

ttime

A MAGAZINE FROM TRELLEBORG GROUP

3-2022

Solutions that seal, damp and protect critical applications.

PLUS

LARGE COMPANIES AND
STARTUPS JOIN FORCES

WAVE HELLO
TO OCEAN POWER

LNG: A STEP TOWARDS
SUSTAINABILITY

THE MAGIC FORMULA

How Confor Foam improves F1 safety



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EDITORIAL

SAVING LIVES

Safety and sustainability are two things that are fundamental to the majority of Trelleborg's solutions, and in this issue of *T-Time*, they are in focus as usual.

Many of you may be avid followers of F1. After a legacy of serious accidents, it now boasts a good safety record, helped in part by our Confor Foam. As challenging as racing is, so is the firefighting environment. We meet firefighters who are behind the development of a lifesaving piece of equipment.

Protecting the Essential is a part of everything we do. We're highlighting how we protect the well-being of people and the tiny moldings that are advancing medical devices.

Sustainable energy is a much discussed topic. In this *T-Time* you can find out about

membranes we are supplying to a leading-edge wave power project, and how we support the LNG industry; it's a greener fossil fuel that's seen as a key transition energy source until renewables can fulfil all our needs.

On a lighter side, we visit Kim Dalum who is making beer brewing more sustainable and helping create carbon neutral breweries.

Enjoy your reading!

Peter Nilsson,
President and CEO



Cover photo:
Lars Baron/Getty Images

The next issue of *T-Time* will be released in March, 2023.

Responsible under Swedish Press Law:
Patrik Romberg,
patrik.romberg@trelleborg.com
Editor-in-Chief: Karin Larsson,
karin.larsson@trelleborg.com
Co-Editor: Donna Guinivan

Production:
Appelberg Publishing
Project Manager:
Cajsa Högberg
Language Coordinator:
Kerstin Stenberg
Art Directors:
Tom Barette and
Markus Ljungblom
Subscription:
Get a notification when there is a new issue available by subscribing to the Trelleborg Group's press releases:
www.trelleborg.com/en/media/subscribe

Address: Trelleborg AB (publ)
Box 153, SE-231 22 Trelleborg, Sweden
Tel: +46 (0)410-670 00
Fax: +46 (0)410-427 63

T-Time is published three times a year. The opinions expressed in this publication are those of the author or people interviewed and do not necessarily reflect the views of Trelleborg. If you have any questions about Trelleborg or wish to send us your comments about *T-Time*, please email: karin.larsson@trelleborg.com

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Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way. The Trelleborg Group has annual sales of about SEK 34 billion (EUR 3.34 billion, USD 3.95 billion) and operations in about 50 countries.

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

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TRELLEBORG

PHOTO: GALLERYSTOCK

EDGE CONFOR FOAM

Since the introduction of Confor Foam collars to Formula One in 1996, they have dramatically improved the protection of racing drivers against serious head injuries. Trelleborg developed and supplies F1 with this lifesaving material.

TEXT ANDREW MONTGOMERY



Safety formula



Formula 1 cockpit safety has dramatically improved. Drivers' shoulders and upper bodies used to be visible from the side of the car. Today, only part of their head can be seen.



Today, F1 drivers' heads are much better protected. The cockpit sides are much higher than before and Confor Foam lines the removable headrest and absorbs shocks.

“It behaves like a soft foam when compressed slowly, but when it receives a heavy impact it behaves like a stiff foam with the ability to absorb and dissipate large amounts of energy.”

Paul Habberfield, Trelleborg

With tens of millions of tv viewers for every Grand Prix, Formula One is one of the world's most popular sports, making superstars of top racing drivers such as Lewis Hamilton, Max Verstappen and Charles Leclerc.

But F1 is very different now to how it was in its infancy. In those days, track conditions were far more dangerous and cars offered limited protection in crashes.

Over its 72-year history, F1 has had a grim roll call of doomed names such as Jim Clark, Jochen Rindt, Ronnie Peterson and Gilles Villeneuve; all taken from us too soon. Even the drivers who survived crashes, such as Niki Lauda, Philippe Streiff and Karl Wendlinger, suffered life-changing injuries.

However, the tireless campaigning of people such as three-time world champion Jackie Stewart and neurosurgeon Professor Sid Watkins, helped F1 become much safer. While serious accidents do still happen, they are much rarer, thanks to improvements

in crash barriers, deeper run-off areas and emergency personnel located trackside.

Another safety milestone came after a series of tragic accidents in the mid-1990s. In particular, it was the deaths of Roland Ratzenberger and triple world champion Ayrton Senna, during the same race weekend in Italy in 1994, which sent shock waves through the sport.

An extensive review of driver safety commissioned by Max Mosley, then head of motor racing's governing body, Fédération Internationale de l'Automobile (FIA), found F1 drivers can experience lateral g-force of up to 6 g when cornering and in addition, that a crash impact creates huge g-forces on a driver's brain.

This discovery led to the introduction of the Confor® Foam collar for Formula One cars' headrests and cockpits.

