t·time

A MAGAZINE FROM TRELLEBORG GROUP | 1-2019

Solutions that seal, damp and protect critical applications.

PLUS
SEALS THAT DIDN'T FAIL

ALTERATIONS UNDER THE HOOD

HOW TO TACKLE A SHORTFALL OF ENGINEERS

PROTECTS THE ROOTS

Steep, muddy terrain and narrow rows are no problem for Trelleborg's Pneutrac tires.

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Cover photo:
Shutterstock

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Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way. The Trelleborg Group has annual sales of about SEK 34 billion (EUR 3.32 billion, USD 3.92 billion) and operations in about 50 countries.

The Group comprises five business areas: Trelleborg Coated Systems, Trelleborg Industrial Solutions, Trelleborg Offshore & Construction, Trelleborg Sealing Solutions and Trelleborg Wheel Systems.

The Trelleborg share has been listed on the Stock Exchange since 1964 and is listed on Nasdaq Stockholm, Large Cap.

TRELLEBORG

EDITORIAL

HEALTHCARE INNOVATIONS

In recent years, Trelleborg has acquired several companies in the field of healthcare & medical. Acquisitions can quickly establish or strengthen our positions in selected segments, niches or product categories. The healthcare & medical industry is showing strong growth and demands polymer-based excellence, so its challenges fit our company very well.

In this issue of *T-Time,* we write about Trelleborg's contribution to a breakthrough in the treatment of burns and chronic wounds, and how polyurethane-coated fabrics are used in hospital mattresses to suppress the development of pressure ulcers. Both of these innovations are now being developed and strengthened using Trelleborg's other competencies related to these applications.

Another important topic is what can be done to attract more men and women to the engineering profession. We do a deep dive in this area on pages 24-27.

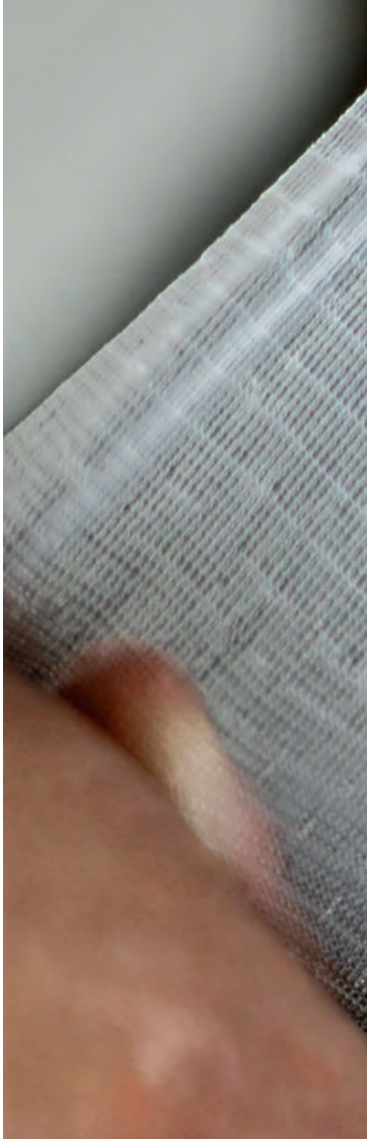
Peter Nilsson,
President and CEO

PermeaDerm, with a non-sticky moist surface, soothes pain, allows wounds to breathe and helps to prevent scar tissue from forming.

When pioneering burn and chronic wound care, specialist Dr. Aubrey Woodroof turned to Trelleborg to help bring his groundbreaking healing concept PermeaDerm to market, the collaboration gave rise to a range of biosynthetic skin products that have taken treatment to a whole new level.

TEXT BIRGITTE VAN DEN MUYZENBERG **PHOTO** GETTY IMAGES AND PERMEADERM

BURNING MATTERS



It takes a special person to invent something revolutionary, and Aubrey Woodroof is one of those people. In the academic and medical community, Dr. Woodroof is known for his pioneering treatment of patients with burns and chronic wounds.

Dr. Woodroof is the inventor of PermeaDerm, a groundbreaking acellular biosynthetic skin substitute. He and Paul Butorac, Principal Development Engineer at Trelleborg Sealing Solutions, have spent the past three years working to transform his dream into a market-ready range of products. In addition to Butorac, a key team of specialists at Trelleborg in Tustin, California, US, have worked together to make PermeaDerm a reality, including Sean McPherson, Sales Engineer, Healthcare & Medical, and Mark Gordon, Product Manager.

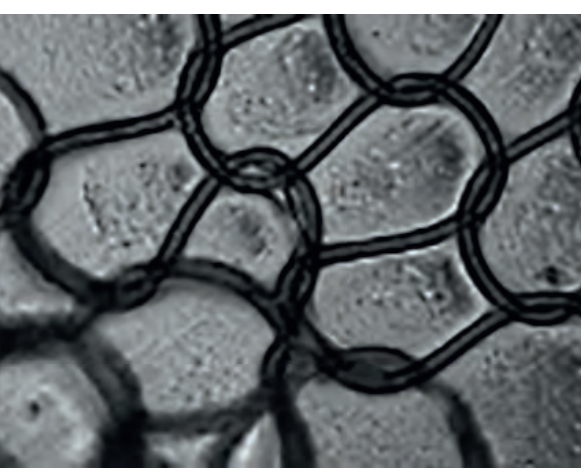
"When Dr. Woodroof first called us in 2014, he was hoping that we would be able to provide just the silicone element of his proposed wound dressing system," McPherson says. "Little did he know that we would actually be able to bring a whole range of capabilities to the table, including raw material research and selection, equipment design, process development, packaging, validation and sterilization management."

While Dr. Woodroof had a theoretical concept and some basic handmade prototypes, Trelleborg was able to provide drawings, material controls, work instructions, certification of active ingredients, a quality control system and a manufacturing system. This would ultimately produce a high-quality marketable product while securing global regulatory acceptance for a complete combination drug-and-device solution, in other words, the entire framework that would make his products a success.

Dr. Woodroof had a winning concept but the manufacturing strategy involved in bringing it to market was complex. "It was quite a challenge to develop and optimize a manufacturing process that would make this whole project feasible," Butorac says. "At the beginning, the work was very manual – for example, we were sizing product with scissors. This was never sustainable. We systematically applied our quality management framework and manufacturing expertise to help PermeaDerm achieve clinical success and commercialization of their products.

"It was very gratifying to see how excited our operators were to come on board for PermeaDerm production. Extensive training was conducted to educate and motivate the operators, to ensure the process was consistent and to help continuously improve quality while reducing manufacturing times. By providing a complete manufacturing solution, we helped Dr. Woodroof focus on writing critical scientific publications, identify new investors, promote PermeaDerm and develop new ideas."

Below: The view through a microscope shows the makeup of the nylon matrix that underlies PermeaDerm products.



The power of PermeaDerm

PermeaDerm is a biosynthetic skin substitute for the temporary treatment of burns and chronic wounds. This thin, elastic, non-adhesive, porous covering material is made of a three-dimensional nylon matrix embedded in silicone, with a collagen and aloe vera extract coating.

With its non-sticky moist surface, it soothes pain, allows wounds to breathe and helps to prevent scar tissue from forming.

Products include PermeaDerm B for burns, PermeaDerm C for chronic wounds and PermeaDerm G gloves.

Butorac continues, "Working with such a significant yet elegant solution designed to help patients recover from their wounds and change their lives makes for rewarding work gives and a great sense of fulfillment.

