

t·time

A MAGAZINE FROM TRELLEBORG GROUP

3-2024

SOLUTIONS FOR ADVANCED APPLICATIONS
IN CHALLENGING OPERATING CONDITIONS

PLUS

SAFER AND HEALTHIER
FOOD PROCESSING

IMPLANTABLE
MEDICAL DEVICES

TRELLEBORG IN THE US



Why airships are on the rise again

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EDITORIAL

In full flight

Trelleborg has a long history in the aerospace industry. When you board an aircraft, there are hundreds of products on the plane developed by us – from engine seals to evacuation slides. We are further strengthening our position in the industry with a new facility in Morocco that will open at the end of 2025.

Based on our expertise in aerospace, our involvement in airships seems natural. With our materials knowledge in engineered fabrics, we are leading the development of lighter-than-air technology.

A key driver for our business is protecting the essential. What is more essential than water? That is why we provide solutions



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Pakistan's plan to retrofit 28 million vehicles with electric engines.

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IMPLANTABLE DEVICES

How advanced medical technology is transforming patient care.

for building new water infrastructure and repairing existing pipes. In this issue, go underground and see how old leaking concrete pipes are cured in place in Hong Kong.

Another example of protecting the essential is in medical technology. Find out how polymer implants can significantly improve patients' lives.

Enjoy your read!

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Cover photo: Getty Images

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Trelleborg is a world leader in engineered polymer solutions that protect advanced applications in challenging operating conditions. Its innovative solutions accelerate performance for customers in a sustainable way. The Trelleborg Group had annual sales of about SEK 34 billion in 2023 and operations in about 40 countries.

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





Airships are being proposed for passenger air travel in remote areas, such as the Scottish Highlands and Islands.

RISING ABOVE

AS THE AEROSPACE INDUSTRY SEEKS SUSTAINABLE ALTERNATIVES, A RESURGENCE IN AIRSHIP TECHNOLOGY IS TAKING FLIGHT. TRELLEBORG STANDS POISED TO PLAY A PIVOTAL ROLE IN THIS GROWING INDUSTRY SEGMENT. ►

TEXT ANDREW MONTGOMERY
PHOTOS GETTY IMAGES AND TRELLEBORG



PHOTO: GETTY IMAGES

“We are uniquely placed in this market segment due to our technical expertise and extensive processing capabilities.”

Kevin Maine, Trelleborg



The re-emergence of airships as a sustainable mode of air travel is capturing the global imagination. In the early 20th century, huge engine-driven balloon-shaped Zeppelins were the first aircraft capable of controlled powered flight, but by the 1940s these lighter-than-air giants had lost out to much faster commercial airplanes.

Today, however, the urgency of climate change has seen several start-ups go “back to the future” to develop new types of airships as sustainable alternatives for some passenger and cargo flights. UK-based Hybrid Air Vehicles, US-based LTA (Lighter Than Air) Research and French company, Flying Whales, are three of the main contenders.

Trelleborg is an ideal partner to help the airship pioneers of the 21st century on their development journeys. Over the past two decades, Trelleborg’s engineered coated fabrics have become market leaders in the lighter-than-air sector. These advanced polyurethane materials for airship construction offer multiple functional benefits. The materials are robust enough to securely contain helium gas and support engines, while providing crucial protection against ultraviolet rays. Despite their strength, they remain sufficiently lightweight to facilitate high-altitude navigation.

“We are uniquely placed in this market segment due to our technical expertise and extensive



Airships have been rare since the 1940s but tethered aerostats are widely used. Here, one is tied to an oil rig support ship in Canada's Northwest Territories to monitor icebergs.



READ MORE

For more information about this topic, [click here.](#)

processing capabilities,” says Kevin Maine, who is Commercial Director for Trelleborg’s North American aerospace business. “We blend polymers and textiles through various coating and laminating processes tailored to the unique needs of aerostats and other lighter-than-air applications. Our materials are engineered to perform exceptionally in diverse and demanding environments, ensuring reliability where it matters most.”

Sarah McGuire, Business Development Manager, adds, “Our 25 years of experience in aerostat applications has not only deepened our technical expertise but also enhanced our ability to innovate. The materials we’ve developed are crucial for the operational success and longevity of these applications.”

Aerostats are ground-tethered balloon structures that rely on helium buoyancy or static lift rather than floating in the air as airships do. Often equipped with cameras, sensors and antennae, aerostats serve critical roles in surveillance and reconnaissance, primarily for security applications. Trelleborg provides advanced materials essential for some of the major international entities in this segment. Beyond security, aerostats find applications in weather monitoring and enhancing telecommunications signals.

While aerostats and unmanned airship-style drones are the most common lighter-than-air aircraft, the proposed renaissance of airships is grabbing the headlines. Kevin Maine says their fascinating history, broad range of applications and sustainability profile make the future of airships really exciting.

The UK’s Hybrid Air Vehicles is developing its electric-powered airship to become an option for short-range sustainable flights of up to 100 passengers in more remote areas, such as the Scottish Highlands and Islands, where air travel is limited for geographic and commercial reasons. The company says its aircraft could emit

**Airships:
a brief history**

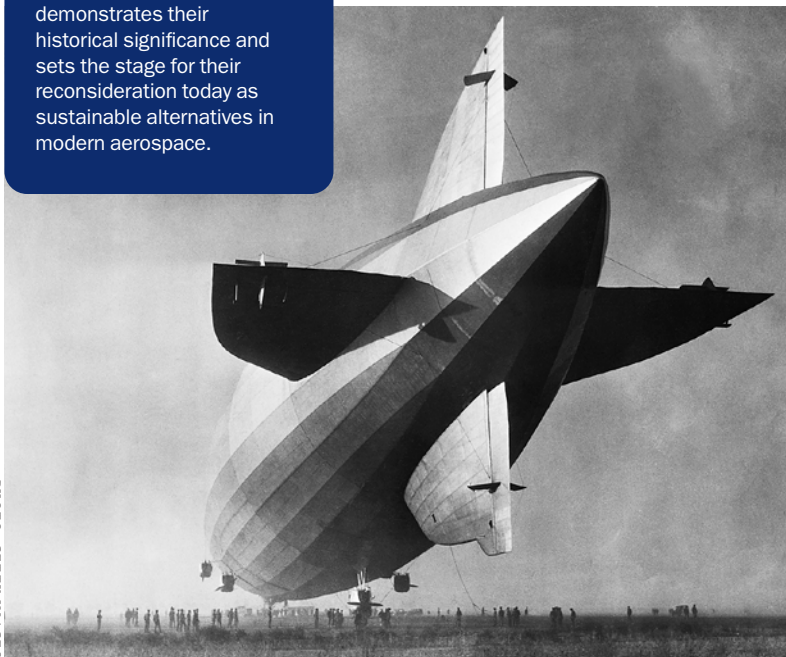
An airship’s ability to hover and maneuver at slow speeds made them suitable for various tasks, including transatlantic flights that offered passengers a unique travel experience. This early use of airships demonstrates their historical significance and sets the stage for their reconsideration today as sustainable alternatives in modern aerospace.

AIRSHIPS GAINED PROMINENCE IN THE EARLY

20th

century serving multiple roles before airplanes became the primary mode of air travel.

PHOTO: GETTY IMAGES



“Our 25 years of experience in aerostat applications has not only deepened our technical expertise but also enhanced our ability to innovate.”

Sarah McGuire, Trelleborg





PHOTO: TRELLEBORG

Engineered coated fabrics: the perfect technology

Trelleborg’s proprietary coated material solutions are designed to meet challenging lighter-than-air requirements for low density, high strength, excellent weathering resistance and low helium permeability.

