcoPoint3 compound which allows the tire's liquid-mixed masterbatches to be produced with less filler, higher ratios of stress at elongation, and minimum impurities. This allows for skid, wear, and rolling resistance for a more energy-efficient tire. It features a 5-deg. sidewall taper and a unique tread for optimal traction and tire life.



MAXAM Tire

More online: newequipment.com/21250844



Reliable Milling System

eliminates incorrect indexing of front and helix inserts

Featuring double-sided helix inserts with 8 cutting edges, the **Helical SN8-13** milling system lowers the cost per edge to boost slotting, side milling, and circular rough milling efficiency. Built for applications involving ISO P, M, K, and S materials, the cutters offer specific sub-family designs featuring left or right-hand helixes, half or full-effective teeth options, two front inserts, and many radii choices.

Seco Tools, LLC

More online: newequipment.com/21252153

Handheld Temperature Calibrators

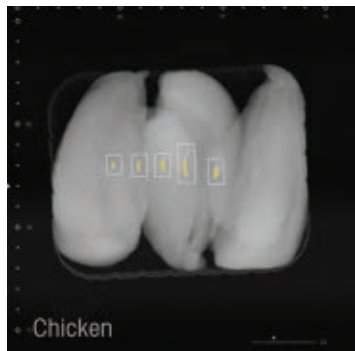
are rated for hazardous environments

Two high-accuracy handheld temperature calibrators—**TEGAM 947A** and **948A**—are intrinsically safe, wireless data-logging options for hazardous environments. The 947A supports 14 thermocouple types and is UL, CSA, ATEX, and IECEx-certified. The 948A offers integrated Bluetooth communication with any software running on a Windows, iOS or Android platform. Both feature simultaneous source/measure functionality and resolution to 0.01°C with an accuracy of $\pm 5 \mu\text{V}$.

Advanced Energy Industries, Inc.



More online: newequipment.com/21265045



Food X-Ray Technology

provides detection of hard-to-find contaminants

DXD and **DXD+** dual energy detector technology identify foreign bodies such as calcified bone, low-mineral glass, rubber, and some plastics. The technology improves the ability to detect low-density contaminants in packaged food products, helping food manufacturers avoid recalls, reduce waste, and enhance product integrity.

Mettler-Toledo, LLC

More online: newequipment.com/21252040



Leveling Feet for Heavy Machines

are suited to compensate for an uneven floor

Two solid machine feet families are particularly suited for large and heavy systems and machines. The **GN 36** uses the weight of the machine to create a stable connection between the threaded stud and the foot. The **GN 37** also has a central fastening hole running clear through which allows the use of an anchor bolt to secure the foot to the floor, preparing it for lateral loads. Both models are offered in three different types: (A) no rubber pad, (B) with a rubber pad, and (C) with an O-ring.

J.W. Winco, Inc.

More online: newequipment.com/21258616



Configurable Lift Truck

features a Dynamic Stability System

Available in the 4,000 to 7,000 lb. (1,814 to 3,175 kg) capacity range, the **GP40-70N** models are the first lift trucks in the Series N lineup. Along with its configurability, these models come with standard features such as an operator-centric design, enhanced visibility, safety and productivity, and low total cost of ownership.

A large, strategically located step, generous grab handle, and contoured hood make it easy for the operator to get on and off the truck. A spacious compartment with easily adjustable controls helps operators stay comfortable. The low dash and wide mast help to enhance visibility of the fork tips and load when picking, placing or traveling forward.

The GP40-70N can be ordered with optional operator assistance systems designed to further support operator and pedestrian awareness and help prevent facility and product damage in specific applications. These technologies include a rear-facing camera and rear-view display, spotlights and pedestrian awareness lights, and pre-set lift height selector.

Yale Materials Handling Corporation

More online: newequipment.com/21256585



High-Capacity Reach Truck

gives the driver an optimal view in all directions

The **NexX** multidirectional reach truck is ideal for use in cramped storage rooms and narrow aisles. In addition to long goods, users can also transport standard-sized loads of up to 3 t. With its compact design and multidirectional steering, the truck allows users to make better use of their existing storage space. With the HX steering, the truck can quickly switch between longitudinal, transverse, and circular travel.