"We have observed the remarkable healing process in patients after treatment with PermeaDerm, often with reduced pain and scarring as a result. Having seen the results of this work, it feels really good to collaborate with and contribute to Dr. Woodroof's success."

Dr. Woodroof commends the Trelleborg team's effort, support and manufacturing expertise. "I have been fortunate to play a role in advancing the art of medicine for the successful management of acute and chronic wounds, such as diabetic ulcers, and burns with PermeaDerm," he says.

The demand for biosynthetic wound and burn care solutions is significant, with burn centers and long-term wound-care providers always on the lookout for new, effective forms of treatment.

When this article was written, the team was busy developing PermeaDerm G – the "G" is short for glove. People's hands are more susceptible to burn wounds, and the demand for an effective treatment solution is currently overwhelming.

Trelleborg's collaboration with Dr. Woodroof is the perfect symbiosis. While PermeaDerm Inc. owns, markets and sells its products, it relies on Trelleborg's backing and support resources.

"If Dr. Woodroof can get to a point where his products are not only being used in hospitals and burn centers but become available over the counter like Elastoplast, we're looking at high-volume sales," Butorac says. "Let's face it: if I had a child with a wound or burn that could cause pain and permanent scar tissue, I would happily use this product. What parent wouldn't?" ■

Above: PermeaDerm, a biosynthetic skin substitute made of a three-dimensional nylon matrix embedded in silicone.

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"I have been fortunate to play a role in advancing the art of medicine for the successful management of acute and chronic wounds."
Dr. Aubrey Woodroof, CEO, PermeaDerm Inc.

Globe Trotting

After relocating from India to England, Inderjeet Singh has shifted his focus from seals with complex designs to seals made of innovative materials. But he says the principles of product management are the same the world over.

TEXT DONNA GUINIVAN **PHOTO** DAVID FISHER

As the UK experienced the hottest summer on record last year, Inderjeet Singh may not have felt out of place in Tewkesbury, England, after relocating from Bengaluru, India, where the average summer temperature tops 30 °C (86 °F).

Inderjeet now works as product manager for the sealing solutions manufactured at the Trelleborg Sealing Solutions facility not far from Birmingham, England's second-largest city. In Bengaluru he was involved with the setup of radial oil seal production at the Trelleborg site there.

"In Trelleborg, networks are very important," he says. "So although I was based in Bengaluru, I also worked within global teams. I already know all the people I am working with here well. Even though I'm somewhere different, it feels like I'm home. Working in Trelleborg is like being part of one big family, so the transition is effortless."

When he joined Trelleborg six years ago, Inderjeet was charged with supporting the development of radial oil seal production capability in India. Over an 18-month period, an empty shop floor was filled with

Inderjeet Singh is product manager at the manufacturing facility in Tewkesbury, England, where he recently relocated to from Bengaluru, India.

Isolast materials

Isolast materials are the gold standard among elastomers. Differing from other rubber compounds, they are chemically resistant to virtually all media while demonstrating outstanding performance.

The benefits of perfluoroelastomers (FFKMs) can outweigh their often seemingly higher cost as they can operate at temperatures up to +320 °C (+608 °F) for long periods in the harshest of process media. These include the aggressive chemicals employed in the cleaning and sterilization regimes used in food production that can potentially destroy a standard seal in hours.

In many cases, FFKMs are the only option in critical aerospace or oil and gas applications. And with the ability to manufacture and pack in class 100 and class 10000 cleanroom environments, seals can be supplied to meet super-clean requirements, such as those needed for semiconductor manufacturing, where the slightest contamination can destroy an electronic product.

tooling, machines, technology and know-how. After that, he could concentrate on product management.

"Our team has been so successful that the radial oil seal facility has outgrown its allotted space, and manufacturing has moved to a larger site," he says.

"In Trelleborg, the role of the product manager is an important one. We are responsible for spearheading new product development that will bring sales and growth for the manufacturing sites we are responsible for. We formulate strategies for segments, regions and even specific customers or applications.

"Supporting the marketing companies in their outreach is vital. We provide them with material to promote our products, educate them and back them up when tackling issues. That means we have to be flexible, ready to visit a customer in the US, China or elsewhere, as required."

Although the products Inderjeet is managing are different now, the principles of product management are the same.

"The only thing is I have to be a bit more polite in England than India," he jokes. "The processes in Tewkesbury are virtually

like-for-like compared to those in Bengaluru."

This may seem a little surprising, as people usually imagine that manufacturing in India, which is thought of as a low-cost manufacturing country, would be manual, while in Europe production would be automated.

"Trelleborg differs from some other manufacturers in that we produce in Asia primarily to meet the needs of international manufacturers who are based there, as well as indigenous companies, rather than using the facilities to produce components cheaply to ship out of Asia," Inderjeet says.

Right: Inderjeet is on a mission to break misconceptions down with regard to Isolast.

Left: Guy Fowler selects an individual mold tool cavity from the Isolast tool carousel that contains over 4,000 tools. Computer controlled, the cavities are easily found via a control panel that rotates the carousel to the correct shelf.

"I've had to go back to school and dust off my old chemistry books so I can more effectively liaise with the material experts who are supporting me."

Inderjeet Singh, Trelleborg

"If a product can be effectively manufactured manually, we may consider doing that. But as soon as this method hampers quality or consistency, then automation is adopted. It's about the correct balance in production."

The one big difference between radial oil seals and the products Inderjeet now manages is that radial oil seals are complex in their design, whereas the seals at Tewkesbury are complex in their material makeup.

"I've had to go back to school and dust off my old chemistry books so I can more effectively liaise with the material experts who are supporting me," he says.

The main product line for Tewkesbury is the proprietary range of Isolast perfluoroelastomer sealing materials, elastomers that are extremely chemically resistant, making them compatible with virtually all process media.

"In Isolast, Trelleborg boasts one of the best ranges of perfluoroelastomers on the market," Inderjeet says. "We've established a very strong O-Ring business to the semiconductor, aerospace, food and beverage markets. Now we're set for the next big step to drive the business forward.

Inderjeet finds the principles of product management the same in the UK and in India.

We've established a very strong O-Ring business to the semiconductor, aerospace, food and beverage markets. Now we're set for the next big step to drive the business forward.

Inderjeet Singh, Trelleborg

"For me as a product manager, it's about breaking misconceptions down with regard to Isolast. As perfluoroelastomers are so chemically resistant, people don't think that you can bond them to metal or other substrates. In fact you can, and we have perfected the techniques to do this. Also, O-Rings are generally thought to be the only choice. Again this is not true. Perfluoroelastomers can be injection-molded into intricate geometries. Both these manufacturing options extend design possibilities, meaning that we can meet ever more demanding higher volume requirements and offer real benefits in terms of accelerating our customers' performance."

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Inderjeet Singh

Inderjeet Singh is product manager for the Trelleborg sealing solutions produced at its manufacturing facility in Tewkesbury, England, where he recently relocated from Bengaluru, India. He did his mechanical engineering degree and MBA in India and has spent over 14 years in the sealing industry.

He is married, with an eight-year-old daughter and a five-month-old son. He and his wife have lived in England and Germany, so he does not see the transition as too difficult for the family.

Inderjeet likes cooking, although sourcing vegetables for some of the dishes he cooked at home in India may mean trips to specialist supermarkets or adapting recipes to local produce. He also follows cricket and plays badminton, and he plans to join a badminton club in the Tewkesbury area.

NEWS

Brawler High Performance Solid tires are designed for extreme environments.