“Our role is pivotal in guiding our clients toward the most suitable coated material constructions, balancing helium retention and strength-to-weight ratios.”

Rick Malo, Trelleborg



90 percent less carbon emissions than passenger jets. It plans to establish a UK manufacturing site in Doncaster. Already orders for a handful of aircraft have been placed by Spain’s Air Nostrum.

Meanwhile, LTA Research, started by Google co-founder Sergey Brin, has a vision of zero-emission airships being used to deliver food, water and equipment drops to speed up disaster response and relief work.

Flying Whales promises “a revolution in air cargo transport,” with a 200-meter-long and 50-meter-wide aircraft for carrying very large payloads – up to 96 meters long and eight meters wide. This could provide better access into hard-to-reach areas such as remote mining sites in northern Canada that need huge specialized equipment that is difficult to transport.

There are still significant regulatory hurdles for airships, such as meeting stringent aviation authority equipment tests and for pilots to attain flying hours on a type of aircraft few people have flown in the past 80 years. However, Trelleborg is already actively engaged in supplying engineered coated fabrics

for autonomous electric airships that are aimed at infrastructure monitoring of oil and gas pipelines and power lines, enabling early leak detection and minimizing waste and pollution. This technology also supports advanced agricultural practices, enhancing crop and weather monitoring to optimize farming efficiency.

Rick Malo, Plant Manager at Trelleborg’s Monson, Massachusetts, facility in the US, says, “Our role is pivotal in guiding our clients toward the most suitable coated material constructions, balancing helium retention and strength-to-weight ratios. We’re adept at managing the entire production spectrum, from sourcing to manufacturing, and excel in collaborative prototyping.”

McGuire adds, “Nearly every component of the ship itself, from the ballonet, a gas-filled bag in the airship that controls buoyancy, to the fin, hull and tapes, is composed of coated fabrics, affirming Trelleborg’s unique position in this market segment. Potential growth for this niche could significantly increase the demand for our materials.” ■



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NEWS



Less disruption

Trelleborg Group has acquired BP-Tech Group, including Boldan and Spraypoxy, a pipe repair specialist based in Rajamäki, Finland. The business is an innovation leader in trenchless pipe technology, which ensures that repairs to pipes in urban areas are quicker and cause minimal disruption.



PHOTO: BOLDAN

“Aging infrastructure in Europe and North America sees between 25 and 50 percent of piped water lost to leaks annually with significant cost and environmental consequences. Trenchless technology is vital to the repair of critical infrastructure,” says Jean-Paul Mindermann, President of the Trelleborg Industrial Solutions business area.



Play it again, Sam

Casablanca was the name and location for the iconic 1942 movie when actor Humphrey Bogart asked Dooley Wilson to play the song again. Now it is also the home of Trelleborg's latest planned facility that will focus on aerospace sealing solutions.

With a prime position in the city's Midparc Industrial Freezone right next to the Mohammed V International Airport, the state-of-the-art building will take advantage of the African sunshine and receive a substantial part of its energy supply from solar panels on its roof.

PHOTOS: TRELLEBORG AND GETTY IMAGES



PHOTO: GETTY IMAGES

Calming the storm

Above: The Maeslantkering in an open position on the Nieuwe Waterweg to Rotterdam in the Netherlands.

Rubber supports and fenders from Trelleborg are playing a pivotal role in enhancing the safety and durability of the Maeslantkering, a storm surge barrier near Hoek van Holland in the Netherlands.

Trelleborg supplied 14 special rubber support points for each of the barrier's water retaining doors along with 248 fenders within steel containers at the barrier's base. The supports act like resilient springs while the fenders address kinetic energy issues during door closure.

Safer electric vehicles

Electronic sensors and controllers are vital to today's rapidly evolving electric vehicles. To protect these critical systems, Trelleborg has developed the Rubore Washer, which offers virtually leak-free sealing beneath screw-heads. These safeguard, for example, the vehicle's battery pack from extreme temperatures, precipitation and exposure to salt.



PHOTO: TRELLEBORG



READ MORE

For more information about this topic, [click here](#).

Fender technology has greatly improved in recent years, with fenders becoming highly engineered products.

A SAFE BERTH

FENDERS MAY LOOK THE SAME AS THEY DID 20 YEARS AGO, BUT THE TECHNOLOGY INSIDE THEM HAS COME A LONG WAY. EXTENSIVE TESTING IS KEY TO THIS ADVANCEMENT.

TEXT DONNA GUINIVAN PHOTOS WANG KAN

Fenders are critical to bringing ships alongside a berth in a safe and efficient way.

They feature in all ports and on all types of vessels, and although they may appear simple from the outside, they are anything but that on the inside.

“Up until just a couple of years ago, fenders were seen as a commodity product,” says Mishra Kumar, Business Unit Director responsible for fender R&D technology and innovation at Trelleborg. “However, the status of fender technology has significantly improved lately. Now the industry regards fenders as highly engineered products rather than just lumps of rubber.”

It is impossible to tell the quality of a fender from the outside. Recent research conducted by Politecnico di Milano, a renowned test facility in Italy, revealed that approximately

one-third of fenders tested did not meet performance requirements.

“The Politecnico evaluated fenders from five different brands, including Trelleborg,” says Marco Gaal, Technical Director Marine Fenders Technology and Innovation. “All our fenders passed testing parameters, but some of the fenders from other brands did not.”

Testing is vital to validate performance claims against design parameters. Trelleborg has cooperated for many years with the world association for waterborne transport infrastructure, PIANC, to help regulate fender quality.

The association recently released its latest Fender Guidelines 2024. “Notably, the revised guidelines include a section focusing on fender testing, outlining specific testing types and protocols as well as pass





Global fender projects

Container Berth, Poland

Initially the port opted for relatively low-cost fenders from one of Trelleborg's competitors but the systems failed to perform to expectations. Testing revealed significant discrepancies between the performance claims and the actual results.

In response, Trelleborg provided the client with new fenders, along with independent testing conducted at a third-party laboratory. This restored client confidence, securing a fender order for the original project and its second phase.

LNG Terminal, Latin America

The terminal suffered from severe conditions leading to extreme fender fatigue.

Trelleborg offered its solution, and to assure reliability the company conducted durability and fatigue tests at a third-party institution. These tests were crucial in demonstrating to the client that Trelleborg fenders could withstand the terminal's harsh conditions. Subsequently, the fenders have successfully operated for more than four years.

Fender System Replacement Project, US

The main factor in Trelleborg securing this project was the confidence instilled in its product through independent third-party performance testing.

Collaboratively, the client and Trelleborg formulated a high-level specification, encompassing thermo-gravimetric analysis and independent third-party performance testing. Notably, low-cost competitors opted not to bid, so Trelleborg won the contract and its fenders have now undergone further rigorous testing prior to installation.



Trelleborg's fenders are designed to withstand the tough operating conditions at ports and terminals.



Maggie Wang is supply chain manager at Trelleborg's Qingdao fender testing facility.



Trelleborg's facility in Qingdao, China, is the company's main global test center for fenders.

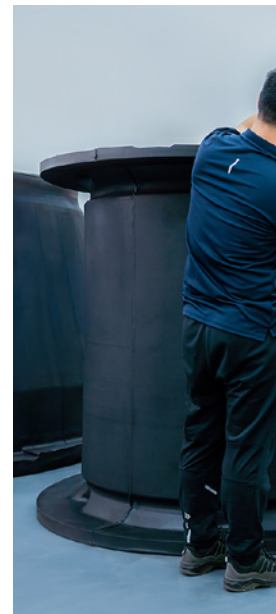
and fail criteria," Gaal explains.