HUBTEX Maschinenbau GmbH & Co. KG

More online: newequipment.com/21256198

Durable Trailer Bulkheads

protect product integrity throughout the cold chain

The **TBH Series** insulated trailer bulkheads are available in a two-panel, bi-fold design or in a three-panel, Z-shaped configuration that can accommodate odd-number pallet configurations between temperature zones. A single TBH Filler Panel is also available for situations in which an individual bulkhead panel is needed. Made of Arcel resin, the ClimaTrek bulkheads are rugged enough to minimize the need for frequent replacement, yet lightweight and ergonomically sound enough to allow for easy maneuvering and repositioning.

Rite-Hite



More online: newequipment.com/21248451

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FROM THE COVER



Back-Assist Exosuit

removes 75 lb. of strain off workers' backs
The **Apex 2** back-assist exosuit provides assistance for men and women who perform lifting and sustained or repeated bending, reducing the risk of back injury without restricting their freedom of movement. The suit weighs less than 3 lb. and can remove 75 lb. of strain off of a worker's back with every lift.

The modular design fits all body types; elastic bands stretch as your muscles extend during movements, then recoil as your muscles contract, returning energy and assisting with every bending motion. The patent-pending switch makes it easy for users to activate assistance when they need and deactivate it when they don't.

HeroWear, LLC

More online:
newequipment.com/21264589



Harsh-Duty Photoelectric Sensors

offer light-on or dark-on operation

Eaton **E58 series** M30 photoelectric sensors feature stainless steel, PVDF, and tempered glass components that are assembled with Vitron seals to ensure resistance to chemicals and moisture. The sensors are available in diffuse reflective with background suppression, retroreflective, polarized reflective, and through-beam models. All models offer good excess gain, allowing them to function in heavily contaminated applications.

AutomationDirect

More online: newequipment.com/21251290



Cable Reel LED Lights

feature adjustable steel hooks

Three industrial-duty **LED Lights** are available on the C (Dual Purpose) reels. They feature a range of industrial-grade features and options, including a 50,000-hour rating, internal light diffusers, and shatter-resistant polycarbonate lenses. Whether you're looking for a compact light (-M), a light with additional power (-K) or an industrial-duty, UL-Listed light (-H), these reels complement a variety of applications.

Coxreels, Inc.

More online: newequipment.com/21251262

Indexable Milling Grades

are suitable for wet or dry cuts

Increasing productivity in cast iron and compacted graphite cast iron machining, the **KCK20B** and **KCKP10** grades offer higher wear resistance and longer tool life. Both grades offer consistent performance during roughing, semi-finishing, and finishing operations. They feature a golden top layer for fast, easy wear identification, ensuring maximum tool life for each cutting edge.

Kennametal, Inc.

More online: newequipment.com/21251142



Automotive Relays

are capable of switching up to 145V DC

The **A3K Series of Automotive Relays** use a blow-out magnet to break the arc that's formed when the contacts of the relay are opening. With a large switching capacity of up to 80A, the series is available as 1A or 1C, offers resistor and diode options for coil suppression, and is available with or without a mounting bracket.

CIT Relay & Switch

More online: newequipment.com/21252667

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Tel-Tru Mfg. Co.

More online: newequipment.com/21259665

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print high-quality receipts from almost anywhere

Mobilink TM-P20II, TM-P80II, and TM-P80II

Plus portable receipt printers offer a sleek and modern enclosure, rugged design, and wireless connectivity. The compact printers are small, lightweight, and easy to carry for a variety of indoor and outdoor applications. The printers have an IP54-rated enclosure, a fast-charging time, and a long battery life of up to 48 hours. Additionally, the printers can integrate with iOS, Android, and Windows platforms through Wi-Fi, Bluetooth or USB-C cable.

