

ttime

A MAGAZINE FROM TRELLEBORG GROUP

3-2017

Solutions that seal, damp and protect critical applications.

STAYING HIGH AND DRY

Rising sea levels threaten coastal cities around the world. Customized sealing solutions can help manage the challenge.

SMART TIRES BOOST CROP YIELDS



NEVER TOO REMOTE FOR ENERGY

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POLYMER PROFESSIONAL

With nearly 30 years in the business, Nancy Getz is well known throughout the world of sealing solutions.

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MORE CHOCOLATE, PLEASE

As 4.5 million tons of cocoa beans are turned into chocolate each year, Trelleborg solutions are there every step of the way.



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EDITORIAL

AT THE FOREFRONT

Protecting people and the environment,

as well as infrastructure and assets, is a key task for Trelleborg's products and solutions in water-sensitive areas. Trelleborg is a proud supplier to several of the world's most vulnerable environments, and we specialize in solutions, from breakwaters and dry docks to aqueducts. In this issue of *T-Time*, you can read about how we help protect large cities against floods.

Another current area in focus is precision farming. Precision technology in agriculture is used today on more than 5 percent of cultivated land, and the portion is expected to

rise to 20 percent within the next decade.

Driverless machines and robots will increase rapidly, helping farmers to produce more with less. Trelleborg's variable tire pressure control system reduces soil compaction by optimizing the footprint of a combine harvester's tires.



A stylized, handwritten signature of Peter Nilsson in black ink.

Peter Nilsson,
President and CEO



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RETHINKING LNG

A new solution delivers liquefied natural gas to locations that lack traditional harbors and jetties.

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PRINTING THE FUTURE

Free-thinking Professor Olaf Diegel explains how 3D printing technology is forcing designers to rethink product design.



Cover photo:
Sean Gladwell, Getty Images

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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 SEK 31 billion (EUR 3.23 billion, USD 3.60 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, and the operations of Rubena and Savatech.

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

The Trelleborg logo, consisting of a stylized 'T' made of three parallel lines, followed by the word 'TRELLEBORG' in a bold, sans-serif font.

Rising sea levels and an increasing number of megacities could become a difficult combination if water infrastructure isn't given the attention it deserves. Thankfully, there are solutions to some of the world's water challenges.

Text Cari Simmons Photo Getty Images

WATERTIGHT CITIES

S

Sea levels are projected to rise by as much as 122 centimeters (48 inches) by 2100. Couple this with growing urban populations, especially in coastal areas, and millions of people are under threat from flooding. In fact, the number of people affected by rising water is expected to triple in less than 15 years.

The cost of flooding in the world's largest coastal cities is already huge, and the figure for 2017 is expected to be significantly higher due to the damage caused by several extreme weather events, including Hurricane Harvey. By 2050, the total cost of flooding in coastal cities is projected to rise to a staggering USD 1 trillion a year. Miami, New York, Shanghai, Bangkok and Mumbai are just a few of the cities at high risk of flooding if water management isn't prioritized.

Some local governments have grasped the urgency of the situation and are taking measures to prevent flooding, for example by building dikes, storm surge barriers, flood barrages, sluices and dams.

Venice, the city of canals, has made significant investments to ensure that rising tides do not put it under water for good. Venice joined forces with neighboring cities to undergo an ambitious storm surge solution, called the MOSE project. It provides flood protection through the installation of 78 mobile flood barriers at various inlets. These surge barriers activate if the tide gets too high, and they remain tucked away in special housings at the bottom of the lagoon when not in use.

Trelleborg was involved in the Venice project from the beginning, working with the project design team early on and providing custom-made sealing solutions and multiple fender systems.

"Trelleborg has long experience with different types of water management projects around the world," says Ruud Bokhout, Business Development and Marketing Director within Trelleborg Offshore & Construction. "Our solutions can be found in storm surge barriers and other infrastructure around the world."

Examples of Trelleborg's involvement in flood prevention globally include the St. Petersburg storm flood barrier, a complex water infrastructure project consisting of a 25-kilometer dam, two navigation channels and the longest undersea road tunnel in Russia.

Venice, the city of canals, has made significant investments to ensure that rising tides do not put it under water for good.



Trelleborg was engaged in designing a solution to seal the tunnel's 15 sections. At 40 meters wide and seven meters high, the Trelleborg Omega seals will provide resistance for 100 years with no maintenance required.

In Los Angeles, robust Omega seals are also a part of flood prevention actions in the city's efforts to minimize the possibility of water entering its congested road system, providing seals to the state of California's Department of Transportation.

Threatened by rising river levels, countries such as South Korea and the Netherlands have turned to Trelleborg solutions such as self-activating seals and compression seals for their storm surge barriers and other infrastructure.



The number of people affected by floods is expected to triple to 54 million in less than 15 years.



Omega seals withstand high water pressure in combination with large movements in all directions.

Bokhout is confident that flood damage can be prevented through such solutions, but he urges people not to wait. “These projects take time,” he says. “Complex structures need to be built, and the technology is very advanced. It is important that Trelleborg is involved at an early stage to ensure the engineering of a suitable and fully reliable solution.” ■

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Sources: United Nations World WaterDevelopment Report 2014; United Nations World Cities Report 2016; NASA: Climate Change and Global Warming; Aqueduct Global Flood Analyzer; American Water Works Association State of the Water Industry Report, 2015.