"It's imperative that any reputable supplier adheres to the latest PIANC guidelines," says Kumar. "However, at Trelleborg we surpass these standards."

Our proactive approach is behind the recent investment in a dedicated fender testing facility in Qingdao, China, where Maggie Wang is supply chain manager. "The new facility is now the main test center for fenders globally," she says. "Working to and going beyond the new PIANC guidelines, it is cutting edge. Uniquely, it houses high-speed fender testing and a fully temperature-controlled test room equipped with various test presses."

Fender technology is continuing to develop; testing, along with the data it provides, is vital to future advancements. "The evolution of our industry, coupled with heightened client expectations, necessitates continuous innovation," says Kumar. "Our R&D testing capabilities are unparalleled, enabling us to gain deeper insights into fender behavior so we can push the boundaries of product development. Our resources facilitate continuous improvement activities such as tightening product performance tolerances and exploring novel, sustainable compounds."

This has become a recent focus for Trelleborg, Gaal says. "For





Measuring fenders at the Qingdao test facility.



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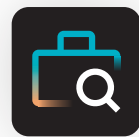
example, we are developing rubber compounds using bio-based oils and recycled carbon black.”

“Trelleborg has not only enhanced its materials but also optimized fender geometry,” adds Kumar. “This translates into smaller fenders, also contributing to increased sustainability as well as cost savings for clients.”

Trelleborg is a leader in supporting the development of smart ports, which leverage innovative technologies and data-driven solutions to enhance port efficiency, safety and sustainability while lowering operational risk. Fenders are still a necessity, combining with equipment, such as Trelleborg’s

“Trelleborg has not only enhanced its materials but also optimized fender geometry.”

Mishra Kumar, Trelleborg



WORK WITH US

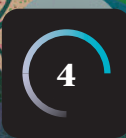
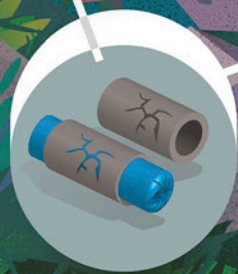
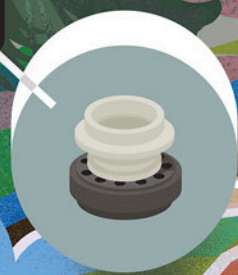
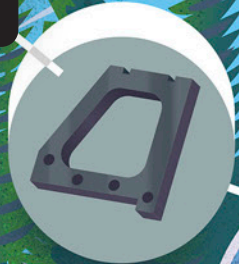
Do you want to find your new career within Trelleborg? Read more here.

Fender testing technology is vital to future enhancements.

Docking Aid Systems and Portable Piloting Units. “It was only a matter of time before we looked to make our fenders smart, too,” says Gaal. “We’re now beginning to integrate smart features into traditional but essential fender products.”

Kumar tells us that in the near future, Trelleborg will be prototyping smart fenders at two ports, one in the Middle East and one in Europe. “Our objective is to introduce smart fenders next year that will be capable of gathering berthing data,” he says. “This data will not only enhance fender maintenance but also provide information to allow us to design more robust fender systems in the future.” ■

THE AMERICAN DREAM





TRELLEBORG

H₂

Hydro

40

45



TRELLEBORG

H₂

40

45

THE AMERICAN DREAM

From dense Alaskan forests to rolling prairies in North Dakota, and from the Rocky Mountains' chilly peaks to Florida's tropical weather, the diverse climate of the US offers unique opportunities for Trelleborg's products and solutions.

TEXT JAN SKLUCKI

ILLUSTRATION NILS-PETTER EKWALL

1. Above and beyond

Advanced composites fuse layers of material to create durable structures for aircraft, replacing aluminum parts to reduce weight, lower fuel consumption and allow for more passengers.

2. To good health

Trelleborg has a strong presence in health care and medical technology in the US, with eight manufacturing units, three innovation centers and a new business area, Trelleborg Medical Solutions, headquartered in Minneapolis.

3. No dig? No problem!

Trenchless pipe rehabilitation seals sewers from the inside using a polymer liner, thus stopping pollution from seeping into groundwater. Avoiding excavation minimizes disruption to communities, traffic and the environment.

4. Brakethrough technology

The US has a long history in the automotive industry, becoming the largest car manufacturer in the world following the advent of mass production. Brake shims reduce vibrations for a smoother, safer and quieter journey.

5. Back on track

Reliability is critical when transporting hazardous chemicals. O-Rings and gaskets ensure that trains have no accidental releases and are available immediately through the Tran-SECURE program to reduce downtime.

6. Cleaner energy

Hydrogen is an alternative way to meet sustainability goals when moving away from fossil fuels. A new testing facility in Indiana supports the development of the specialized H₂Pro materials.

7. Moor than meets the eye

Mooring solutions are behind safe docking operations worldwide, accommodating the largest cruise ships in ports such as Miami. They integrate smart technologies, providing real-time data to improve port efficiency and safety.

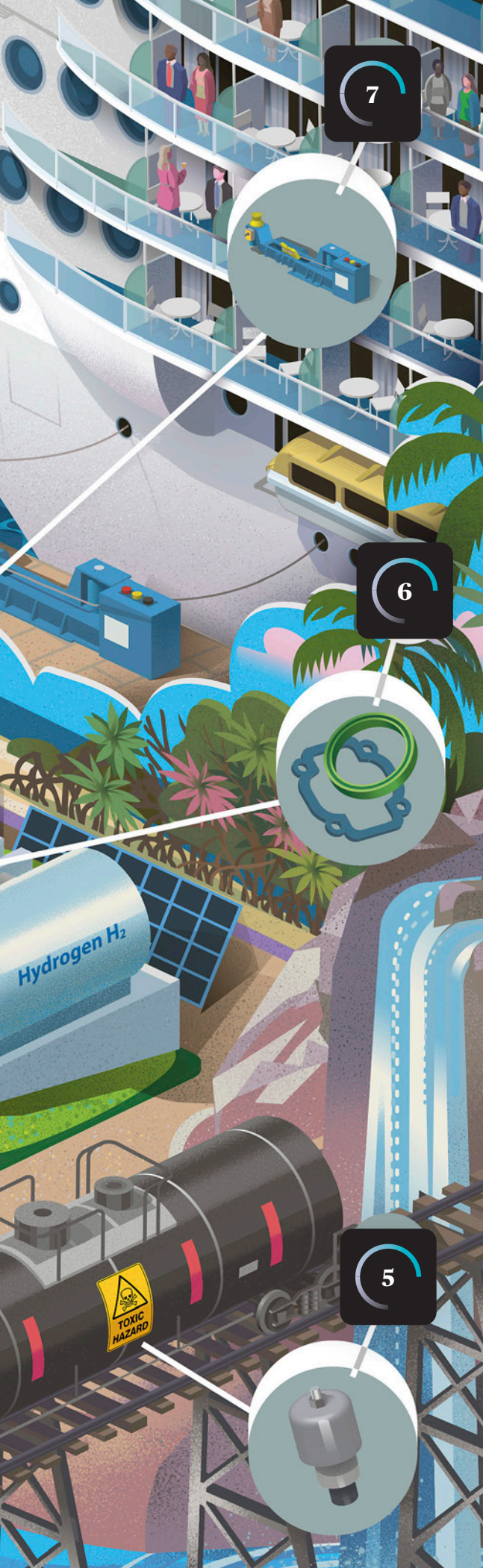




PHOTO: GETTY IMAGES

Left:
The plane's crew evacuated the passengers from Flight 1549 through its four overwing window exits and into an inflatable slide raft deployed from the front right passenger door.