Epson



More online: newequipment.com/21265047

Intuitive Digital Torque Wrench

features an LED display ring on the handle

The reliable **OPEXplus** digital torque wrench can measure both the torque and the angle of rotation. It covers a range of torques from 3 to 800 Nm, and it transfers the tightening results to any IT system without the need for additional control. The wrench allows fatigue-free work with its ergonomic design. The wrench's camera-based scanner uses an optical aiming device to read in barcodes and QR codes and transfer them to higher-level systems quickly and correctly.

Bosch Rexroth



More online: newequipment.com/21253890



Variable Speed Drive Compressor

The sustainable **GA VSDS** energy-efficient compressor reduces energy consumption by adjusting the motor speed to the fluctuations in compressed air demand. It has a minimal number of components and features an IE5 ferite-assisted synchronous reluctance motor. It will be available first in the 30 to 50 hp (22 to 37 kW) GA oil-injected screw compressor range.

With up to 20% higher free air delivery than a fixed-speed equivalent, users can select a lower horsepower compressor and still get the air they need. The Smart Temperature Control system ensures the compressor operates with an optimal oil temperature at all times. It also comes with Boost Flow Mode, giving users the ability to safely exceed their compressors' maximum capacity temporarily. Additionally, the compact design and low sound levels allow it to be installed on the production floor.

Atlas Copco Compressors, LLC

More online:
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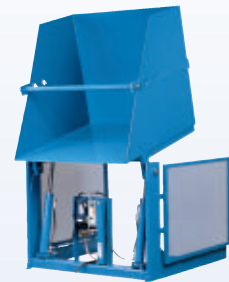
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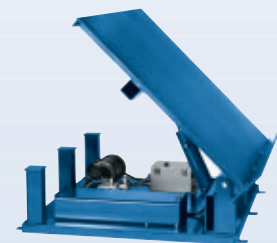
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Digital Machine Safeguarding System

protects against unauthorized restart
Preventing unauthorized machine restart, the digital **"Key-in-Pocket" system** is a flexible safeguarding device that ensures machines do not restart while maintenance work is being done and that unauthorized personnel do not gain access.

The system is based on the access permission system PITreader and is implemented using the configurable PNOZmulti 2 controller or the PSS 4000 automation system. Users are given an RFID key with their individual permissions, creating a personalized security ID that is stored in the controller and is kept in a safe list. Once authenticated, the machine can be shut down and accessed for maintenance. "Key-in-pocket" offers an alternative to mechanical LO/TO systems, providing more flexibility, security, and traceability.

Pilz Automation Safety

More online:
newequipment.com/21264510



Modular 5-Axis Pull Clamping System

eliminates tool interference during workpiece machining

Compact in size and completely modular, this **5-axis pull clamping system** allows height adjustment by coupling the modules. It's designed to eliminate tool interference during workpiece machining. The pins or screws can be

attached to the underside of a plate or a workpiece for a standardized locating base on the position of the clamps.

Locating repeatability is 5 microns. Styles include flanged type, single and double type, as well as hook type. Together with the bushings, pins and clamping screws, this modular pull clamping system is designed to save space and increase efficiency in a variety of clamping applications.

Fixtureworks

More online: newequipment.com/21261597

MIG Welder Machine

is compatible with push-pull guns

Allowing operators to weld a variety of materials, the **Millermatic 355** MIG welder is an easy-to-use power source designed for fabricators and manufacturers. With the ability to work in many environments, it can operate on single-phase or three-phase AC power. The machine provides MIG and pulsed MIG capabilities for mild steel, aluminum, and stainless steel in thicknesses from 22 gauge to 0.5 in. (12.7 mm).

Miller Electric Mfg.



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drums, totes, and in bulk for wheel bearings in refractory plants, paint lines, drying ovens, sealed-for-life units, automatic lubrication systems, lithographic chains, and more.

Renewable Lubricants, Inc.

More online: newequipment.com/21265479



Specialized F Connector Tool

accesses tight spaces

The **Extra Force F Connector Tool, 12"** (RFX-12) helps installers access F connectors in narrow spaces or high-density locations where cables may be twisted, bent or corroded, making them difficult to remove. It's specifically designed with a heavy-duty socket welded using premium materials to withstand high amounts of force and torque.