Cat chooses Brawler

The Brawler HPS Solidflex solid tire line, from Trelleborg Wheel Systems, has been selected as the Original Equipment Manufacturer (OEM) solid tire option for Medium Wheel Loaders and Small Wheel Loaders by Caterpillar Inc.

Caterpillar is the world's leading manufacturer of construction and mining equipment, diesel and natural gas engines, industrial gas turbines and diesel-electric locomotives.

Fluid goes digital

Trelleborg Industrial Solutions has launched a new web portal for its fluid handling products. The web portal allows its customers and distributors to send technical inquiries, check stock and track orders at any time, day or night, as well as access the latest information on its products.

Visit the website to discover more: trelleborg.com/en/fluidhandling

Recent acquisitions

Lamcotec: Polyurethane-coated and laminated fabrics

The US-based company Laminating Coating Technologies Inc. (Lamcotec) develops and manufactures polyurethane-coated and laminated fabrics primarily used in the aerospace, healthcare and medical industries.

The company has its head office and production facility in Monson, Massachusetts, in the US. Total sales amounted to about USD 21 million (SEK 185 million) in 2017.

TRS: Tires and wheels

The New Zealand company TRS Tyre & Wheel Ltd is a distributor of tires for agricultural, material handling and construction vehicles in New Zealand. It specializes in tires and complete wheels for tire and tractor dealers.

The company is located in Wanganui, New Zealand, and has operations in four other locations within the country. Annual sales amounted to about NZD 27 million (SEK 160 million).

Sil-Pro: Silicone and thermoplastic components

Sil-Pro is a US-based contract manufacturer of high-tolerance silicone and thermoplastic components that also offers assembly for medical devices. The company specializes in applications mainly for medical technology original equipment manufacturers.

Sil-Pro has its head office and production facility in Delano, Minnesota, in the US. Total sales amounted to about USD 40 million (SEK 350 million) in 2017.

The innovation center in Stuttgart, Germany

Expanded R&D center

Trelleborg Sealing Solutions has expanded its research and development (R&D) capabilities at its headquarters in Stuttgart, Germany. The space for R&D increased by 50 percent, to around 3,000 square meters (32,000 square feet), including a 300-square-meter (3,200-square-foot) showroom area dedicated to the department and demonstrating R&D and product innovation capabilities.

"Innovation is not only about new products and materials, but advancements in analytical and technical capabilities to support problem resolution and to accelerate technological breakthroughs," says Konrad Saur, Director Global R&D at Trelleborg Sealing Solutions.

The innovation center will host laboratories with the latest analytical equipment and measurement centers next to innovation and prototype facilities, as well as a major test area with a fully equipped tool room and materials laboratory. The capabilities will range from standard mechanical testing to material analytics, including thermal gravimetric analysis, digital scanning calorimetry and Fourier-transform infrared spectroscopy, to a highly advanced, high-resolution scanning electron microscope with an energy-dispersive X-ray.

"With such capabilities working in combination, complex problems can be assessed and brought to resolution rapidly," Saur says. "No time is lost shipping samples from lab to lab, and turnaround times and iterative assessment are enabled as cross-functional competencies work directly together."

DRIVING INNOVATION

The car you drive today is far from Mr. Ford's original Model T. The business of designing and building vehicles is changing constantly, and automotive suppliers are key to making them safer and more efficient and sustainable.

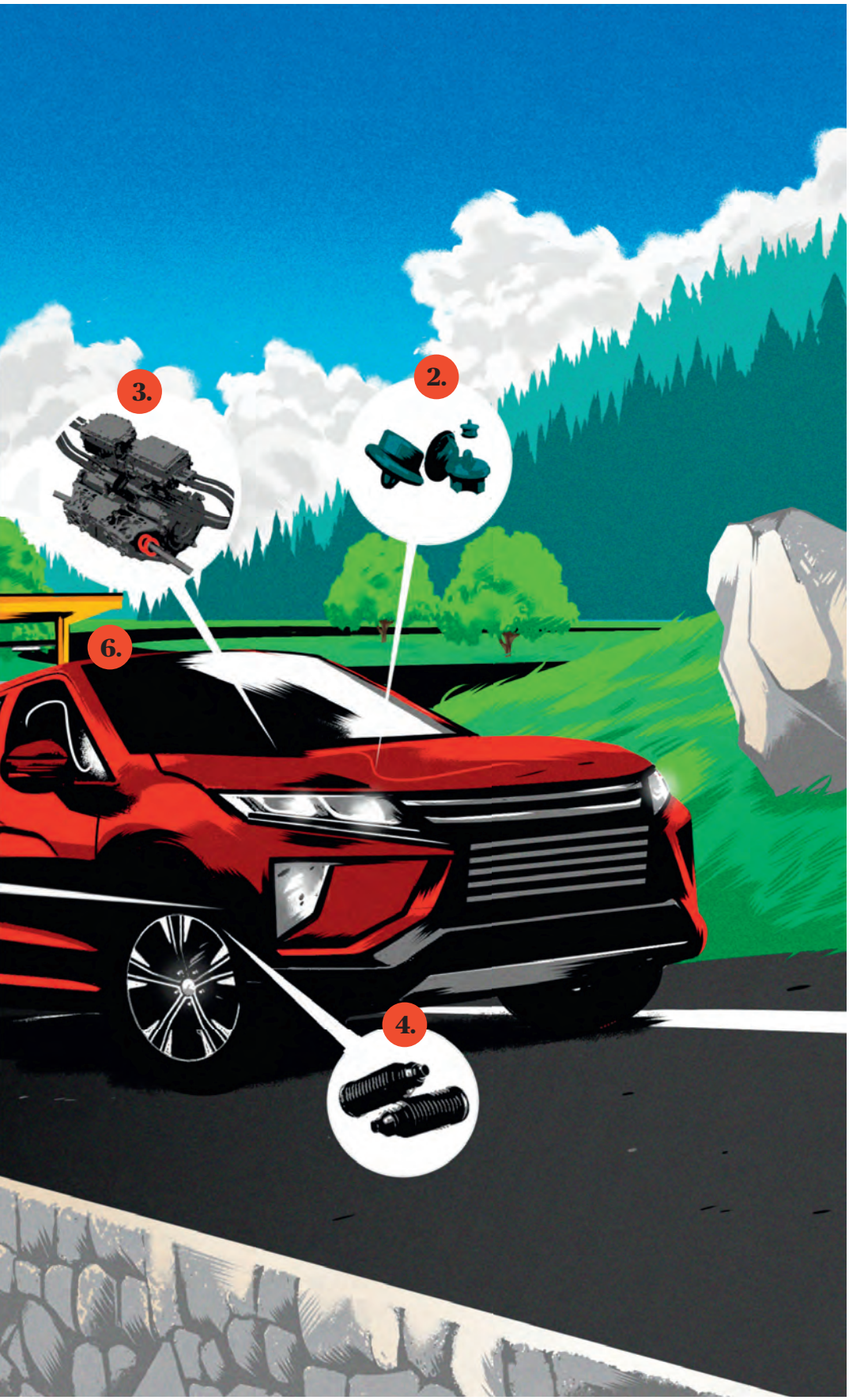
TEXT PETRA LODÉN
ILLUSTRATION ALEXANDER WELLS

Traveling by car should be a safe and comfortable experience. The automotive industry may have been around for more than 100 years, but innovations are coming thick and fast.

Many of us spend a considerable amount of our time behind the wheel of a car. It might seem that vehicles don't change much over time, but in fact automotive technology is evolving continuously.