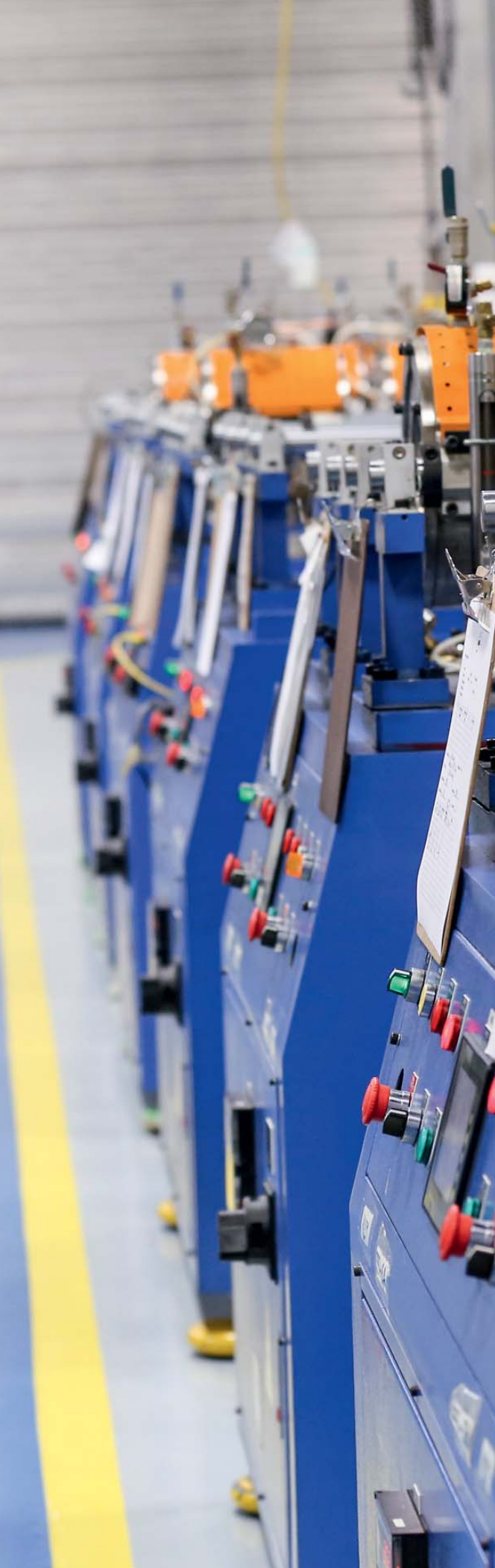
FLOOD STOPPERS

Trelleborg offers customized sealing solutions for water management projects worldwide. These are some of the products commonly used:

- Self-activating seals/lip seals are activated by water pressure. They are suitable in radial, horizontal or vertical sluice gates.
- Compression/D profile seals enable the sealing of expansion joints and are made of rubber that is highly resistant to deterioration from exposure to weather, sunlight, oils and impact.
- Inflatable gaskets seal an opening or gap by inflation and pressurization with air or water.
- Omega seals withstand high water pressure in combination with large movements in all directions.
- Gina seals provide a seal between two concrete elements, for example in an underwater tunnel or for sealing a temporary bulkhead at the end of a tunnel.



Nancy Getz is Product Line Director for Global Operations Engineered Plastics at Trelleborg Sealing Solutions in the U.S. She has built a successful career from lab to field, then onto management.



From the facility floor through the research lab to the field, Nancy Getz has seen a lot of the world in nearly three decades of working with sealing solutions. Her goal is to ensure that Trelleborg is a partner that delivers the best solutions to its customers.

Text Cari Simmons Photos Anchor films

SEALED FOR SUCCESS

Nancy Getz is famous in the world of sealing solutions. After 29 years in the business, she has a vast network that stretches from her home base in Fort Wayne, Indiana, to Denmark, India, China and everywhere in between.

“People know my name because I’ve been here a long time, and if you are a female who is technical in a male-dominated field, they remember you,” says Getz, Product Line Director for Global Operations Engineered Plastics at Trelleborg Sealing Solutions in the U.S. “Being recognized makes it easier to influence and work together to achieve what needs to get done.”

Being technical and an achiever has certainly helped Getz in her career, which started in 1989 at the manufacturing facility of W.S. Shamban, a company that was eventually acquired by Trelleborg. One thing led to another, and soon Getz was studying polymer chemistry and thermal analysis and working in the R&D lab.

“Polymer chemistry is interesting when you couple it with seals,” Getz says. “Seals in the scheme of things are usually the lowest-priced component within an application, but they have such a critical function; part of that is the ability of the polymer to perform under extreme conditions.” ▶

- After 16 years in the research lab, Getz headed cautiously into the field, meeting customers and learning about their businesses. “The more we can meet with the customer face-to-face, the better it is,” she says. “So much can be lost in translation. When you can see what is going on from the customer perspective, we can provide a more complete solution from sealing, product installation and advanced delivery solutions. We want to be a partner, not just a supplier.”

Emboldened by her applications and sales experience, Getz eventually moved on to management and earned a degree in organizational leadership and an MBA. “Anything is possible if you believe in yourself and do the work to get there,” she says. “Trelleborg offers opportunities to do many different things, take on projects outside your area of responsibility or go on an exchange in another country.”

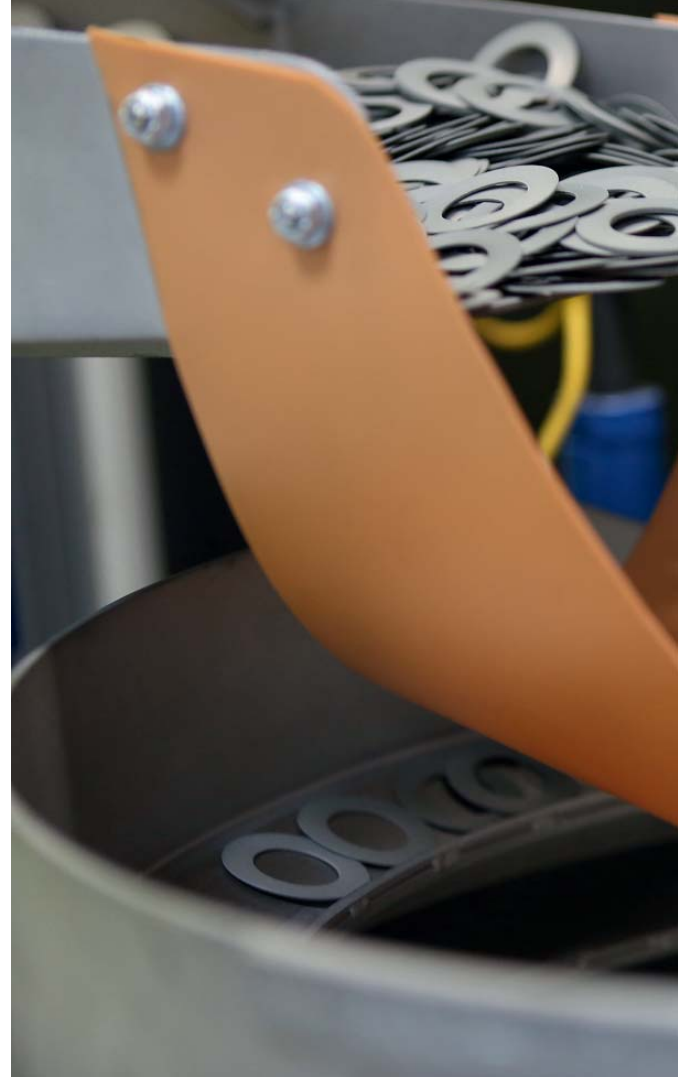
A significant factor in Trelleborg’s value creation is the expertise and diversity of its employees, Getz adds. “They recognize the importance of having a diverse workforce and the significant impact it has on improving business performance,” she says. “It is exciting to see more women coming into Trelleborg.”