Below:
An example of the airplane escape slides that are made with Trelleborg coated fabrics.



Miracle on the Hudson

In 2009, US Airways Flight 1549 departed from New York City to North Carolina. Disaster struck when the aircraft lost both engines after striking a flock of birds shortly after takeoff. Following a daring landing on the Hudson River, 150 passengers relied on escape slides and rafts manufactured with coated fabrics from Trelleborg.



PHOTO: GETTY IMAGES

SETTING SAIL

The Icon of the Seas is the world's largest cruise ship, weighing 248,663 gross tonnes and measuring 365 meters in length. It took its maiden voyage in January 2024, departing from the Port of Miami. The vessel can hold 2,350 crew for 5,610 passengers and is the first ship of this type that LNG can power.



PHOTO: GETTY IMAGES

800,000

MILES is the estimated length of the US public sewer network.

SOURCE: [INFRASTRUCTUREREPORTCARD.ORG](https://www.infrastructurereportcard.org)



PHOTO: GETTY IMAGES

10.6

MILLION motor vehicles were produced in the United States in 2023.

SOURCE: [WWW.STATISTA.COM](https://www.statista.com)

As hydraulic systems often operate in difficult environments such as construction sites, the seals prevent materials from getting in that could harm the hydraulics.

**READ MORE**

For more information about this topic, click here.

LESS FRICTION

ACHIEVING POWER REDUCTIONS BY CLEVER DESIGN OF HYDRAULIC SYSTEMS MAY NOT BE AN OBVIOUS SUSTAINABILITY ACTION, BUT IT CAN BE A SIGNIFICANT WAY OF LOWERING ENERGY USE. ►

TEXT DONNA GUINIVAN **PHOTOS** TRELLEBORG AND GETTY IMAGES

PHOTO: GETTY IMAGES



“We are building on our unique, unrivaled knowledge to continuously improve hydraulic sealing systems, and one area we focus on is energy reduction.”

Mandy Wilke, Trelleborg

Hydronic systems are everywhere: controlling the movements of arms and buckets of off-highway equipment, in many motive applications, on the landing gear of planes and even in prosthetic knee joints.

“Inherently, elastomer and polyurethane seals stick to their countersurfaces,” says Mandy Wilke, Technical Manager for rotary sealing at Trelleborg. “In dynamic applications within hydraulics, that stickiness causes friction, which requires extra energy to move the hydraulic systems. This is especially true at low speeds and when movement starts, a phenomenon called stick-slip. The greater the friction, the greater the energy consumed.”

Sealing hydraulics requires complex configurations of seals, each specially designed and combined to do a specific role within the sealing system.

“Rod sealing systems, for instance, usually consist of three main elements,” explains Wilke. “There is a primary and secondary seal, along with a scraper. In addition, there will be guiding elements.”

Lubrication within the sealing system is key to making it work effectively. Wilke says, “It is simple: the better the lubrication, the lower the energy consumption.”

However, the technology behind system designs is not simple, and the expertise required to optimize the performance of hydraulics and maximize its energy saving benefits in equipment should not be underestimated.

“Because hydraulic systems have been around since the sixth millennium BCE, and Pascal’s Law, one of the principal laws of hydrodynamics, goes back to 1647,

hydraulics tends to be thought of as an old technology,” she says, but she emphasizes that this is not the case.

“Trelleborg was one of the founding fathers of modern-day hydraulic sealing systems, and many of the sealing geometries that are now used as standard in the industry are our inventions,” Wilke says. “However, we are innovating all the time. We are building on our unique, unrivaled knowledge to continuously improve hydraulic sealing systems, and one area we focus on is energy reduction.”

This is especially important for Trelleborg’s

Do You Know?

Approximately

20%

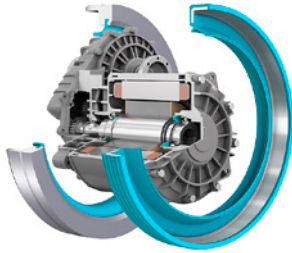
of the total energy expenditure of the world is due to the impact of friction and wear in the transportation, manufacturing, power generation and residential sectors.

SOURCE:
‘GLOBAL IMPACT OF FRICTION ON ENERGY CONSUMPTION, ECONOMY AND ENVIRONMENT’;
HOLMBERG & ERDEMIR, 2015.



ILLUSTRATION: TRELLEBORG

HiSpin HS40 rotary seals are specifically designed for applications in e-Axles.



customers, with sustainability being a major driver for new product designs and system modifications.

“It’s about making sure the tribology of the system is right,” says Wilke. “To do this we’re focusing holistically on the friction, lubrication and wear of interactive surfaces



Sealing solutions for fluid power applications showing engine, lubrication cylinder, accumulator, valve, rotary seals and drivetrain.

Hydraulic sealing

In hydraulic systems, pressurized liquids such as mineral oil or water generate, control and transmit power. In hydraulic components such as cylinders, motors and actuators, seals keep hydraulic fluids within the systems.

In addition, as hydraulics often operate in difficult environments, such as construction sites, they prevent the ingress of external media that could harm the hydraulics.

Sustainability on- and off-road

An example of how seals contribute to energy saving and sustainability are the specially engineered dynamic seals within the swivel joint of central tire inflation systems (CTIS).

These systems adjust the pressure of tires while trucks and tractors travel on- and off-road, optimizing tire pressure by matching it to the surface the vehicles are traveling on. Not only do CTIS reduce fuel consumption of vehicles by up to 15 percent, they also protect the soil when tractors are operating in the field.



PHOTO: GETTY IMAGES

in relative motion, combining our knowledge of physics, chemistry, materials science, mathematics, biology and engineering.”

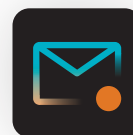
Before the advent of computers, designing hydraulic systems relied on physical samples and trial and error. Now, finite element analysis and other simulation methods make an engineer’s job not only easier but also more effective.

“In the virtual world, we can combine different sealing elements and modify seal types and materials, while varying distances between seals in a cylinder to balance lubrication,” says Wilke. “Critically, we can analyze flows so there’s enough lubrication but not too much and make sure that lubrication is in the right places – for instance, providing a higher fluid film under the primary seal.

“We make sure the systems we design work harmoniously to minimize friction when operating and especially at start-up, even after equipment shut down,” she says. “That’s particularly important to saving energy.” ■



Zurcon buffer Seal IM is a heavy-duty primary rod seal.



CONTACT

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READ MORE

For more information about this topic, [click here.](#)

The healthy eating trend means food processing equipment needs adapting for more fibrous, abrasive foods.

FOOD SAFE

Food processing equipment needs to be adapted to ever more stringent demands from consumers and regulators. Trelleborg has developed materials and testing processes to meet such requirements.

TEXT PATRICK GOWER
PHOTOS GETTY IMAGES AND TRELLEBORG

Consumers want foods that suit healthy, fast-paced lifestyles. They want nutritious options that take little or no preparation before eating, and increasing numbers want plant-based foods. These are meals that entail intensive processing, so manufacturers must innovate to stay ahead.

“If you take one of the big trends, like vegan, plant-based foods – the products look like meat but the process behind them is more complicated,” says Dr. Ana Lucia Vasquez-Caicedo, Global Technical Manager, Food & Beverage, at Trelleborg. “Often food processors need to adapt their equipment to handle a wider range of ingredients with different physical properties, mostly containing particles or fibers

that are more abrasive to equipment surfaces.”