Some modifications are more visible, such as the shift from analog to electronic controls, but other transformations are not so obvious. In particular, as car manufacturers make their vehicles more sustainable, significant alterations are being made under the hood.

These developments as well as the emergence of electric vehicles are making the demands on automotive component suppliers more challenging. But high-end engineering from Trelleborg meets and exceeds the most stringent requirements of the vehicles of today and tomorrow. ■



1. Brakes
Unique rubber-to-metal composite materials damp noise and vibration in disc brake shims, enduring enormous strains and tension – extreme temperatures, mechanical stress, salt, water and oil. They are tested and proved in mountains and deserts, as well as in urban traffic and on the open highway.

2. Battery
Ventseal is specially designed for locked container applications such as batteries. It combines a seal and pressure relief function in a single product, making fuel-saving stop-start technology possible.

3. Drivetrain
The electric drive unit, a combined electric motor and gearbox in a shared housing, is the main cost driver of future electric vehicle development. While the gearbox of the drive unit requires efficient lubrication, it is essential that the motor remains dry. Two innovative new seals from Trelleborg, HiSpin™ HS40 and PDR RT, provide a highly reliable seal between the two parts of the unit.

4. Steering gear
Boots that fit any type of steering system – hydraulic or electrically assisted power steering (HPS or EPS). The seal protects the steering joint from dirt and debris, as well as extension, compression and bending stresses.

5. Hoses
Volukler hoses for gasoline, biofuel and diesel pumps are textile-braided, long-lasting and resistant to abrasion with a smooth cover.

6. Roof
When the sun is shining and drivers are on the open road, there is nothing better than feeling the breeze through an open sunroof. Precision seals ensure that even in torrential rain, everything in the car stays dry.

AUTOMOTIVE

11% of Trelleborg's net sales derive from niches within the automotive segment.

USD 70,000,000
The most expensive car sold in a private sale is the Ferrari 250 GTO (4153 GT) racer, purchased for 70 million dollars in Germany in 2018. Built in 1963, the Ferrari 250 GTO model is one of the world's most desirable cars, with only 36 ever built.

100 hours

Residents of Los Angeles are famous for spending time in the car, and being a driver in the second-largest US city requires patience. Commuters spend more time in traffic jams than in any other city in the world – more than 100 hours in 2017.

"While approaching the speed of sound, I was more than 50 feet off-line at 90 degrees of steering with the car sliding sideways."
Andy Green

The official land-speed record, measured over one mile, is 1,227.985 kilometers per hour. It was set in 1997 by Andy Green from England in a Thrust SSC, in the Black Rock Desert in Nevada, in the US.

1 out of 5 people
The number of cars in the world is growing rapidly. Today there are nearly 1.4 billion of them rolling on the streets and highways. In theory this means that nearly every fifth person on the planet, or every individual in China, could have his or her own car.

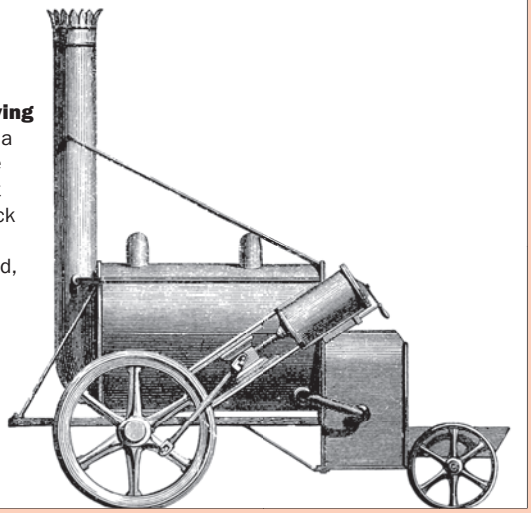
35% gradient
There are a number of hills out there, but Baldwin Street in the city of Dunedin in New Zealand is officially considered to be the world's steepest residential road. At its peak, the slope has a gradient of 35 percent.

3.3 million
From being almost nonexistent in 2010, the number of rechargeable cars has expanded rapidly in recent years. Today there are about 3.3 million electric and charging hybrids around the world, representing about 0.25 percent of the number of cars in the world.

6,688 meters
The record for driving to the highest altitude by car was set in 2007 by two Chileans. In a modified 1986 Suzuki Samurai, they reached 6,688 meters (21,942 feet) on the slopes of the Ojos del Salado volcano in Atacama, Chile.

1801

The first passenger-carrying automobile in the world was a steam-powered road vehicle carrying eight passengers. It was built by Richard Trevithick (1771-1833) and first ran at Camborne, Cornwall, England, on December 24, 1801.



Sources: Inrix, Guinness World Records, Atlas Obscura, Teknikens Värld

Not shook up

When the Kobe earthquake hit Japan in 1995, it claimed more than 6,000 lives, and the devastation to infrastructure including underground pipelines was widespread. But while most conventional connector seals failed, those manufactured by Trelleborg remained intact.

TEXT BIRGITTE VAN DEN MUYZENBERG **PHOTO** GETTY IMAGES, IPLEX NZ

When a major seismic event occurs, the tremors and aftershock can be devastating to the communities and infrastructure all around. Fully functional underground pipeline systems are a cornerstone of the modern urban human community, carrying fresh water for drinking and washing, and channeling away both stormwater and sewage. If pipes buckle or burst, the damage can cause critical disruption to society and present a significant danger to public health.

Seismic activity is among the most damaging hazards to buried pipelines. This is particularly the case with shallow seismic events, which are closely associated with the liquefaction of soil; losing its strength and stiffness when shaken, it begins to behave like a liquid. In these situations, pipes can float upward, and joints tend to telescope, buckle and rupture, spilling out their contents and allowing liquefied material to seep into and pollute water.

Below: The Kobe earthquake occurred on January 17, 1995. Over 6,000 people died, and hundreds of thousands of buildings were destroyed.

"Our customers know that our high-performance seals will do the job, and in places where earthquakes are common, they consider the investment in our solutions to be worth every penny."

Martijn Boerma, Trelleborg

"Flexible connector seals in infrastructure systems are essential because they allow for lateral joint movement," says Martijn Boerma, Business Development Manager for pipe seals in Asia Pacific within Trelleborg Industrial Solutions. Trelleborg offers a series of flexible pipe connectors including the Kor-N-Seal Pipe-to-Manhole Connector, which is produced in the U.S. and marketed worldwide.

Trelleborg's F-576 Anger-Lock seals are used in oriented PVC (PVC-O) pipe systems, which are more flexible and the material of choice in New Zealand. "We sell

about two million Anger-Locks and almost half a million Kor-N-Seal seals globally every year," Boerma says. "Our customers know that our high-performance seals will do the job, and in places where earthquakes are common, they consider the investment in our solutions to be worth every penny."

After the 1995 Kobe earthquake in Japan, an initial inspection of 52 manholes in the municipality – half of them with conventional pipe-to-manhole connections and half with Trelleborg's Kor-N-Seal flexible connectors – found that the majority of the conventional connections had suffered varying degrees of failure. However, of those featuring Kor-N-Seal connectors, only one was found to have a small leak.

Above: Preparing to lay a pipe in New Zealand that is fitted with the distinctive blue-and-black-colored F-576 Anger-Lock.

The Japanese government sets high requirements relating to the performance and ease of installation of pipe and joint seals. Today, when old pipes that have sockets with a G-ring become dysfunctional, they are most commonly replaced with pipes fitted with Trelleborg's integrated seals.

One of Trelleborg's valued customers in Japan is concrete pipe manufacturer Ito Yogyo.