Jonard Tools

More online:
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Open System Platform

includes five powerful elements

iCube Control (i³ Control) is a single control technology that puts engineers, application developers, machine builders, and designers in total control over their systems. The platform consolidates a variety of automation controls into one centralized controller, allowing for seamless and secure collaboration by teams across different locations. It combines powerful, modular hardware with a flexible software infrastructure, is easily scalable, and is fully customizable to meet individual needs.

Yaskawa America, Inc.

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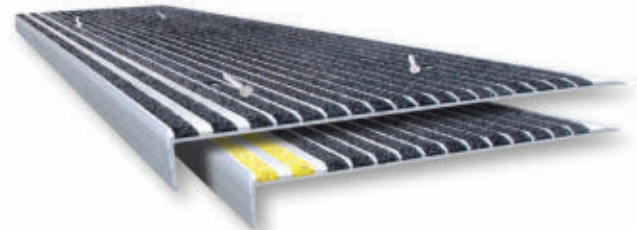
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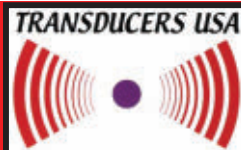


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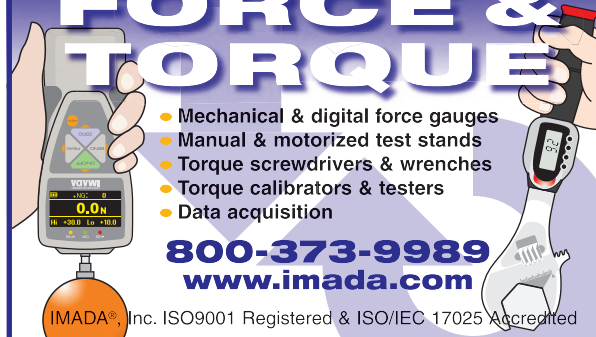
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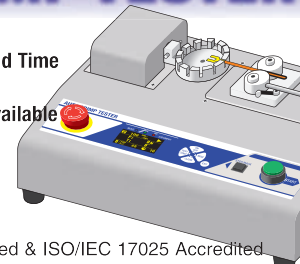
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Continuous Power Platform *brings continuous motion to automated robot fleets*

CaPow's **Genesis** system is a battery-free, wireless, energy delivery ecosystem for autonomous robots that provides continuous power while eliminating robot downtime due to charging. It eliminates the need for batteries or stationary charging ports and is immediately scalable and industry-agnostic—it can be integrated into any hardware and deployed in any facility.

CaPow

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Self-Cleaning Inline Strainer *operates continuously as a sealed device*

The **GS-288-C** self-cleaning filter for process flows of up to 2,500 GPM works continuously without bags or elements, reducing downtime from filter changes. Interchangeable Wedge-wire or perforated screens of various openings allow one strainer to be used for multiple applications. The product to be filtered enters the strainer through the inlet, with filtration occurring from the outside in. Screened particulate accumulates within the canister and is purged through the bottom drain as needed. Purged particles are piped away for disposal, recycling or re-use.

Spencer Strainer

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Full Line of Round Bumpers *come in many sizes, styles, and configurations*

A complete line of inch and metric rubber and polyurethane bumpers are now available from Fairlane. Designed to guard, stop, align, and protect machines or workpieces, the round **bumpers** are available in inch and metric sizes with a variety of different styles. The bumpers, commonly identified as RB-516, come in mounting options such as tapped hex shoulder and threaded, stud mount, and steel plate mounted.

Fairlane Products

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FROM THE COVER



The Dolly Mover AMR

instantly calculates new routes when faced with obstacles

The **Omnidirectional Dolly Mover (ODM)** accepts loads with a maximum weight of 661 lb. (300 kg) to a maximum lifting height of 10 in. (250 mm). The compact vehicle travels autonomously and navigates freely on the production floor or in the warehouse, ensuring in-house material flow.