The rise of convenience and plant-based foods are not the only trends driving change in the food processing industry. Consumers also want to know that their meals are ethically sourced and sustainably produced with minimal waste. At the same time, surging population growth and the rise of the middle class in emerging markets are pushing manufacturers to produce an ever-changing array of products to suit local tastes.

And it is not just consumers who are more demanding. Regulators in the EU, the US and China are introducing stricter rules governing materials used for food processing to ensure both consumers and the environment are protected

PHOTO: GETTY IMAGES





Trelleborg's testing lab includes gas chromatography-mass spectrometers.

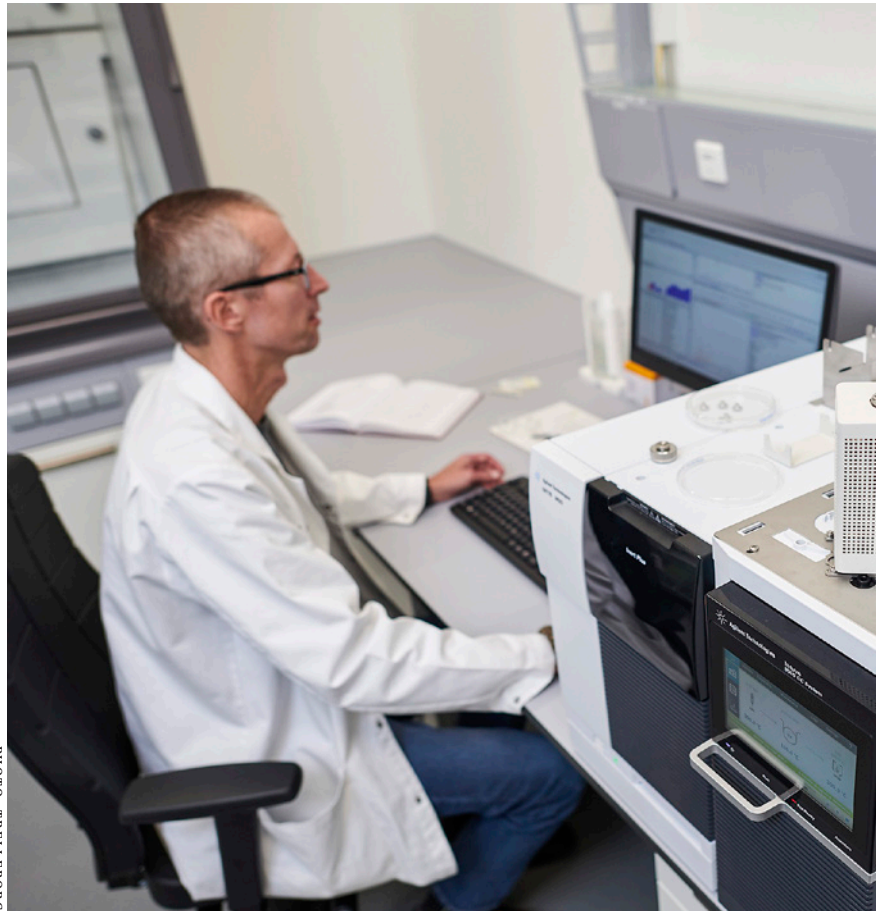


PHOTO: TRELLEBORG

– rules that do not always overlap. “If a food contact material is compliant in the European Union, in many cases that will also work for the US Food and Drug Administration, but then Chinese regulations might present an additional challenge,” says Dr. Petra Hilt, Global Manager Compliance Food Contact Materials at Trelleborg. “We must find a good solution for rubber and plastic materials that works well technically but is still compliant. This is challenging because there is a limited number of ingredients from which we can choose.”

Elastomer seals play an integral role in food processing equipment. They prevent leakage of fluids, lubricants and other media, protecting equipment and foods from external contaminants. Seals must be compliant with the fats, oils and acids required to make various foods, while withstanding high temperatures, high-pressure cleaning regimens, such as cleaning in place and steam in place, which ensure production cycles can be repeated again and again.

Conditions are now so demanding that in response Trelleborg introduced FoodPro, a range of polymer-based materials specifically designed to meet the unique requirements of the food and beverage industry. FoodPro materials satisfy regulatory requirements globally and, tested in-house,



Turcon Varilip PDR rotary shaft seals offer excellent performance at high rotational speeds in food mixers.

operate in a wide range of operating temperatures and within a broad array of cleaning techniques. This enables Trelleborg experts to provide recommendations, whatever the application.

“Following an eight-hour production cycle of something like yogurt, equipment must be cleaned well in order to ensure that microorganisms can’t grow in the processing system,” Vasquez-Caicedo says. “Some equipment can’t be dismantled, in which case it is flushed with cleaning solutions that remove dirt and microorganisms. These can be very harsh on sealing materials. With FoodPro, we’ve tested everything for compatibility with cleaning processes and can show how many cycles the customer can expect without seal replacement.”

Indeed, rigorous testing is part of what sets Trelleborg apart,

“Rigorous testing is part of what sets Trelleborg apart.”

Ana Lucia Vasquez-Caicedo, Trelleborg





Trelleborg testing

FoodPro materials go through extensive testing to ensure they are compliant with global food contact regulations. Experts design test programs at Trelleborg's state-of-the-art research and development facilities, as well as external laboratories with relevant accreditations.

Migration and extraction testing uses food simulators to examine how much of a substance can transfer from food contact materials, such as rubber seals, into the food itself. The tests are carried out under conditions resembling the worst-case scenario that can occur in real-world applications.

Trelleborg also tests materials for specific substances using advanced analytical techniques such as, liquid chromatography, gas chromatography and mass spectrometry, depending on migrants.



“The regulatory landscape has become so difficult that you need sufficient expertise to understand and comply with demanding regulations.”

Petra Hilt, Trelleborg

much information as we can, so that they can reduce validation time.”

Vasquez-Caicedo and Petra Hilt are currently adapting three new test rigs to evaluate the performance of various materials and designs. These will enable customers to respond rapidly to further shifts in the regulatory landscape and help Trelleborg support customers by identifying and tailoring sustainable materials for their specific needs, Petra Hilt says.

“The regulatory landscape has become so difficult that you need sufficient expertise to understand and comply with demanding regulations,” she says. “You need to have dedicated experts experienced in the food and beverage segment to serve demanding customers within the food processing industry. It’s something that only a few companies can do.” ■

Vasquez-Caicedo says. The company develops and tests the performance of seal designs and materials at dedicated in-house facilities. Those tests include simulation techniques such as finite element analysis, or FEA, which models and evaluates seal performance under various conditions and enables a team to qualify prototypes initially in the virtual world.