> **“Flexible pipes such as our PVC-O pipes with Anger-Lock seals have generally performed well, with significantly fewer breaks and leaks observed.”**
>
> Frank O’Callaghan, National Technical Manager at Iplex

Chikako Kotani, who works in the development department at Ito Yogyo, says, “Our pipes with Trelleborg’s integrated seals have a longer spigot and socket, providing enough twirls and the required ‘drawing’ amount. These pipes have become popular in the Kinki, Tokai and Kanto districts where many earthquakes occur.”

The islands of New Zealand are situated astride one of the most active tectonic plate boundaries on Earth. From 2010 to 2012, the city of Christchurch was largely destroyed as a result of major earthquakes. Besides natural disasters such as these, shallow tremors occur on a regular basis, and these can have a serious effect on infrastructure. This is why most counties in New Zealand have switched to relatively flexible PVC-O pipes, fitted with Trelleborg’s unique F-576 Anger-Locks.

Frank O’Callaghan, National Technical Manager at Iplex, one of Trelleborg’s long-term partners in New Zealand, says, “There is simply no such thing as an ‘earthquake-proof’ pipe. However, flexible pipes such as our PVC-O pipes with Anger-Lock seals have generally performed well, with significantly fewer breaks and leaks observed compared with other commonly used nonflexible pipes.” ■

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Below: Flexible connector seals in infrastructure systems are essential, allowing for lateral joint movement. Trelleborg offers a series of flexible pipe connectors.

Flexible pipe connectors

F-103 integrated sealing system: Cast into the socket during pipe or manhole manufacture, F-103 can be used for concrete pipe connections to manholes.

F-576 Anger-Lock: A locked-in sealing system for plastic pressure pipes, wastewater conduits and cast-iron fittings.

Kor-N-Seal 106-406 Series: The most widely used flexible connector in sanitary sewer applications throughout the world.

STEADYING THE BRIDGE

The Farris Bridge in Norway is visually stunning, but its method of construction means it can potentially be subject to vibrations or large rotations and movements. Trelleborg helped resolve this issue.

TEXT TRELLEBORG
PHOTO TRELLEBORG

Farris Bridge, a 570-meter (1,870-foot) motorway bridge in southern Norway, is designed with high-rise slanted towers. Opened in 2018, it has a beautiful architecture and is set to become a visual landmark at the exit to the city of Larvik. But its method of construction potentially has the side effect of creating vibrations or large rotations and movements in the 24 cables attached to the towers.

The bridge was built by a joint venture between PNC and Implenia called Joint Venture Farris Bru ANS (JVF). JVF contacted Trelleborg Offshore & Construction in 2017 to discuss how rubber could help solve the vibration challenge. Following inspections of the project design, Trelleborg's engineering team proposed rubber dampeners to suppress the vibrations in the supports for each of the 24 bridge cables in the main tension section. During installation, the vibration elements were compressed so that they filled out and formed a compact rubber damper between the bridge cable and the steel pipe that forms the lower cable anchor.

Each anchor attachment is unique, with all 24 vibration dampers customized for the project. The complete solution was delivered with an installation manual so that the customer could complete the installation of the dampeners using its own team after receiving training from a Trelleborg supervisor.

Roger Whiston, Project Manager at Farris Bridge, says, "The product was accepted by our customer, the Norwegian Public Roads Administration, without further customization. We were very satisfied with the quality of the drawings, the material specifications and the installation documentation that was delivered with their 'hands-on approach' to training JVF's installation staff on the job." ■

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Above: Trelleborg designed dampeners to suppress the vibrations in the supports for the 24 bridge cables on the Farris Bridge.

28m

Width of the bridge

570m

Length of the bridge

€80M

Total cost of the project.

Left: Farris Bridge is a motorway bridge on the E18 that runs from Larvik in Vestfold, Norway.

Resting protectively

Looking at a hospital bed, it might seem that the mattress is designed simply to lie on. But the technology behind the fabric that covers it is highly advanced and can be critical to patient recovery.

TEXT DONNA GUINIVAN **PHOTO** GETTY IMAGES, LINET, TRELLEBORG

Left: A hospital bed, if properly designed and covered with the right fabric, can help prevent painful pressure ulcers.

A bed is probably thought to be the most basic item in terms of patient care. However, this is far from the truth. Its construction and the textile that covers it can contribute to how long patients remain in the hospital and how comfortable they are during their stay.

"Hospital mattresses have to be waterproof," says Richard Haxby, Technical Director within Trelleborg Coated Systems. Richard Haxby previously worked for Dartex Coatings, a company Trelleborg acquired in 2018. Its polyurethane-coated fabrics are the recognized choice for support surface fabrics.

"Gone are the heavy PVC-covered mattresses that were commonly used in the past. Polyurethane-coated fabrics are the recognized choice for support surface fabrics. Behind today's mattress technology is the desire to create a bed that can contribute to a patient's welfare and recovery. In particular, the driving factor is to suppress the development of avoidable pressure ulcers."

PHOTO: LINET

Above: An example of effective use of printed graphics on hospital mattresses, demonstrated on Linet's Opticare mattress range.

Pressure ulcers, also known as pressure sores or bedsores, are injuries to the skin and underlying tissue, caused primarily by prolonged pressure on the skin. They usually affect people confined to a bed or those who sit in a chair or wheelchair for long periods of time. These ulcers are a huge problem globally. In the US, up to USD 11.6 billion is spent annually on treatment, and each pressure ulcer adds more than USD 48,000 in costs to a hospital stay. There is a lack of data on potential savings, but a recent study by the Organisation for Economic Co-operation and Development found that the cost of treating pressure ulcers is substantially higher than the cost of prevention.

"The dilemma we have in engineering a mattress textile is to achieve a balance between breathability and durability."

Richard Haxby, Trelleborg

A healthcare mattress must be both breathable and durable, which is why polyurethane is the best choice for medical applications. Breathability is important to keep a patient cool and comfortable. Durability is vital to avoid cracks and puncture or strikethrough. These can allow fluid ingress through to the inside of the mattress. In addition, fabrics must be resistant to stringent cleaning regimes that use damaging bleaches, which can cause cracking

and degradation of the mattress cover if not properly used.

"The dilemma we have in engineering a mattress textile is to achieve a balance between breathability and durability. The more durable a covering, the less breathable it is, and vice versa," says Haxby.

Working in partnership with hospital mattress manufacturers is essential to optimize the performance of a bed. "It's key to understand the use of the mattress. Different primary uses will determine the textile design in relation to the mattress and what the balance needs to be between breathability and durability.

18%

Did you know?
- 18% of a hospital's patient population may have a pressure ulcer at any one time.
- Doreen Norton in the 1950s was the first nurse who used research to show that a patient should be turned every two hours to reduce pressure.
- Presence or development of a pressure ulcer can increase the length of a patient's hospital stay by an average of 10 days.

"For instance, with a mattress used in a burns unit, where a patient would have exuding wounds, breathability would be the priority to keep the skin cool and dry – while for a mattress for community use, where it's likely to be moved frequently from bed to bed and perhaps handled robustly, durability becomes important."

The inner core of the mattress will also have an influence on the covering. If it's foam, gel or air, then the outer fabric needs to match the inside. The latest innovation in mattress core is noodle technology. Unlike traditional foam mattresses, this core is machine washable on the hospital site.