Getz has been a Product Line Director since October 2016. Her job is largely focused on the growth of seals and coming up with products and strategies that best serve the local and global customer markets.

“One of our main functions is to have a well-developed product portfolio to assure we are offering the right products to serve the needs of the market today and in the future,” Getz says. “We make sure the facilities are prepared to support manufacturing of new product lines and that we are producing in the right locations.”

The product line directors work collaboratively to quickly set up and replicate product lines across facilities, regardless of location. They understand the needs of global customers for consistency in materials, products, processes and services worldwide,” Getz says.

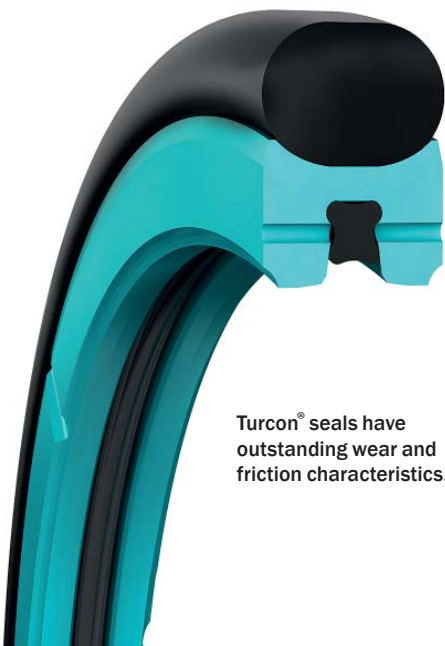
Everywhere in the world Trelleborg Sealing Solutions uses the same material



formulations and processes and facility guidelines that apply to on-time delivery goals, prototype turnaround time, customer service and more, to assure high quality and consistent service. Through Trelleborg’s sharing of best practices and excellence programs, everyone continues to raise the bar further.

Getz deals primarily with elastomer energized slipper seals, comprising about 20 core product families that come under Trelleborg’s Turcon®, Zurcon® and Turcite® brands of polytetrafluoroethylene (PTFE) based and polyurethane seals, and nonmetallic bearings.

Turcon seals are resistant to virtually all media, including a broad range of lubricants. They have outstanding wear and friction characteristics that provide customers with extended seal life and high-quality performance in flight actuators, steering controls, molding



Turcon® seals have outstanding wear and friction characteristics.

TWO NEW TURCON® SEALS

Turcon® Roto Glyd Ring® DXL is a rotary seal primarily for machinery with hydraulics that operate at high pressures and velocities. Among its many features and benefits is a multi-purpose backup ring for harsh media, extrusion resistance and pressure-balanced design.

The Turcon® Roto Glyd Ring® V is a double-acting rotary seal designed with reducing friction in mind. It gives improved performance in oscillating service or with frequent changes in pressure or velocity. The product is primarily for machinery with high requirements for service life such as machining centers, excavators, robotics and hydraulic motors.



Nancy Getz deals primarily with elastomer energized slipper seals, comprising about 20 core product brands of PTFE-based and polyurethane seals, and nonmetallic bearings.



machines, hydraulic cylinders and other applications.

"We launched two new Turcon seals at the beginning of the year," Getz says. "The Turcon Roto Glyd Ring V was developed with a built-in valve function to reduce torque and friction while increasing lubrication under the seal, and to stop rotation between the Turcon and elastomer components."

The other new seal is the Turcon Roto Glyd Ring DXL. "This is a rotary seal that fills a market gap where there is a need for high speeds in combination with higher pressures," Getz says. "The seal is targeted toward the oil and gas industry, but it is suitable for other industrial segments too." Some applications include hydraulic swivels, down-hole tools, top drives, manipulators, hydraulic pumps and motors.

While PTFE-based seals are widespread in the industry, Getz is convinced that Trelleborg's seals are a notch above others. "Trelleborg is unique when it comes to the selection of raw materials, processes and extensive research and development to ensure a long product life," she says. "We may not be the biggest seal manufacturer in terms of volume, but we can offer a system solution to optimize performance, not just a single component solution." ■

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NANCY GETZ

Nancy Getz began working in the sealing and rubber industry 29 years ago, starting on the facility floor and moving into various roles in R&D, sales and management. She is currently Product Line Director Global Operations Engineered Plastics at Trelleborg Sealing Solutions in the U.S. After a long career, she enjoys helping others as a mentor.

Getz spends about three weeks of every month traveling to Trelleborg sites, meeting with manufacturing, R&D, marketing and other segments and working closely with facilities in the United States, Denmark, India, China and Brazil. "I love working with so many different cultures," Getz says.

Watch Nancy Getz
tell us about her job
in a video on
trelleborg.com

"You get a different perspective, and it makes people more creative and open to ideas and how to accomplish things."

She enjoys trying the food in different countries, and she recently began sampling craft beers as well, keeping track of them in the Untappd App. Her days off are happily spent relaxing with family and friends at her home in Fort Wayne, Indiana, in the U.S.