ODM uses an omnidirectional drive concept allowing it to travel transversely into rack aisles and turn on the spot, enabling it to maneuver even in the tightest spaces. Autonomous route-finding also enables vehicles to avoid obstacles unaided. If it's impossible to get past a detected obstacle due to its size or the available clearance, the AMRs calculate a new route within seconds to reach their destination as quickly as possible.

The LiFePO4 accumulator ensures short charge times and long operating cycles.

AGILOX

More online: newequipment.com/21264961

Large Diameter Drilling Machine

has 3-axis capability

The **TechniDrill TBTA-3A-6** is a deep-hole drilling machine using the Boring & Trepanning Association process. It can drill a 6-in. (152 mm) diameter hole from solid in a single pass and has 3-axis capability. The work table moves horizontally back and forth to provide the X-axis travel, and the drill slide moves vertically on a column to provide the Y-axis travel. The spindle motor is available with up to 75 hp.



Kays Engineering, Inc.

More online: newequipment.com/21265489



Enhanced Coolant Chiller

monitors and maintains cutting zone

Chipblaster CC 34K SA Chiller maintains optimum temperature of CNC machine coolant and cutting tools to ensure accuracy, extend tooling life, and improve through-

put. A touchscreen HMI makes it easy to change temperature settings and monitor all activities. The high-efficiency scroll compressor reduces vibrations for quieter operation and the parallel, double-cartridge filters enable 10 or 5-micron coolant filtration.

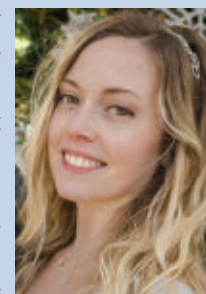
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FROM THE EDITOR

A Different Kind of Skills Gap

I recently read an article about how Gen Z, dubbed the digital-native generation, is one of the least technologically-savvy generations getting into the workforce, which really surprised me. I'm a millennial and I assumed that all the tech experiences that I grew up with would be no different than the generation right under me. When I think about it though, I can see why.



I grew up with computers just coming into the home, dial-up internet, floppy disks for saving your work at school, computer typing classes, all the iterations of digital music and mp3 players, and so on. There was a lot of advancement while I was in school that required us to learn the technology as it evolved.

Gen Z is anyone born from 1996 to 2012, and they're kind of in that space where things haven't stalled, but for the most part, they haven't changed that much either. Smartphones are still smartphones, every app essentially operates the same way, and they're not spending the bulk of their time traversing a computer as the older generations did. We learned how to accurately use search engines using Boolean operators (which are still useful, by the way).

It's not their fault though. They had smartphones a lot younger in age than I had my first cell phone. They had their parent's tablets and smart TVs to play around with where there was no such thing for us. Instead of spending after school chatting through AOL instant messenger, they're texting, Snap-Chatting, and Tik-Toking—consuming media all day, every day.

What they mostly learned was how to scroll and click—no one taught them how to use computers because a lot of the technology they grew up with was fairly flushed out already. No one thought they needed to be taught since they were already immersed in it. And this is a problem now as some of them start to enter the workforce. Most jobs are still using computers, copiers, emails, corded phones, etc. And if you think this seems crazy since these are pretty simple devices to operate, just ask a teacher of middle schoolers or high schoolers right now.

When I had my first job out of college for a wire service, I was shocked at the state of the technology this large company was using. Our system would go down more than you would expect, the computers lagged and overall, it felt like we were using equipment and technology from the early to mid-2000s rather than the mid-2010s. But I still knew how to use it.

Schools aren't much different either in this aspect. New equipment and technology require investment, and most schools don't have that kind of money and companies don't really either; and if they do, they would prefer to try and get by with what they have if it works.

So imagine the disconnect Gen Z will face or has already faced when entering the workforce. It's something that needs to change and if it doesn't, it will only create an even bigger skills gap than the one we have already.