"The design of this mattress core is very clever, but the nature of the noodles originally meant that it failed key flame retardant tests," Haxby says. "We solved this issue with the development of a cover that enabled the product to go to market. Like all furniture, mattresses must meet stringent fire resistance regulations. Our fabrics comply with Crib 5 and Crib 7 regulations in the UK and Europe, as well as CAL 117 for the US."

Fabrics don't just apply to beds – they're also used for chairs, wheelchairs and pillows.

"Our latest developments are focused on hospital chairs," Haxby says. "Moving a patient from a bed to a chair is done as early as possible to help patient mobility, even in acute wards. Chair fabrics, though, tend not to be so advanced, so we're looking at how to bridge the gap between the high standards of bed materials and those of chairs. We also have the capability to produce graphics on our fabrics, such as printing manufacturer cleaning instructions and corporate imagery directly onto mattresses." ■

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"Sweaty Betty" helps in the analysis of sweat buildup on fabrics, a critical aspect of pressure ulcer prevention.

HOW TO MAKE A DIFFERENCE

TEXT SUSANNA LINDGREN **PHOTO** KIT OATES & UNSPLASH

Companies across the globe are struggling to find the right engineering talent. In the UK, the Royal Academy of Engineering and the industry are working to promote engineering careers by showing that behind every YouTube designer or heart surgeon, there are cool engineers creating the necessary tools.

"Kids interested in helping people often say they want to become a doctor, but most advances in medicine are actually all about engineering," says Rhys Morgan.

It might be easy enough to find engineering talent if your logo says Google, Spotify or Facebook. In the UK market, huge and well-known international manufacturing companies such as Airbus, Rolls-Royce and Jaguar still have a lineup of eager applicants.

"Where we see a critical shortage is particularly in smaller companies," says Rhys Morgan, Director of Engineering and Education at the Royal Academy of Engineering in London. "Even in attractive companies there will be a shortage due to an aging workforce, and in growing sectors like aerospace and automotive we still need engineers and technicians that support the skilled engineers."

The Royal Academy of Engineering, in cooperation with major engineering organizations and with funding from the industry, has initiated a social media campaign called "This is Engineering," targeting young people aged 13 to 18.

"Other industries, like the fashion business, have been very good at promoting themselves to young people," says Morgan, who is in charge of the campaign. "Architecture, law and finance have also been good at branding themselves, but engineering has been very slow to follow."

Companies need to understand young people's attitudes: an interest in flexible working, opportunities to travel and making a difference.

To attract young people, he says, it is essential to understand their aspirations and attitudes toward life – such as an interest in flexible working, opportunities to travel and making a difference.

"The campaign is about getting them to recognize the importance of engineering for, among other things, solving some of the world's future challenges," Morgan says. "It might be in terms of building sustainable cities with electric cars, addressing water shortages or improving communication across the world. Kids interested in helping people often say they want to become a doctor, but most advances in medicine in recent years are actually all about engineering, like MRI scans, ultrasound or hip implants."

The "This is Engineering" campaign started in January 2018 and has attracted more than 20 million views, making it an unparalleled social media campaign to promote engineering specifically to teenagers in the UK. Short YouTube videos introduce viewers to engineers like Josh, who calculates the best way to get casualties out of collapsed buildings; Chris, who makes wearable robots and prosthetic limbs; and Sonya, a visual effects artist who creates special effects in blockbuster movies.

Rhys Morgan

Title: Director of Engineering and Education, Royal Academy of Engineering
Where he lives: London, England
Education: Bachelor's degree in engineering, PhD in additive manufacturing from Liverpool University
Work and career: Academic researcher and industry R&D engineer. Joined the Academy in 2009 to increase the number of young people in engineering
Family: Married with two daughters. The elder says she wants to be an engineer, while the younger one wants to be a farmer
Interests: Walking and cycling, kitchen science activities with the kids
Hidden talent: Created a formula for winning at the game of Poohsticks
What drives him: A passion for amazing engineering and wanting more young people to enjoy an exciting and creative career in engineering

"The UK has among the lowest proportion of female engineers in Europe, only 12 percent, and we are working hard to address that issue as well," Morgan says, adding that getting more female students is critical to filling the skills shortage. "Engineering companies work to serve people, communities and societies. If their workforce doesn't properly reflect societies, those services and products will not be as inclusive as they could be."

Companies will also miss out on a diversity of thinking around the product solutions.

"That goes for different ethnic minority groups and people from different strata of society as well," he says. "If you have a very homogenous white middle-class engineering workforce, which we largely do in engineering in the UK, then you miss out on many potential business opportunities and ways to serve society."

The speedy developments in artificial intelligence mean that a lack of diversity is a concern.

"That's a very live issue in the UK," he says. "How do we make sure that there aren't just white male engineers programming their unconscious bias into the algorithms they are creating? And again, a more diverse workforce will help to negate that."

It's too early to see the long-term effect of "This is Engineering."

"Through our own surveys we can see that young people who have seen the campaign are considering engineering as a career choice," Morgan says. "So we see green shoots of optimism and hope the tide is turning. But it will be a while before we see the impact on the profession. It's like an oil tanker – it takes a very long time to turn." ■

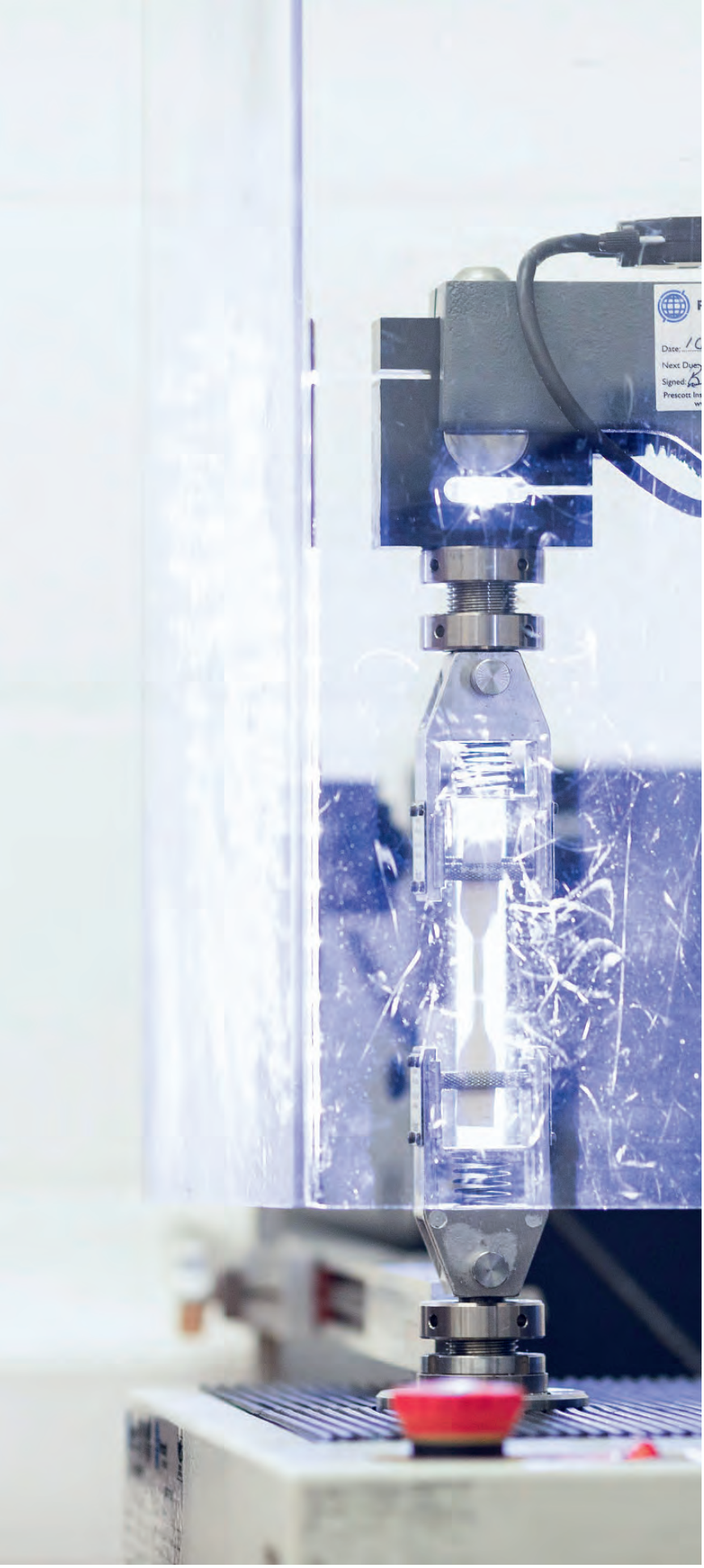
"Engineering companies work to serve people, communities and societies. If their workforce doesn't properly reflect societies, those services and products will not be as inclusive as they could be."