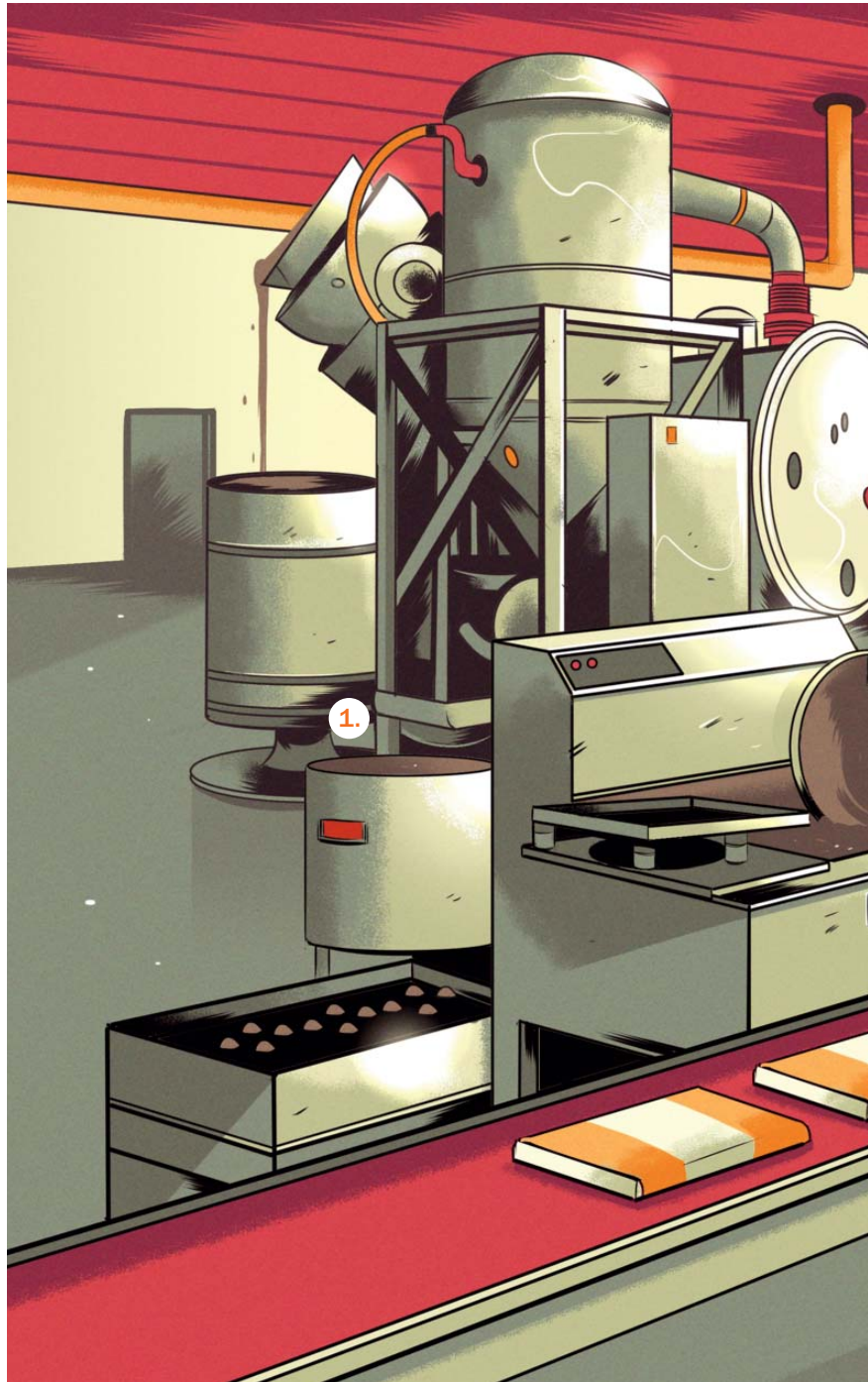
On the road, Trelleborg is like an extended family, Getz says. "No matter where you go around the globe, Trelleborg employees treat you like they've known you for a long time. It is a very welcoming environment."

LITTLE SURPRISES AROUND EVERY CORNER

A visit to a chocolate factory is probably high on many children's wish lists. Take a look at the solutions Trelleborg is supplying to keep the chocolate flowing and the world supplied with this "food of the gods."

Text Petra Lodén Illustration Alexander Wells

Demand for sustainable solutions, advanced automation, meeting stringent standards – these are some of the challenges faced by manufacturers. Focusing on these issues, Trelleborg helps production run smoothly by providing innovative products and service solutions, all the way from the start of processing through to packaging. In chocolate production, Trelleborg solutions withstand oils, acids, sugars, salts and other media involved in confectionery making. At the same time, hygiene and cleanliness are absolute top priorities. ■



1. Anti-vibration Rubber elements minimize noise and damp vibrations. These include mounts for stationary and mobile installations, sensitive equipment, machine tools and processing equipment.

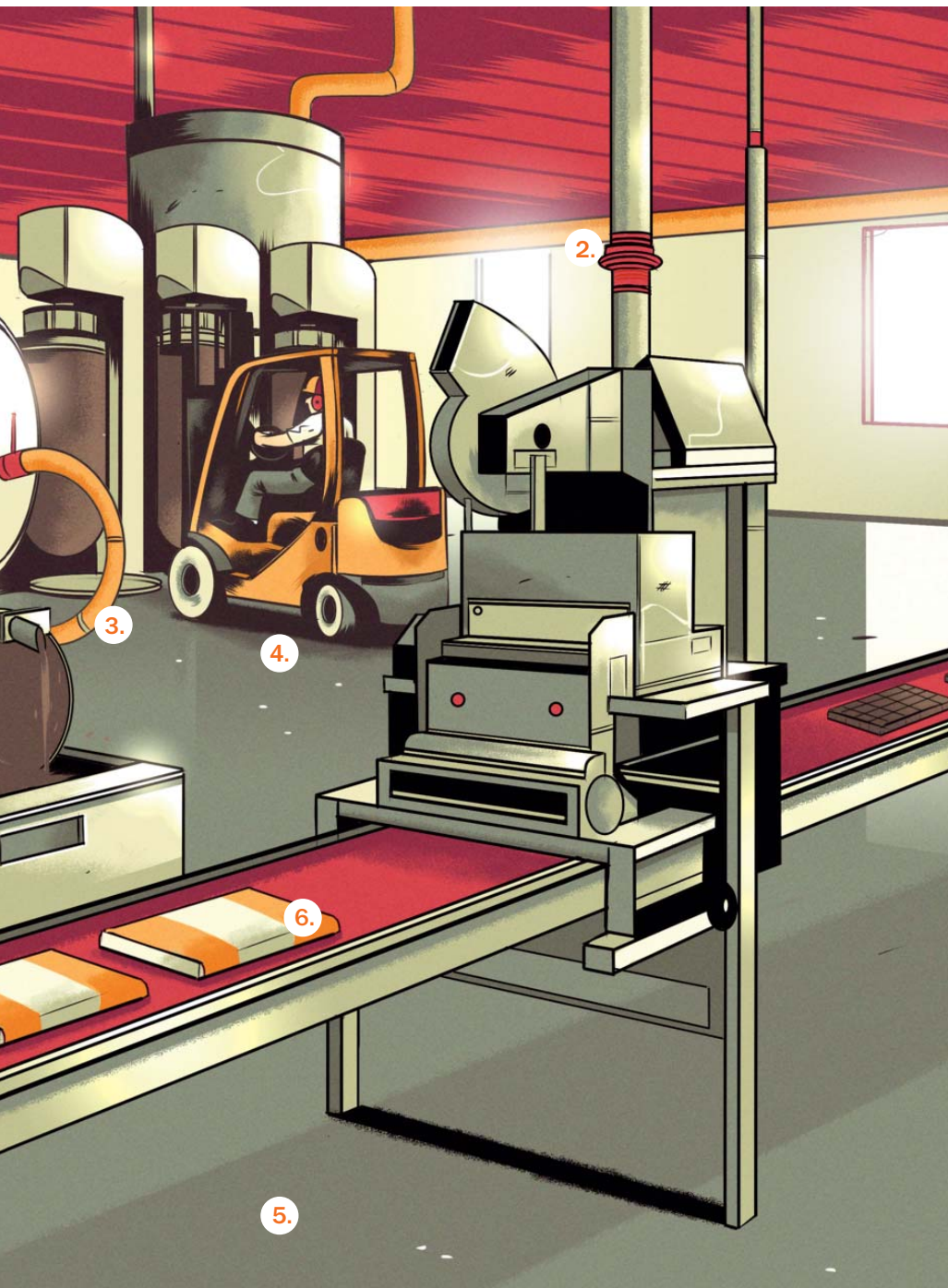
2. Expansion joints Solutions absorb pressure surges, movement and vibrations in pipe systems.