Confor Foam is an open-celled foam with temperature-dependent urethane technology at its core. It is breathable, does not irritate the skin and helps dissipate moisture



Above:
A driver retires from a race. The headrest is seen on top of the car.

Left:
Ayrton Senna, who died in a crash at the San Marino Grand Prix in 1994.

PHOTOS: GETTY IMAGES





from the body; making it ideal for body-contact cushioning applications such as motorsports.

“It behaves like a soft foam when compressed slowly, but when it receives a heavy impact, it behaves like a stiff foam with the ability to absorb and dissipate large amounts of energy,” explains Paul Habberfield, Business Development Manager for the material. “This is key, as some so-called energy-absorbing foams store energy and return it to the impacting body, which is not desirable. The impact energy is dissipated through the semi-open-celled structure of the foam and dispersed as low-grade heat.”

When making what may appear to be a stiffer grade of foam, many manufacturers load foam with fillers, which adds little to the foam’s performance other than density and the impression of being stiffer. At 93kg/m³, Confor Foam is the same density as the soft grade foam used in conformal packaging for high-value equipment but has the stiffness of grades used in jet-fighter ejection seats.

In fact, the Confor Foam’s development originated with the NASA Space Shuttle program. Scientists were searching for an ultra-comfortable, long-term seating material. Because of the material’s damping and shock

Below:

Confor Foam is designed to absorb and dissipate shocks and impacts.



PHOTO: TRELLEBORG



PHOTO: GETTY IMAGES

Left:
Both the driver's head and body are protected by padding with shock-absorbing Confor Foam.

Right:
Trelleborg has sponsored over 50 Formula Student racing teams with head-rest protection materials.



Trelleborg helps university race teams

Formula Student (FS) is Europe's most established educational engineering competition. Each year, more than 100 university teams from around the world travel to the Silverstone racetrack in England to compete in static and dynamic events.

With the support of industry and high-profile engineers such as Formula One Group Managing and Technical Director Ross Brawn, FS aims to encourage and develop enterprising, innovative young engineers.

FS usually forms part of a degree-level project. The motorsport industry regards it as the gold standard for engineering graduates, combining practical engineering experience with soft skills including business planning and project management.

Trelleborg supplies FS competitors from the UK, Austria, France, the US, Germany and Spain with Confor Foam, the use of which is mandatory, free-of-charge.

"Because Formula Student participants are the motorsports engineers of tomorrow, we see this as an ideal way of not only supplying the mandated Confor Foam material to the teams, but a way to boost recognition of the Trelleborg name among engineers, particularly in motorsports," says Paul Habberfield, Business Development Manager for Confor Foam.

absorption capabilities and after subjecting the foam to high g-forces on a vertical deceleration tower, it has been specified as padding for ejection seats.

Trelleborg has supplied Confor Foam to Formula One since the mid-1990s. Almost thirty years later, it continues to be on the list of head-rest materials that is specified by the FIA for Formula One and other sports cars.

"Every single car on the Formula One grid will be using Confor Foam throughout the 2022 racing season," says Habberfield.

"In the car, Confor Foam forms a combined headrest with side impact protection and is a vital safety feature, especially in heavy crashes," he explains. "The foam is typically contoured, has a 75-millimeter thickness and is covered in Kevlar, then painted in the team's livery. It can sometimes be seen when the drivers get out of their cars, as the

foam collar often has to be removed for them to exit the car."

Although Formula One has not been incident-free since the deaths of Senna and Ratzenberger, it certainly has had a much better safety record, and Confor Foam has made a major contribution to this.

Indeed, in 2001 Professor Watkins commented: "The biggest advance we have made is in the area of head and neck protection. The drivers wear a U-shaped collar filled with this Confor [Foam]. It has undoubtedly saved lives. Jos Verstappen had a huge accident at Spa [Spa-Francorchamps] in Belgium... and Heinz-Harald Frentzen would have had serious head injuries in Canada two years ago [1999] instead of mild concussion."

Formula One uses the most advanced technologies, but a relatively simple foam protects world champion Max Verstappen today in the same way that it did his father Jos back in 1996. ■



CONTACT

For more information:
paul.habberfield@trelleborg.com

NEWS



PHOTO: GETTY IMAGES

For lighter landings

Aircraft landing gear needs to be strong enough to withstand tremendous stresses and strains. It also needs to be lighter, as the aerospace industry seeks ways to reduce aircraft weight to lower fuel consumption and make the sector more sustainable.

In response, Trelleborg launched its Orkot® C620 material, a unique high-load composite used as an alternative to metal for bearings. The lighter components reduce take-off weight and extend the number of flying hours before maintenance is due.

High pressure and temperature seals

Trelleborg launched the custom-engineered, spring-energized elastomer seals, XploR™ S-Seal and XploR™ FS-Seal. Meeting the needs of the energy industry, these offer maximum extrusion resistance in the most demanding high-pressure, high-temperature (HPHT) sealing environments. The seals are single-piece components, engineered to make installation easier and safer.



Bonding breakthrough

Multicomponent technology can greatly reduce costs. Until recently there was no way to bond thermoplastic to thermosetting elastomer or rubber to the required strength.