Rhys Morgan

This is Engineering

"This is Engineering" is a digital marketing campaign created in response to a significant demand for engineering talent in the UK – an annual demand for 124,000 engineers and technicians with core engineering skills. Current perceptions of engineering are that it is narrow and uncool, but in reality it's exciting and relevant to all our lives. The campaign aims to reset the conversation about engineering, tapping into young people's passions such as sports, technology and design, and illustrating that the profession is diverse, challenging and creative.

www.thisisengineering.org.uk



Trelleborg's employer branding strategy is about promoting how employees shape the industry from the inside through new, groundbreaking, customer-focused solutions. Properly used, Trelleborg's in-depth competence in polymers is an essential tool to drive global innovation and to have an impact on society, customers and local communities.

A Passion for Engineering

Anne Russo, Program Manager within Trelleborg Sealing Solutions in Albany, New York, US, is passionate about advocating for women and girls in science, technology, engineering and math. She has been a member of the Society of Women Engineers for the past 15 years.

What made you choose a career within engineering?
As a child, I always loved math – my parents got me to eat my peas at dinner by asking me to count the number in each spoonful I ate! I also loved building with K'NEX or Erector sets and doing science experiments. In high school, I particularly enjoyed chemistry and calculus classes. My mom saw that I loved problem solving, and encouraged me to pursue engineering.

What would you say to a high school girl who hesitates if she should go for a career in engineering?
My advice to high school kids considering engineering is to talk to as many different engineering professionals that you can and ask a lot of questions. There are many different types of engineering, and one may fit your interests more than another. Look for opportunities to job shadow, so that you can see a day in the life of an engineer. Engineering is a fulfilling career since it enables you to make an impact in your community and the world.

What is best with your job?
My favorite part of my job as an engineer at Trelleborg Sealing Solutions is that many of the products we make are custom or prototypes. Since each project is unique, there is always a new problem to solve. I enjoy seeing the whole process: from engineering design to manufacturing to testing and validation of a product.

Anne Russo, Program Manager, Trelleborg

NEWS

Find the suitable offset blankets for the press and job involved online.

Shopping in France

An e-shop has been launched for the French market. Printers now have the opportunity to purchase Vulcan, Rollin and Printec offset printing blankets, as well as a range of press chemicals, direct from Trelleborg.

"Printers throughout France can log on using a password and will be able to more effectively take advantage of digital services, such as our product configuration software," says Matthias Horn, Regional Sales Director EMEA (Europe, Middle East, Africa) for printing solutions within Trelleborg Coated Systems.

Start shopping at trelleborgprintingshop.com

App for printers

Find the nearest dealer, browse through the printing blanket e-book and find technical data sheets. All this is possible by using the printing solutions app. Available for both Apple and Android devices.

185 tons

In the new test facility in Skelmersdale, UK, Trelleborg will have the ability to simulate deep water conditions and to confirm the reliability of products in subsea environments. The logistics associated with the delivery and installation of two hyperbaric pressure vessels, each 12 meters long, 2.5 meters in diameter and weighing 185 metric tons, were extremely challenging, traveling at a speed of 10 miles per hour and accompanied by an escort from the Highways Agency from the port of Liverpool.

Are you social?

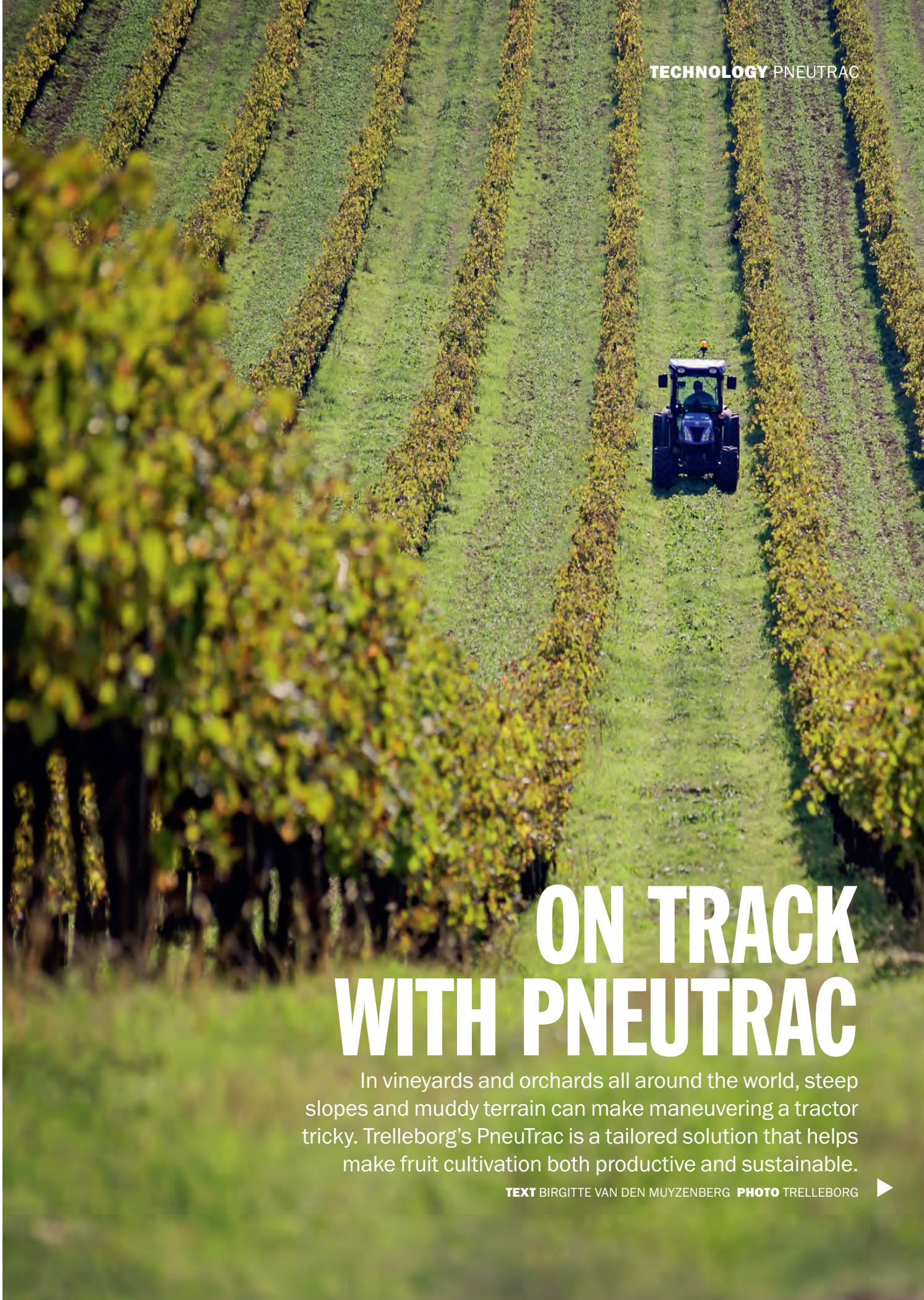
Then why not keep up to date on the latest Trelleborg news and events on our social channels.