3. Hoses Hoses provide good resistance to abrasion, piercing, impact, flexing

and microbiological attacks. Their smooth inner liners ensure optimum flow.

4. Tires The Pit Stop Line of forklift truck tires lets users know with 100 percent accuracy when tires need replacing to ensure safety and minimize waste.

5. Rubber flooring Extraordinarily tough flooring solutions are needed in workplaces. They can be fire resistant



and offer dielectric strength or anti-static properties, as well as being resistant to oil or hydrocarbons, while isolating vibrations and noise.

- 6. Packaging** Printing blankets for image reproduction. High-quality packaging to present chocolates beautifully relies on premium printing blankets that provide the best print definition.

Seals These can be found in many places in the facility. O-Rings, rotary and hydraulic seals manufactured in specialty materials are compatible with harsh environments processes and cleaning regimes, extending seal life to minimize maintenance downtime.

DID YOU KNOW?

4.5 million tons

4.5 million tons of cocoa beans are consumed annually.

USD 33 billion

The largest chocolate manufacturer is Mars Inc., with annual revenue of 33 billion US dollars.

1964

British author Roald Dahl wrote *Charlie and the Chocolate Factory* in 1964. The book was turned into a movie called *Willy Wonka & the Chocolate Factory*, in 1971 and generated box-office revenue of 4 million US dollars; the 2005 remake grossed USD 475 million.

0.5 percent

The organic cocoa market represents a small share of the total cocoa market, estimated at less than 0.5 percent of total production.

20 species

The plant *Theobroma* literally means "food of the gods." There are roughly 20 species of these small trees. *Theobroma cacao*, the best-known species, is used to make chocolate.

BIG 5

Ivory Coast is by far the world's largest producer of cocoa beans. Its production alone exceeds that of the next four countries combined: Ghana, Indonesia, Cameroon and Ecuador.

B30 1JR

Enter the postcode to find your way to Cadbury World in Birmingham, England, if you want to visit a chocolate factory for real.

Sources: International Cocoa Organization, World Cocoa Foundation, Forbes, Candyindustry.com, Wikipedia

BLUE DIMENSION*

*Blue Dimension™ refers to Trelleborg solutions for better sustainability. They protect people, the environment, infrastructure and assets.

ENERGY SAVERS

Wherever in the world it operates, Trelleborg is working to reduce its energy consumption and CO₂ emissions. Take the example of Tewkesbury, England, where a new compressor has reduced the energy used to produce compressed air by 62 percent.

Text Cari Simmons Photo Fisher Studios



Large pot spray guns are used to apply bonding agent to metal parts before molding rubber to metal bonded shaft seals.

Like most large companies, Trelleborg consumes a great deal of energy. But with Trelleborg's Energy Excellence program, efforts are under way company-wide to reduce annual local energy consumption by 3 percent in relation to production output.

To meet this objective, Trelleborg has engaged in a number of initiatives including targeting energy waste, increasing awareness among employees and gradually replacing old equipment with more energy-efficient solutions.

One site that recently made substantial energy savings is a 5,700-square-meter manufacturing facility in Tewkesbury, England, that produces high-precision quality seals for aerospace and other high-end applications. The process of making these seals requires a large volume of compressed air for various applications, such as actuating pneumatic doors on machinery, spraying on bonding agent or removing completed parts from molding tools.

When Tewkesbury was in the market for a new, more efficient compressed air system to replace its two aging

compressors, the solution was the Atlas Copco's Variable Speed Drive vsd+ compressor. The new compressor system helps eliminate idling time and is so efficient (running at just 40 percent of its capacity most of the time) that the facility no longer requires a second compressor on standby.

Prior to installation, Atlas Copco engineers carried out an energy audit on the existing compressor system in order to compare the data.

"The old machine consumed 18,000 kilowatt hours per month and this year, with the new compressor, energy is down to about 8,000 kilowatt hours per month," says Ian Henderson, Engineering Manager for Trelleborg Sealing Solutions in the UK. "That is 10 whole megawatt hours per month of energy saved."

Compressor costs previously represented about 5 percent of Tewkesbury's total energy costs. With the new compressor, Tewkesbury has cut its energy consumption for compressed air by 62 percent, from a 45 to a 17 kilowatt compressor. This in turn has saved the UK facility more than GBP 12,000 in annual energy costs.



ENERGY EXCELLENCE AT TRELLEBORG

Trelleborg's Energy Excellence program targets continuous improvement of energy efficiency within the Group. The objective is to reduce annual local energy consumption by 3 percent in relation to production output. All manufacturing sites must have at least two energy efficiency activities under way, and they are required to monitor and track these activities in the Group-wide Excellence Activity Tracker (EXACT) system.

Trelleborg also aims to increase its use of renewable energy for a 20 percent reduction in CO₂ emissions by 2020. Today, electricity and natural gas stand for 82 percent of the company's energy consumption.

Encouraged by these results and prompted by the Energy Excellence program, Tewkesbury is now focusing on additional ways to reduce energy consumption. "Now, when we purchase new equipment, we look at its energy efficiency and how it will benefit us, for example by selecting equipment with variable drives," Henderson says. "We are also educating people and raising awareness in the workplace so people understand the importance of, for instance, shutting off equipment that is not being used. We also have timers that automatically shut off equipment when we're not running at night."

In addition to the energy and cost savings, the new Atlas Copco compressor has delivered added benefits – it doesn't make noise like most compressors, eliminating the need for a compressor house or enclosed area. "Normally a compressor is the noisiest piece of equipment in a facility, but this compressor is almost whisper-quiet," Henderson says.