“Whenever you change a material, you need to re-validate the application,” Vasquez-Caicedo says. “We set up test rigs, simulating application conditions, so that we know completely from the beginning of a design how a material change will perform in the final application, and we can provide our customer with a lot of good data to support this. Of course, they need to validate the proposed design further, but we work hard to provide our customers with as

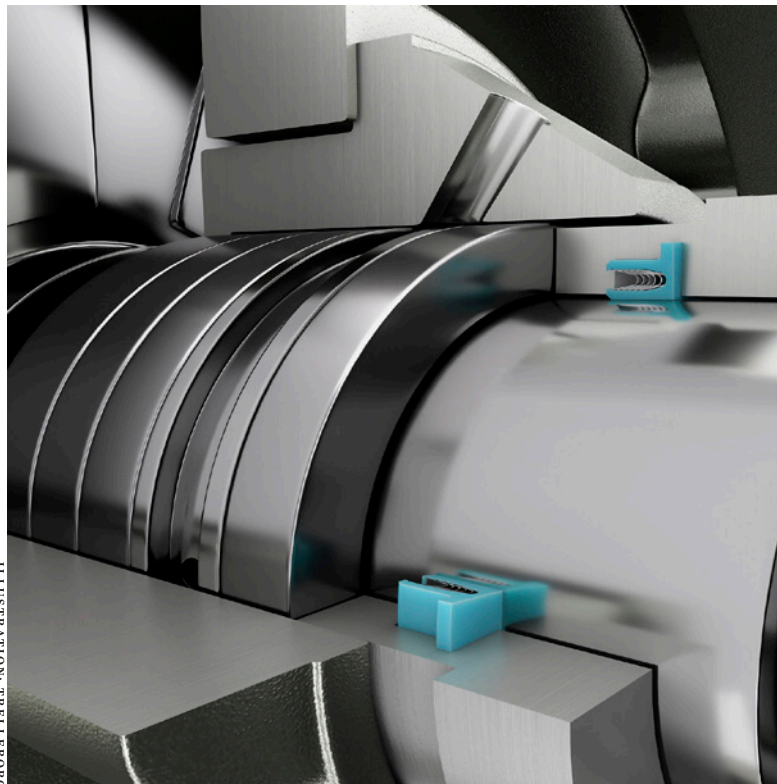


ILLUSTRATION: TRELLEBORG

Test rigs are used to evaluate the performance of materials and designs.



CONTACT
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Dr Aazir Khan holds a string of electric vehicle patents and owns the UK-based artificial intelligence and electric vehicle firm Aliera.



Aazir Khan

Lives:

Lahore, Pakistan

Occupation:

Director of the Integrated Engineering Centre of Excellence at the University of Lahore.

What motivates you?

“When I was small and lived in England, I used to tell my parents that I wanted to be a milkman because of the little electric vehicles they used to drive. To work with my childhood passion motivates me every day.”

How do you spend your free time?

“My wife loves running and keeps signing up for half marathons, so she’s encouraging me to go running with her.”

ELECTRIFYING ECONOMIES

DR. AAZIR KHAN IS PIONEERING A PLAN TO RETROFIT THE 28 MILLION MOTORCYCLES ON PAKISTAN’S ROADS WITH ELECTRIC MOTORS. STEPS LIKE THESE WILL BE KEY IN CUTTING EMISSIONS IN EMERGING ECONOMIES, HE SAYS.

TEXT PATRICK GOWER PHOTOS TAIMUR ALI PHOTOGRAPHY

What springs to mind when you think of the electrification of the global economy?

Perhaps you imagine rows of electric cars or sophisticated robots building products in factories. Maybe you see fields of solar panels powering a growing share of Europe’s energy needs.

Experts say this is a narrow view of what the decarbonization and electrification of our society really means. For emerging markets, electrification looks quite different. While you might still see the occasional Tesla, you are more likely to encounter a motorbike retrofitted with an electric motor. While some factories are implementing increasingly sophisticated electrical and automated systems that have collectively become known

as Industry 4.0, simpler solutions such as water-heating solar collectors are a far more feasible first step for nations without the resources of stronger economies.

Dr. Aazir Khan, Director of the Integrated Engineering Centre of Excellence at the University of Lahore in Pakistan, leads a team of researchers studying disruptive technologies often linked to sustainable development and green tech. He holds a string of electric vehicle patents and owns the UK-based artificial intelligence and electric vehicle firm Alieria, which has worked with vehicle manufacturers Volvo, Mercedes and Bentley. All of this gives him a unique perspective on the issues surrounding electrification and decarbonization in emerging markets.

The discrepancy in progress, he says, “is partly about resources, but in nations like Pakistan we’re still trying to develop the organizational systems that would underpin developments like Industry 4.0. It’s going to be incremental. Rather than Pakistan suddenly opening factories that look like they’re from science fiction movies, there will be a series of much smaller, transitional steps.”

Khan grew up in England and completed an undergraduate degree in materials science and composite engineering in Pakistan at Lahore’s University of Engineering and Technology. He has master’s degrees from the Hamburg University of Applied Sciences in Germany and Cornell University in the US and a Ph.D. from the University of Genoa in Italy. Vehicles have long been his personal passion; by 2005, he had developed his own patents for an electric bike, in part prompted by the Spanish government’s decision to invest 250 million euros to create an electric grid for charging on major highways.

Khan soon turned his attention to Pakistan, the country of his birth, where the government has set ambitious targets for the introduction of electric vehicles. Officials want half of all sales of two- and three-wheelers to be electric by 2030 and 90 percent by 2040.

How to stay creative

“I don’t know if this is good advice,” says Dr. Aazir Khan, “but if you’re able to make a living from your hobby, you’ll always be motivated to come up with fresh ideas.”

“I encourage people to try lots of things – people should dabble to find what they love. In Pakistan I started with 150 projects and slowly narrowed it down to two or three.”

“Of course, the other side of the coin is making your hobby your work, you take something from your free time, but it works for me. I occasionally forget the time while I’m working and look at the clock to find it’s 3 a.m.”

“If you’re able to make a living from your hobby, you’ll always be motivated to come up with fresh ideas.”

Dr. Aazir Khan

The challenges faced by manufacturers in Pakistan in producing electric vehicles are comparable to those faced in many emerging markets that are seeking to develop and embed new technologies, Khan says. More than 20 manufacturers produce electric vehicles, but they tend to assemble rather than build core components. That means the market



PAKISTAN IS
AIMING FOR

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“Let’s try to go for the electrification of the vehicles that are already present.”

Dr. Aazir Khan

is reliant on materials from China, whether for battery management systems, motors or battery cells.

The motorcycles that rely on those imports are generally too expensive for some consumers, which is why Khan is pioneering a plan to retrofit the 28 million motorcycles that are already on Pakistan’s roads with electric motors.

“Often, the people that own these bikes will not be able to buy another bike easily because it’s very expensive,” he says. “So we’ve said, ‘Let’s try to go for the electrification of the vehicles that are already present.’”

Pragmatic solutions such as this are finding their way into various parts of the economy, particularly those under pressure from global companies that are seeking to slash emissions in their supply chains. Textile manufacturers that use water-intensive production methods are turning to simple solar collectors to heat water, for example.