— Laura Davis, Editor-in-Chief

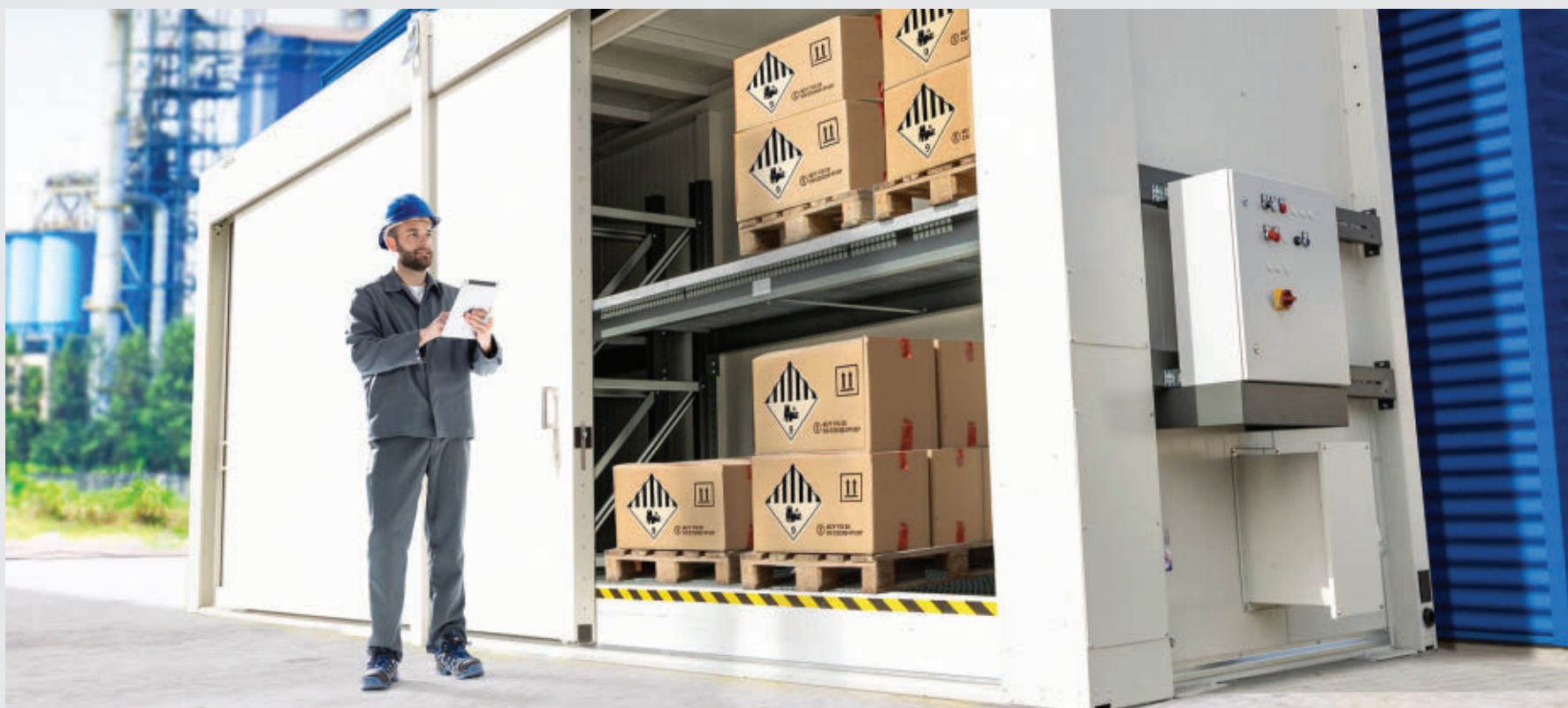


Image courtesy of DENIOS.

The **KEYS** to Safe Lithium-Ion Battery Storage

By Shannan Jones, DENIOS

SINCE THEIR LAUNCH IN THE EARLY 1990S, lithium-ion batteries have gradually replaced old technologies due to their high performance and compact design. They are pervasive, with new uses being adopted seemingly every day in a wide range of industries.