And that too is good news for the environment. ■

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MUTUAL BENEFIT

Trelleborg provides Atlas Copco with seals for its vacuum pumps, and some parts are actually made at the Tewkesbury facility. When Atlas Copco was looking for a live application to demonstrate the energy-saving capacity of its new compressor, Tewkesbury provided the perfect venue. As Ian Henderson, Engineering Manager for Trelleborg Sealing Solutions in the UK, says, "It's much better to have a mutually beneficial approach to a purchase and a collaborative effort when buying a product."



Small pot spray guns are used for the application of release agent before molding elastomer face seals.

Revolutionary TRANSFERS

Remote locations have struggled to fulfill their energy needs due to infrastructure challenges. This is about to change.

Text Otto Aalto Photos Trelleborg and Johannes Tervo



Kenneth Engblom,
Wärtsilä



Vincent Lagarrigue,
Trelleborg

The Liquefied Natural Gas (LNG) market is growing globally. In particular, the shift from large land-based terminals to a more agile and scalable model for LNG transfer will boost the market as the needs of regions that have energy infrastructure challenges can now be met.

Wärtsilä set out to design a solution that would enable small- and mid-scale LNG deliveries to locations with no existing LNG infrastructure. These include areas where the water is too shallow for ships or a jetty, or where a jetty is otherwise impractical. The concept should also allow operations in environmentally sensitive areas.

“Wärtsilä wanted to provide reliable, complete, turnkey solutions for these kinds of requirements,” says Kenneth Engblom, Wärtsilä’s Director, Global Sales & Marketing, LNG Infrastructure and Energy Solutions. “There are countless sites around the world where traditional harbors and jetties are unfeasible. Our jettyless solution is perfectly suited to difficult or environmentally sensitive locations.”



Cryoline floating hoses enhance safety, operability and availability of LNG facilities as they allow the distance to be increased between the vessel and shore facility.



In Wärtsilä’s solution, the jetty is replaced by a self-propelled Floating Transfer Terminal (FTT) that is connected with a shore facility through Trelleborg’s Cryoline floating hose. The terminal can travel as far as 500 meters offshore. The FTT has been developed in cooperation with the marine engineering firm Houlder and Klaw.

Wärtsilä first approached Trelleborg with the idea of a jettyless LNG terminal at the end of 2016 with a request for a floating transfer hose suitable for LNG.

“We needed a solution that would replace the traditional jetty,” Engblom says. “The solution should be cheaper than a traditional jetty, and it had to give the confidence to investors and banks that it is a proven and reliable solution. Trelleborg is an innovator in its field, and with a partner like that we felt confident to go forward. The company is well known for its high standards in its products and documentation, which made it a logical partner in our venture. And it helps that its corporate values are very similar to ours.”

Gas in its liquefied form presents a challenge as it needs to be transported at a temperature of -163 °C. It requires specialized hosing to transfer, and floating hoses to cover stretches of water. With Trelleborg’s floating cryogenic hoses, vessels can be moored as far as 300 to 500 meters away from an onshore storage unit. Besides the ship-to-

There are many sites around the world that cannot have traditional harbors and jetties.



TRELLEBORG CRYOLINE LNG FLOATING HOSE

- Hose-in-hose design with insulation
- Sizes 6 to 20 inches (inner diameter)
- EN 1474-2 Certified Technology
- Maximum allowable operating pressure 20 bar
- Integrated leak monitoring system
- For wave heights up to 5.5 meters.

In addition to Trelleborg's hoses, Trelleborg is a world leader in Ship-Shore Link (SSL) and Emergency Shut-Down (ESD) technology for the LNG industry. From LNG carriers, Floating Storage Re-gasification Units (FSRUs) to LNG terminals the Trelleborg system has been an industry standard for nearly 20 years.

shore connection, the hose also allows for ship-to-ship transfer in deeper waters and will be much more forgiving and flexible than a fixed loading/unloading arm.

Trelleborg's hoses are available with large inner diameters ranging from 6 to 20 inches, allowing them to cope with an LNG transfer flow rate of up to 10,000 cubic meters per hour. When not in use, the hoses are stored onshore on a custom-designed reel system.

"Our Cryoline hose enables us to rethink LNG transfers from vessel to shore," says Vincent Lagarrigue, Oil & Marine Director within Trelleborg Industrial Solutions. "The jettyless solution is cost-effective, quick to deploy and friendly to the environment. We are fortunate to have a partner like Wärtsilä. Our cooperation is a true win-win situation."

Engblom adds, "Cryoline's technology has been a key component for the jettyless concept. One of the keys was that the technology is certified and qualified globally."

Engblom and Lagarrigue agree that jettyless LNG terminals will be in high demand in the near future, and they are already seeing this in the interest generated by the concept. ■

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Precision farming technologies are gradually transforming the agricultural industry into a high-tech business. Trelleborg is contributing with an intelligent wheel design that automatically controls tire pressure according to load and ground conditions.

Text Elaine McClarence Photo Trelleborg

SMART TIRES RELIEVE THE PRESSURE

The **Variable Inflation Pressure** (VIP) system is a smart, autonomous, complete wheel capable of self-adjusting the pressure of a combine harvester's tire during operation according to its precise load. The VIP™

system helps farmers optimize a tire's footprint to reduce soil compaction, increasing efficiency and productivity. A VIP-equipped wheel can sense whether a combine is in the field or on the road. It can also detect differences between loads on each tire on the same axle. On a slope, for example, this means the VIP system can set two different pressures to enable maximum safety, high flotation and a constant footprint, resulting in good handling and low soil compaction.

In tests, measurements of the contact pressure and the footprint dimension of the tire, showed that on average there was 10 percent less contact pressure with the VIP system. "From an economic point of view this generates two effects – a better crop yield for the next season and also less energy necessary for the future plowing operations of the terrain," says Piero Mancinelli, R&D Director for agriculture and forest tires at Trelleborg Wheel Systems. Tests have shown up to a 5 percent higher crop yield than with a standard wheel.

Building an autonomous smart device integrated within a wheel rim was a challenge. "The system is made of a set of sensors, a compact compressor adapted to the reduced space inside the rim, an electro valve,



HOW VIP WORKS

The heart of the VIP™ system is a central processor that gathers information from sensors that measure sidewall deflection, pressure and temperature. Based on these readings, the processor adjusts the tire pressure via a compressor and valve according to the prevailing ground conditions. Trelleborg has developed a control system that can interpolate and correlate the data to define the actual instantaneous load acting on a single tire, so that the tire pressure can adjust quickly.





some connectors and a central logic unit to make calculations and communicate data,” Mancinelli explains. One issue was how to power the system because of battery limitations. “The solution was found with rotational electric contacts on the back of the rim,” he says.