- linkedin.com/company/trelleborggroup
- twitter.com/trelleborggroup
- facebook.com/trelleborggroup
- youtube.com/trelleborg

What is this?

A jellyfish or a new kind of grain?
Answer at the bottom of the page.

It is fabric joined using a drop-stitch technique and subsequently rubber-coated. The technique enables the product to be inflated, similar to an air mattress. There are several areas of application, but the product comes into its own when used in the bottom structure of an inflatable boat or raft.



ON TRACK WITH PNEUTRAC

In vineyards and orchards all around the world, steep slopes and muddy terrain can make maneuvering a tractor tricky. Trelleborg's PneuTrac is a tailored solution that helps make fruit cultivation both productive and sustainable.

TEXT BIRGITTE VAN DEN MUYZENBERG **PHOTO** TRELLEBORG

How do you maneuver a heavy tractor around the slippery slopes of a rain-drenched vineyard while minimizing the damage to topsoil, roots and plants in the process? It's a risky business, and when it goes wrong there can be a hefty price to pay. Not only might vines fail to yield the kind of harvest that growers expect, but the safety of the driver is also at stake. What's more, in a bad case of soil erosion, the damage can be serious.

For years, Trelleborg has been working to meet the specific needs of fruit farmers, listening carefully to their increased demands for innovation and cutting-edge technology. Now Trelleborg has come up with the answer to these needs: PneuTrac, a tire engineered to boost a farming operation's productivity, sustainability and efficiency. In short, it's a hybrid solution that is set to change the face of fruit farming.

"Roots and topsoil need to be treated with great care, and this becomes even more challenging when you factor in the narrow spacing between rows of vines," says Emiliana Vesco, a Senior Manager at Trelleborg Wheel Systems who is responsible for marketing training and development. "PneuTrac delivers all the flotation of a conventional agricultural track while reducing the total width of the tractor compared with a standard tracked solution. Besides this, tractors equipped with PneuTrac are on average 20 percent lighter than those with conventional tracks, which in turn means they have less impact on the soil."

French and Italian vineyard keepers were involved in the testing of PneuTrac. One of them says, "I agreed because we have a sustainable approach to agriculture and we're interested in soil life. I found the low compaction of PneuTrac particularly successful."

Vesco says Trelleborg is always looking for environmentally friendly ways to improve the performance and efficiency of its products and solutions. "Our mission is to move from the traditional theme of low soil compaction to a deep overall respect for the Earth," she says. "Farmers benefit from our care for the environment, which can also bring them real financial savings through increased productivity and lower fuel consumption.

"We firmly believe that PneuTrac is a game-changing innovation that helps to protect valuable agricultural assets, demonstrating our commitment to sustainable farming," she says. "People's futures rely on farming. And as the global population continues to grow, our role is to look for innovation-driven solutions to feed the world while addressing the environmental impact of agriculture. Our efforts will help to protect centuries-old traditions, enrich the quality of our foods and protect the planet."

Vesco says Trelleborg's research into specialized agriculture drives innovation and feeds the imagination of its engineers. "We are passionate about creating solutions that will secure a sustainable future for farming, and PneuTrac is the proof of that," she says.

Vesco regards PneuTrac as a

Emiliana Vesco, a Senior Manager at Trelleborg Wheel Systems: "Our mission is to move from the traditional theme of low soil compaction to a deep overall respect for the Earth."

The technology that sets PneuTrac apart

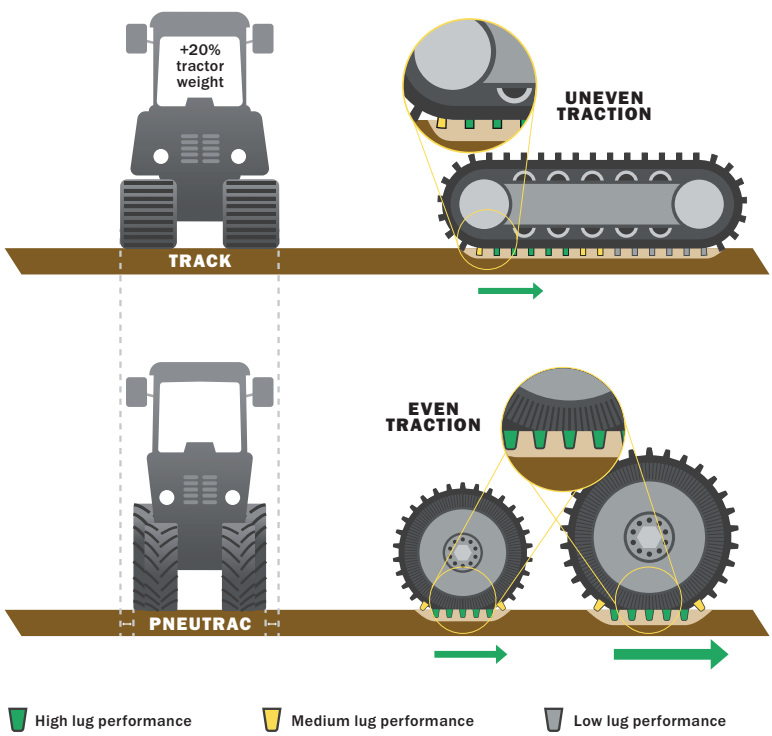
Think of a cross between a tire and a track, and you get the picture. PneuTrac offers the combined benefits of an agricultural tire with those of a track, delivering unbeatable performance on tricky terrain and reducing downtime to virtually zero.

But there's more to it than that. PneuTrac's sidewall is shaped according to a characteristic "omega" design. Powered by CupWheel* technology, this design helps the wheel to sustain the load, boosting the efficiency of the tread. Its extra-long footprint results in superior flotation, traction and lateral stability, without compromising fuel efficiency, comfort or handling.

While conventional track lugs are at their most efficient toward the rear of the assembly, PneuTrac gives lug efficiency for the entire length of its footprint, resulting in even traction with high grip and low soil compaction.

*CupWheel technology by Galileo Wheel Ltd.

20% less
PneuTrac tires ensure optimal root protection and deliver a 20 percent reduction in overall soil compaction compared with a standard tracked vehicle.



potential all-in-one option for any customer who feels uncertain about choosing between a tire and a track, or who is currently forced to have two machines, one wheeled and one tracked.

"Today's agricultural machine producers are developing integrated precision farming solutions that are GPS enabled, drone assisted, cloud connected and app interfaced," Vesco says. "Independent tractors, driverless machines and robots are becoming a reality in modern agriculture, and the Internet of Things along with the Big Data environment will make tools, farmers and machines fully connected. This will ensure the best farming procedures, using the right resources, at the right time and in the right place. PneuTrac fits into this scenario perfectly." ■

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