While this technology has significant advantages over its predecessors, lithium-ion batteries are not as safe as you might imagine. Incorrectly handling lithium-ion batteries is potentially hazardous. Explosions or fires from lithium-ion batteries can have disastrous consequences with equipment, facilities, and, in the worst case, people being harmed. Because of these risks, it's critical to understand the dangers of lithium-ion batteries and how to safely store and charge them.

How Lithium-Ion Batteries Work

There are many different types of batteries where lithium is used in a pure or bonded form. However, these lithium cells fall into two categories, secondary or rechargeable cells, and primary or non-rechargeable cells. We'll focus on the secondary, rechargeable type.

Inside each lithium cell, there's a positive and a negative electrode—the anode and the cathode—with an ion-conducting electrolyte between them. This ensures the transport of the lithium ions between the electrodes during the charging and discharging processes. The separator is also an important part of the device because it stops direct contact between the anode and cathode to prevent a short circuit.

During the discharging process, lithium ions and electrons are released on the anode side. The electrons flow through the external circuit and perform electrical work. At the same time, the lithium ions cross through the electrolyte fluid and the separator over to the cathode.

Common Issues

Lithium batteries can present a considerable safety hazard if they are incorrectly handled or stored. Some common issues with lithium-ion batteries are fire hazards due to thermal runaway, deep discharge or mechanical deformation.

Thermal runaway can be triggered by thermal loads, mechanical damage or factory defects. This is an exothermic reaction, which can ignite the stored lithium and cause an extremely hot fire that produces its own oxygen. Then, high levels of heat energy vaporize the electrolyte fluid, creating additional heat and combustible gases. If the ignition temperature for a gas is exceeded, it will ignite and set fire to the battery.

Thermal propagation can create a devastating chain reaction that once set in motion, only takes a few minutes until the battery burns and explodes. These thermal runaways are especially dangerous since they are often caused by short circuits that are not apparent upon visual inspection.

If lithium-ion batteries are not used for a long period of time, they can completely discharge. Decomposition of the electrolyte liquid can then lead to the formation of easily combustible gases. If an attempt is made to recharge a discharged lithium-ion cell, the supplied energy can no longer be correctly converted due to insufficient electrolyte fluid. The resulting deep discharge can result in a short circuit or fire.

Lithium-ion batteries can be damaged during handling, including collisions with operating vehicles or being dropped. This can lead to internal short-circuiting and fire within the battery if the cells are deformed as a result. In rare cases, it's possible that particles that are falsely released into the cell during production can damage them from the inside over time with internal short circuits as a possibility.

Safe Storage Solutions

Because of the risks behind lithium-ion batteries, many companies use fire-safe cabinets to store their batteries when not in use. Fire-safe cabinets can store new, questionable, damaged, defective or end-of-life batteries of all shapes and sizes. The key benefit of these cabinets is that they offer companies up to two hours of fire resistance. Storage cabinet solutions can also double as rechargeable centers for batteries. This allows the batteries to safely recharge overnight or in off-hours when there are fewer (if any) people present.

As mentioned before, the placement of batteries is critical to safety. This holds true for storage as well. Lithium-ion battery storage cabinets should keep them away from any other combustible material. Storage solutions can also feature transportation bases to allow for quick and safe cabinet removal from a facility should the need arise.

While there are no clear regulations and requirements for safely storing lithium-ion batteries yet, that shouldn't stop organizations from taking the necessary steps to provide suitable storage and charging solutions for lithium-ion batteries. Failure to do so may result in companies being personally liable by insurers if inadequate fire measures are taken.

In all safety cases, preparation is key. Whether you are currently using lithium-ion batteries or are planning to soon, knowing the dangers they present and having an action plan to mitigate their harm can help you prevent the worst-case scenarios. **NED**

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The Atlas Copco logo, featuring the company name in a stylized, italicized font, is centered within a blue rectangular box. The box is positioned in the upper right corner of the page. The background of the entire page is a black and white photograph of a man in a workshop, looking intently at a large, curved metal component, possibly a turbine or compressor part, which is the focus of his work. The lighting is dramatic, highlighting the metallic surfaces and the man's concentration.

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