Trelleborg worked closely with the agricultural machinery manufacturer AGCO Fendt on the development of the VIP system. The collaboration gave insight into the challenges of designing the system to work with combines and the technical details that needed to be worked out. “Together we defined the electric power requirements, and AGCO is now designing a suitable upgrade of the electric system of the combine,” Mancinelli says. In the future the two companies will work on further integration of the VIP system with the combine control systems.

As it is forecast that in the near future around 20 percent of cultivated land will rely on precision

farming technology, Trelleborg is committed to further development of the VIP concept alongside other intelligence systems.

“Agricultural machines are increasingly dependent on digital technology, and tires need to play their part in this process,” Mancinelli says. “Several manufacturers have already started to supply tractors that are able to deliver data to a cloud, and such data is useful for many predictions and analysis, such as indicating optimized working conditions or preventive maintenance. Crucial information is still missing in this process – the tire pressure and its optimization to actual conditions – so we want to close this gap.”

Digital interfaces and a specific app allow the operator to have total control of machine setup, footprint area and tire pressure, all of which will help tires support improved machine efficiency in agricultural applications. ■

Farmers increasingly depend on digital technologies. The VIP system that gathers tire information from sensors is one example.

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Offshore testing **ONSHORE**

The NjordGuard™ cable protection system for offshore wind farms has been successfully put to the test. Eight full-scale wet tests were carried out in controlled subsea conditions without having to go offshore.

Text Antony Riley Photo Trelleborg

NjordGuard™ is a protection system for offshore windfarm power cables.



The NjordGuard system for protecting offshore wind farm power cables passed eight controlled wet tests at the Offshore Renewable Energy (ORE) Catapult in Blyth, England. The center contains two still-water test tanks and an artificial seabed. Managing to test and verify in a controlled environment removed the time, effort, costs and risks involved in testing offshore. Additionally, testing in such an environment makes it possible for companies to make decisions on design and development at an early stage.

“ORE Catapult is delighted to have supported Trelleborg Offshore & Construction through such an important series of tests,” says David Hailes, Asset Project Manager – ORE Catapult, Marine. “We are well aware of the challenges of testing sophisticated equipment for use in harsh offshore conditions, and it was critical to conduct the appropriate levels of testing in order to prove Trelleborg’s technology. We look forward to working with them on future projects.”



David Hailes

Besides passing all the tests, NjordGuard was installed and removed from the test rig without the intervention of a remotely operated vehicle.

ORE Catapult’s controlled environment made it possible to develop a test procedure to represent the pulling and locking of cables into an offshore foundation. The test procedure was conducted under the same loads potentially experienced during offshore installation.

NjordGuard is a protection system designed and developed to protect offshore wind farm power cables. It requires minimal assembly, is easily extendable and can be manufactured to protect cables of any diameter. ■

FOR MORE
INFORMATION
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CATAPULTING ALTERNATIVE TECHNOLOGY

The Offshore Renewable Energy (ORE) Catapult is the UK’s flagship technology innovation and research center for wind, wave and tidal energy.

The Catapult centers are a network of world-leading facilities designed to transform the UK’s capability for innovation in specific areas and help drive future economic growth.

ORE Catapult is responsible for several world firsts, including accelerated testing of 66kV cables and operating the world’s largest open-access offshore turbine dedicated to research.

The hottest topic in 3D printing is industry production tooling, says Olaf Diegel, Professor of Product Development. Making a tool with 3D printing can be up to ten times faster than with conventional methods, and this time saving can mean greater profits. But 3D printing technology offers many other benefits as well.

Text Lars Österlind Photo Christian Andersson

PRINTING THE FUTURE



Olaf Diegel's hobby is designing guitars for 3D printing.

His corner office is easy to find – just follow the colorful 3D-printed guitars displayed on the walls. Apart from more guitars, Professor Olaf Diegel’s room at the Ingvar Kamprad Design Center at Lund University in Sweden is filled with weird-looking gizmos and gadgets, 3D-printed models and prototypes. “I encourage my students to repurpose and hack things, to think differently,” he says. “When you improvise, you force yourself to change your narrow view into a broader view. We have 3D printers on each floor in this building and they are free to use for our students.” Diegel’s own “free thinking” might derive from his roving life. He was born in New Zealand, grew up in Canada and studied electronic engineering in South Africa. He also lived in the United States and Japan before coming to Sweden three years ago.

3D printing technology forces engineers to rethink a product’s design. That is one of the focus areas of Diegel’s research – designing for 3D printing to maximize the use of technology. In short, 3D printing starts from a CAD model of, for instance, a cogwheel. The drawing of the cogwheel is sent to a printer that “slices” data into thin horizontal slices. The printer builds up the product layer by layer. This can be done in different materials, usually plastic or metal.

Rethinking design using 3D printing technology brings many benefits. One of them is the ability to make things lighter, while keeping quality and strength intact. “We make an analysis to see where the stress is in the material, then remove all material that’s not needed,” Diegel says. “For one company we made a manifold. The traditional component weighs 14 kilograms, but with 3D printing we made a component that weighs only 1.3 kilograms.”

Another benefit of 3D printing is its ability to handle complicated structures and designs. “The more complex a part or product is to make, the better it is to 3D-print it,” Diegel says. The technology enables a product that traditionally consists of many pieces to be consolidated into one single part.

The ability to make complex and lighter components is especially useful in the aerospace industry, where each kilogram less on a plane is extremely important for saving



Two benefits of 3D printing is its ability to make complex and light components.

fuel. The aerospace industry is an early adopter of 3D printing technology, along with manufacturers of high-value products such as sports cars and medical products.

Over the past five to eight years, printing technology has improved to the point that it can be used for much more than prototyping and high-value products, Diegel says. It means that manufacturers can make full-strength parts and start making spare parts on demand. “Tooling is where we see the big push today,” he says. “You can act faster, increase productivity and control quality in a better way. When we can make the tool with 3D printing we get to market much faster with a product. Being able to make a tool in two or three days instead of two or three months is a big advantage.”

Diegel joins his passion for 3D printing with his other passion in life – music. He designs and prints out guitars. He picks up a gray guitar case from a shelf. “This is number 71,” he says. “I would love to be in a rock and roll band again, but it’s hard to find the time for it.”