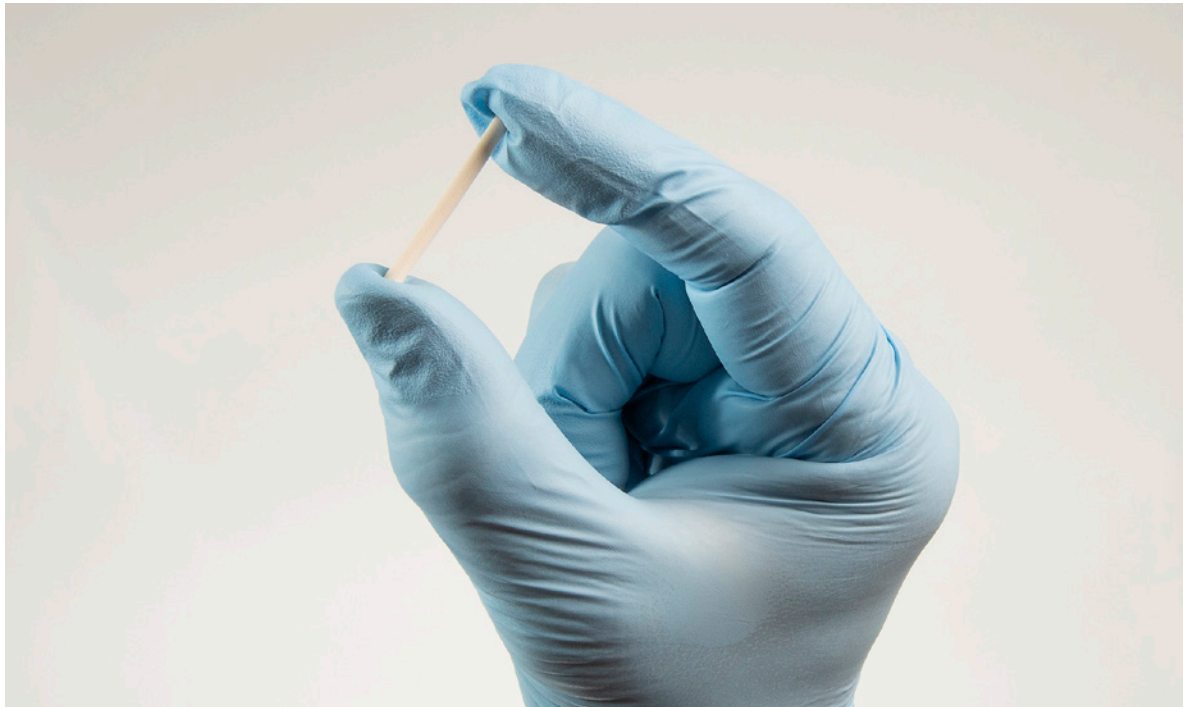
Khan says he is optimistic when it comes to Pakistan’s ability to meet its emissions targets, due in large part to the country’s history of nurturing great minds.

“We have great human intelligence here,” he says. “We can develop technologies that don’t have huge upfront costs, like electric motors.” ■

Retrofitting two-wheelers like these (above and left) to make them electric is key to Pakistan’s sustainability efforts.

There are 28 million motorcycles on Pakistan’s roads.





A common type of sustained-release drug product is a rod-shaped implant.



READ MORE
For more information about this topic, [click here.](#)

A BETTER LIFE

Living with a chronic medical condition can be debilitating, but innovative implantable technology is now improving the quality of patients' lives. Trelleborg's advanced polymer material expertise is fundamental to drug delivery devices.

TEXT DONNA GUINIVAN **PHOTOS** TRELLEBORG

An alternative to rod-shaped implants are ring shapes.



Needing regular medication can be an annoyance. It is hard to always remember to take a pill, and stopping daily tasks to administer a drug is a nuisance. That is why the advantages of drug-eluting implantable devices are beginning to create a significant shift in the management of chronic conditions, as ultimately these solutions solve many challenges patients face.

"Implantables uniquely address issues around administering drugs," says Zach Fletcher, a business development manager

for Trelleborg's medical solutions. "They can ensure patient compliance, localize drug delivery and address bioavailability concerns, while providing a consistent, sustained dosage of a pharmaceutical. This means that as drugs are going precisely where needed at defined doses over time, they work better and have fewer side effects. That is something traditional delivery paradigms struggle with today."

Although these are the main reasons for a rising demand for drug-eluting devices, Fletcher believes we are still at an early stage. "I don't think we have even discovered all the demand drivers for the implantables market yet because the space is still so young," he explains. "By my count, there are only about 18 drug-eluting devices available today, though many more are in development. Product developers are still learning when and where to apply sustained-release technologies."

A less obvious driver for these devices is a physician's time constraints. Fletcher says, "The ophthalmology community is quite

small, so it is a challenge for its physicians to treat all of their patients with chronic conditions affecting the eye with once-monthly injections. Therefore, they need pharmaceutical companies to come up with extended-release therapies, and this has driven quite a bit of momentum in that space.”

Usually, device developers would turn to their traditional partners in oral drug delivery, transdermal patches or injectables to develop implantables. However, sustained-release applications require deep expertise in polymers, and these providers do not possess that expertise, either in the polymers or their manufacturing processes. That is where Trelleborg adds value.

“We have been involved in developing drug-eluting therapies with our customers over the last 15 years,” explains Fletcher.

the correct polymer selections for manufacturability and produce the data needed to advance their product concepts.”

Although Trelleborg’s work in any one polymer is not unique, its offering and knowledge of a broad range of polymer types is.

“Our background in silicone was a fantastic foundation for our drug-eluting solutions,” Fletcher says. “What I am excited about now is our push to continue to expand our expertise in other polymers. For instance, we’re sharpening our knowledge in bioresorbable polymers, materials that safely break down in the body, which are a better fit for shorter-term drug delivery applications providing roughly six months of delivery. We’re also beginning to work in biodegradable materials other than silicone, ones that can withstand implantation into the

“We support customers in making the correct polymer selections for manufacturability and produce the data needed to advance their product concepts.”

Zach Fletcher, Trelleborg

Trelleborg’s team is adept at handling, inspecting and assembling micro components.



“So it’s our in-depth understanding of how polymers behave and what modifications are possible in the manufacturing process that allows us to offer something unique to our medical and pharmaceutical customers.

“Our customers know what drug they want to release, at what rate and for how long,” he continues. “That is their expertise. Our expertise is knowing the right polymer carrier for an application or how to modify a design or manufacture a component to maximize the performance of a drug-eluting device. We support customers in making

human body, such as ethylene vinyl acetate and ones that offer advantages such as lower processing temperatures.”

Fletcher points out that he does not see Trelleborg as selling products. “Instead, we provide capabilities that accelerate the development process for our customers’ future devices,” he says. “In the early stages of programs, we’re a full-service development partner, and then we can scale up projects for clinical trials and high-volume commercial production.”

What are implantables, drug-eluting devices and combination devices?

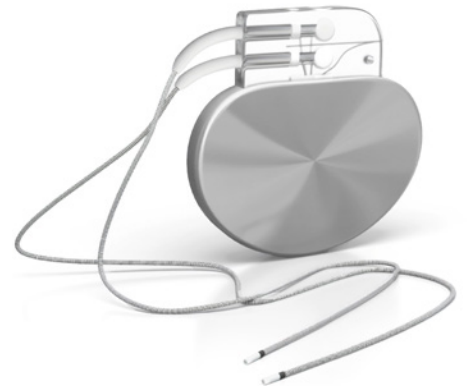
The terms “implantable drug-delivery devices” and “drug-eluting devices” refer to a solid, polymeric implant containing a drug that can provide sustained release of a drug product. Implantable drug delivery systems typically deliver a drug for six months or more from a single dose. Drug-eluting is a broader term and covers shorter-term applications where a medical device is enhanced by delivering a drug for weeks or even days.

The term “combination devices” refers to any combination of a drug, medical device or biological element put together as a therapeutic product where there is a medical device to deliver the implantable drug delivery system.



“I believe, as more drug-eluting products reach the market, more companies will consider these delivery methods. Trelleborg is very well set up to serve those customers.”

Zach Fletcher, Trelleborg



The leads of a pacemaker that attach to a patient’s heart often have drug-eluting components to minimize scarring.

Drug-eluting devices are also commonly classified as combination products. The implant containing the active pharmaceutical is a drug product and is often paired with a medical device to facilitate delivery to a patient. This comes with some challenges.

Fletcher explains: “When we have these two elements – the drug product and medical device – the US Food and Drug Administration (FDA) regulates the device as a combination product. This is a nuance to the regulatory path, and our customers appreciate our support in helping them navigate to approvals.”

Additionally, much of the focus early in drug-eluting programs is making sure the drug will perform. “In just about every one of these programs, we prove the drug product works and then there is always a sprint

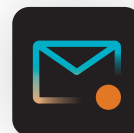
to develop the companion drug delivery device,” he says. “This is where Trelleborg’s background in medical devices allows us to quickly put together a supply chain, leveraging our network of facilities, to produce what’s needed to bring that element of the project online as well.”