One of the main challenges Diegel sees for the future is post-processing of metal objects. “Automating the printing part is a growing trend, but almost nobody is automating the post-processing part,” he says. “That is the bottleneck today. The print time for one of my guitars was nine hours, but removing the supporting material took four days.” ■

“

The more complex a part or product is to make, the better it is to 3D-print it.”

Olaf Diegel



OLAF DIEGEL

Born: In New Zealand, but grew up in Canada and South Africa.

Lives: Malmö, Sweden.

Education: Electronic engineering, PhD in product development.

Profession: Professor of product development at Lund University, Sweden.

Family: Wife and a dog.

Hobbies: Designing guitars for 3D printing, playing music and creating theatrical lighting.

Hidden talent: The ability to improvise and repurpose things. "I encourage my students to have those skills. The modern engineer needs to be a Renaissance man and learn how to pick up new things quickly."

Passion: Technical problem solving.

Sacred art: 3D printing can produce all sorts of models, including this beautiful church.



AN ESSENTIAL TOOL AT TRELLEBORG

Three years ago, Martin Hignett, Managing Director of Trelleborg Sealing Solutions in Malta, visited his 17-year-old son's high school and saw that students were using a 3D printer to make prototypes for their design projects.

"This inspired me to buy the first 3D printer for our facility," he says. Since that day, Hignett and his team of engineers have been printing functional parts for dedicated machines and robots, which are designed and built in-house. "We can now print the parts we need for 10 to 20 percent of the cost compared to having them made the traditional way. The biggest benefit, however, is speed. In a few hours we can go from concept to a functional part on a machine."

Today, the 3D printing laboratory in Malta consists of seven 3D printers featuring different printing technologies. The engineering team has three main objectives for using 3D printing: optimizing the production machines using 3D printed parts, generating new prototypes for customers and developing printed mold tools.

3D printing is also used extensively throughout Trelleborg.

A RUBBER FACTORY BOUNCES BACK

Trelleborg's old rubber plant in Värnamo, Sweden, has been transformed into a vibrant, creative meeting place for business and visitors of all ages.

"Gummifabriken, 'The rubber factory', is more than a cultural center," says Sofie Svensson, Marketing Manager at Gummifabriken. "Here you will find a campus with a technology center, restaurant, library, auditorium and cinema."

The Värnamo plant had been well known for 40 years before Trelleborg bought it in 1980. At one time, half of all the bicycle tires in Sweden were manufactured here – one million tires per year. The product range later expanded into galoshes, raincoats, hoses, hockey pucks and more. Production closed down in 2006, and the new meeting place opened two years later. Activities expanded further in 2017, and today the center offers lectures, cafés, a competence academy, a technology center and venues for theater, music and company conferences.

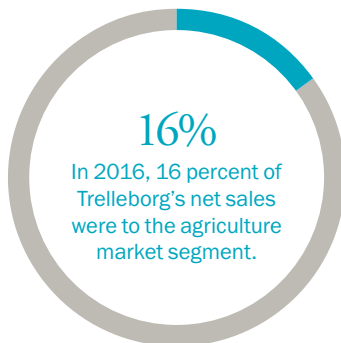
The municipality of Värnamo has a vision of becoming "the human growth municipality" with 40,000 residents in 2035, twice the current population.

"A rich cultural and business community, as well as access to academic education, are prerequisites for a municipality's ability to grow," Svensson says.



DID YOU KNOW?

... that Trelleborg's main raw materials are synthetic and natural rubber, metal components and additives. Supplier assessments are conducted and are high on the corporate responsibility agenda.



New facility in Retford

The new purpose-built, state-of-the-art manufacturing facility in Retford, England, will enhance Trelleborg's applied technologies polyurethane manufacturing capabilities. A

Center of Excellence for diversified polyurethane component manufacturing, it will bring together experience, innovation and technology under one roof.

Ray Cann, Managing Director within Trelleborg Offshore & Construction in Retford, says, "It is essential that we are best placed to meet the growing demands of our customers, not only in terms of capacity, but in terms of developing innovative; cost-effective solutions that provide the utmost quality and performance."



Trelleborg acquires U.S. composites manufacturer

Trelleborg have signed an agreement to acquire U.S.-based Automated Dynamics, a company that specializes in the manufacturing of advanced composite components for particularly demanding applications. The company had its

location in Niskayuna, New York, and had annual sales of approximately USD 7.65 million (SEK 65 million).

"The acquired company provides key capabilities in composites, bringing new competences to Trelleborg," says Claus Barsøe, President of the Trelleborg Sealing Solutions business area. "We already see many opportunities for new products, applications and materials for aerospace and chemical applications, and in the long-term also for other markets."





A BIKE RIDE AGAINST MULTIPLE SCLEROSIS

The Trelleborg Offshore & Construction facility in Houston, Texas, has joined the movement toward a world free of multiple sclerosis – on bicycles. Ten Trelleborg employees, family members and friends participated in the fundraising bicycle ride BP MS 150 2017 – and raised more than USD 7,000 for the cause.

“It was both inspiring and challenging to have participated in the ride along with my Trelleborg teammates,” says Antony Croston, Business Group Director within Trelleborg Offshore & Construction in the U.S. and captain of the Trelleborg team. “I am proud to support the MS Society by helping to raise awareness for the disease.”

The BP MS 150 is a two-day bike ride organized by the National Multiple Sclerosis Society. The ride is the largest event of its kind in North America, with 13,000 cyclists, 3,500 volunteers, and countless spectators along the route and at the finish line in Austin, Texas.

For more information about the Trelleborg team or to make a donation, visit: main.nationalmssociety.org/goto/Trelleborg



WHAT IS THIS?

A set of barbells for doing some heavy lifting at the gym? Or the wheels for the new Mars explorer? Answer at the bottom of this page...



Answer: You will find Trelleborg's high-quality elastomer rollers in ATMs and professional printers as well as in packaging machines.

A photograph of a man and a young child sitting on a thick tree branch. The man, on the left, is wearing a blue and white checkered shirt and dark pants, smiling warmly at the child. The child, on the right, is wearing a light blue long-sleeved shirt and dark pants, looking off to the side with a smile. The background is a soft-focus view of trees and sunlight filtering through the leaves. A blue light flare effect is visible in the bottom right corner.

Blue Dimension™ protects people

At Trelleborg, we believe that the benefits of our solutions stretch beyond functionality and business performance. Whenever possible they should also contribute to better sustainability. In fact, many of our solutions protect the environment and people, as well as infrastructure and assets. This is what we call Blue Dimension™ – Solutions for Better Sustainability.

trelleborg.com/bluedimension