Looking to the future, Fletcher predicts that more and more implantable drug delivery applications will emerge. “Currently, the pharmaceutical industry still tends to lean quite heavily toward delivering their drugs via a pill, and if that doesn’t work, they explore injectables,” Fletcher says. “This is changing, and we’re seeing activity in new types of applications. I believe, as more drug-eluting products reach the market, more companies will consider these delivery methods. Trelleborg is very well set up to serve those customers.” ■



PHOTO: BASILE BORNAND

Current good manufacturing practices ensure the highest quality products are repeatably produced for pharmaceutical applications.



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Implantable applications

Zach Fletcher, a business development manager for medical solutions at Trelleborg, outlines the implantable applications that Trelleborg currently focuses on. “Contraceptives, both intrauterine devices and in-arm implants, are possibly the best-known example of drug-eluting products,” he says, “and we’ve been involved in the development of a number of these.

Additionally, there is huge momentum in ocular drug delivery applications, with many therapies focused on sustained-release product evolutions. We have also seen opportunities within cancer treatments, stents, pacemaker leads, hearing devices and diabetes management, to name just a few.”

NEWS

LTA technology can help meet the need for sustainable transport.

Partnership takes off

Trelleborg is contributing its extensive expertise in engineered coated fabrics used as materials in airships and lighter-than-air (LTA) platforms to a partnership with the Institute for Infrastructure, Environment and Innovation (IMIEU).

The institute's initiative aims to connect innovators, governmental organizations, and academic partners to promote the advancement of LTA technology that helps meet the growing need for sustainable transportation.

Find out more about Trelleborg's LTA solutions in *T-Time's* Edge article on page 3.



PHOTO: GETTY IMAGES



PHOTO: GETTY IMAGES

Boat lift marvel

The Strépy-Thieu boat lift situated in the heart of Belgium's historic Canal du Centre is the second largest of its kind in the world. It is capable of lifting boats up to 1,350 tonnes downstream to upstream.

Trelleborg contributed to this capability by providing inflatable Omega Seals that endure high water pressures and large multi-directional movements. They were instrumental in contributing to a dramatic increase in river traffic from 256 kilo tonnes in 2001 to 2,295 kilo tonnes in 2006.

Above:

Strépy-Thieu, a boat lift on the Canal du Centre, Le Roeulx, Hainaut, Belgium.



323

THOUSAND KILOWATT HOURS

SEE FILM
Learn more here.

210

TONS OF CO₂

The future is bright

Malta is a great place to go on vacation due to its many hours of sunshine. That sunlight is also helpful in achieving Trelleborg's target of lowering its CO₂ emissions.

Trelleborg's facility in the country recently added 500 photovoltaic panels, which builds on a previous installation of 1,200 panels in 2013. The system will produce 323,000 kilowatt hours annually, covering 15 percent of the site's energy needs and saving 210 tons of CO₂.

This is just one of the many solar power initiatives taken by Trelleborg globally.

NIGHT WORKS

In Hong Kong, a Trelleborg trenchless pipe repair project supports urban pipe maintenance with the minimum of disruption to residents of the densely populated Kowloon area of the city.

TEXT JAN HÖKERBERG
PHOTOS JAYNE RUSSELL

By using CIPP technology only one lane of a busy street in Kwai Chung district needed to be closed, allowing traffic to pass by.



It is a cold winter's night in Hong Kong, and the clock has passed midnight. A manhole has been widened at Shek Pai Street, and a crane truck stands to the side to deliver some 100 meters of cured-in-place-pipe (CIPP) liner. Fifteen workers are putting the liner into the manhole to rehabilitate a more than 50-year-old granite-based pipe covered with concrete on top, which has been damaged and poses a risk of the road collapsing.

The 1960s street in the Kwai Chung district in Kowloon is a vital transportation link for the 5,000 residents who live in the area and is surrounded by high-rise buildings on both sides. Despite being a construction site, traffic passes by easily in one open lane and there is little noise.

Underground, there is an old trunk drain that conveys stormwater from upstream catchment areas to the downstream drainage network. Originally, this was a *nullah**

constructed by stone pitching before it was converted to a pipe and the street built over it.

Thanks to CIPP technology and liners, residents in the area can now feel safer after only a minor disturbance on their street for just a couple of nights. If the traditional “open, cut and replace” method had been used, it would have required complete closure of the road for 12 to 24 months, leading to noise, traffic jams and pollution in the form of vehicle fumes, dust and road waste.

“CIPP technology allows the rehabilitation or construction of a new pipe inside an old one without the need to excavate the entire length of the old pipe,” says William Wong, Business Development Manager for Trelleborg’s seals and profiles in Asia-Pacific.

“In this case, only minor construction was required to enlarge the manholes to allow access for the new pipe, which is larger than the original manhole,” he says. “During the day, the road is open; at night, the work is carried out in most cases without the community noticing. This project highlights the advantages of trenchless technology over traditional open, cut and replacement of old and defective pipes.”

Trelleborg has both the expertise and a large range of products to support pipe rehabilitation projects, including customized solutions for water infrastructure challenges.



READ MORE
For more information about this topic, [click here.](#)

*NULLAH CONSTRUCTION

A nullah is a term used in South Asia to describe a drainage channel or ditch that carries stormwater runoff. In Hong Kong, a network of nullahs was constructed in the early 20th century, as the city was frequently flooded during the rainy seasons, leading to the spread of diseases.



“CIPP is a sustainable way to extend the life of infrastructure while also increasing capacity.”

William Wong, Trelleborg



“For the rehabilitation of sewer pipes, our flexible pipe liners are used in combination with our polymer resin systems,” Wong says. “Furthermore, our stoppers and flow-through plugs are optimally suited for the temporary blanking off and bypassing of flows during pipe tests and repairs.”

“Hong Kong is a fully developed and densely populated city,” says Saul C M Chan, Principal Project Coordinator for planning and rehabilitation at the Hong Kong Government’s Drainage Services Department. “The majority of the drainage and sewerage systems were built decades ago and some of them are deteriorating. They should

be rehabilitated as soon as possible to avoid malfunctioning of these systems and the possible adverse impact arising from pipe failures.

“Compared with other trenchless methods, the CIPP method is a proven technology with good control of workmanship and quality,” Chan says.

The old horseshoe-shaped pipe in the Hong Kong project, measured 1.3 meters wide, which is unusually large compared with pipes in Western countries, where 300 millimeters is considered big. Rehabilitation of the pipe with Trelleborg’s product allows extension of the pipe’s life and its service to the community by at least 50 years.

Wong describes CIPP technology as a sustainable way to extend the life of infrastructure while also increasing capacity. “The Shek Pai Street project is just one example of the many drainage and sewerage systems that need to be rehabilitated in Hong Kong,” he says. “The rehabilitation of these systems is crucial to ensure the safety and well-being of the population and to avoid damage to the environment.”

By 6 am, the first phase of Trelleborg’s CIPP project at Shek Pai Street is essentially complete. There will be a couple more nights of work before the project is finally finished, but then the residents in the area can feel assured of effective storm drainage and that roads will not collapse for many more decades. ■

Advantages of CIPP trenchless pipe rehabilitation

- Less disruption to traffic
- Minimum excavation
- Faster construction time – three to six weeks compared with 12 to 24 months
- Work carried out overnight and road returned to service each day
- Less pollution due to smaller carbon footprint of the construction
- Life of existing infrastructure extended a minimum of 50 years
- Historic architecture preserved



CONTACT

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Protecting the essential