Trelleborg has now solved the issue of bonding these materials. Customers can choose from a range of fully tested and validated options.

Polymers for a circular tomorrow

Circularity – the reuse, repair, refurbishing and recycling of materials – is a vital part in creating a truly sustainable economy. Trelleborg is putting an intense focus on circularity and recently set up a cross-organizational team called Polymers for

Tomorrow. This is investigating seven of the Trelleborg Group's key materials to identify ways to increase the proportion of recovered or renewable alternative materials. It will eventually lead to new and even more circular business concepts.



PHOTO: UNSPLASH

A portrait of Richard Hepworth, a middle-aged man with short, light brown hair, wearing a dark grey blazer over a white button-down shirt. He is standing with his hands clasped in front of him, leaning on a white surface. The background is a blurred office setting with a large window and a blue wall featuring the text "Operations Worldwide" and an image of an offshore vessel.

Richard Hepworth

Career: A chartered mechanical engineer with more than 30 years of experience working in the offshore and marine construction industry, undertaking a wide range of roles from design engineering and project management to sales and general management.

Job: President of Trelleborg's Marine & Infrastructure operation.

Lives: After some time spent globetrotting he lives in Dubai.

Backstory: Born and bred in Manchester, England, he still retains his season ticket for Manchester City, despite the Etihad Stadium being 3,500 miles away from home.

Free time: He keeps fit by running half marathons or, if really motivated, full marathons!

Left:

Richard Hepworth, Trelleborg's president for marine & infrastructure, describes the boom in LNG. One driver is the increased demand from developing countries in Asia.

A SMOOTH TRANSITION

What is LNG and why is it the new big thing in the energy market? Trelleborg's Richard Hepworth explains why this option is critical in the transition from fossil fuels to renewables.

TEXT DONNA GUINIVAN
PHOTOS SIDDHARTH SIVA

When natural gas is cooled to cryogenic temperatures of -162°C it becomes Liquefied Natural Gas (LNG), which makes it 615 times smaller in volume than when it is in its gaseous state. This means it can be stored efficiently in large tanks, and shipping over long distances is possible using specialized ships, known as LNG carriers, which have highly insulated tanks to store the LNG and keep it at the required cold temperature.

"This method of transportation eliminates the need to build expensive land-based or undersea pipeline infrastructure to move LNG from the places it is produced, such as Australia, Qatar or the US, to the places where it is consumed, such as China, Japan or Korea," says Richard Hepworth, Trelleborg's president for marine & infrastructure. "It also allows delivery of energy to places pipelines cannot reach or feasibly

go, such as small or isolated islands that need to have a source of power."

The value of the LNG market was USD 44.35 billion in 2021, and with a compound annual growth rate of 6.4 percent over the forecast period, it will reach USD 72.85 billion by 2028.

"And that's just a baseline estimate," says Hepworth. "We're seeing a boom just now and growth is accelerating. Driving this is the increased demand from fast-developing countries in Asia as well as new uses for LNG such as powering ships and trucks. The biggest growth, though, comes from countries looking to become more sustainable by switching to gas instead of coal or oil as a fuel to generate electricity."

Trelleborg offers a wide range of solutions for LNG applications, from intelligent docking and mooring and marine fenders to cryogenic hoses, seals and transfer systems.

“LNG is an extremely demanding fuel to work with and is subject to strict industry standards to ensure the absolute safety of all activities connected with the handling of LNG,” says Hepworth. “The extreme low temperatures require specially developed polymer materials for seals and hoses. When it comes to docking and mooring, the safety and security of LNG carriers at berth in the LNG terminal is vital.”

“All Trelleborg’s engineering and product development efforts for LNG focus on safety,” he continues. “Products and solutions undergo extensive qualification testing, both in our manufacturing facilities and when installed on site.”

Some may think that the rapid growth and promotion of LNG as a fuel is going in the wrong direction

in a world focused on increased sustainability and a shift away from fossil fuels.

“Yes, LNG is a fossil fuel,” Hepworth says, “but it is seen as a vital part of the energy transition as the world moves from the use of oil and coal toward renewable forms of energy. It’s the cleanest of traditional fuels, and until the infrastructures are there to supply all renewable energy needed from wind, sun or water, it represents a compromise between fulfilling fuel demands and the goal of sustainable energy production.”

LNG emits much less carbon dioxide (CO₂), sulfur dioxide (SO₂) and nitrogen dioxide (NO₂) than oil or coal.

“The combustion of natural gas does not emit soot, dust or fumes,”

“If just 20 percent of coal-fired power stations switched to gas there would be a potential saving of 680 million tons of CO₂ emissions annually.”



Right:

Shipping LNG over long distances is possible thanks to highly insulated tanks, which can keep it at the required temperature.

PHOTO: GETTY IMAGES



Left:

Richard Hepworth says that LNG is seen as a vital part of the energy transition as the world moves toward renewable forms of energy.



CONTACT

For more information:
richard.hepworth@trelleborg.com



Hepworth says. “It generates 30 percent less CO₂ emissions than fuel oil and 45 percent less than coal. The emission of NO₂ is a massive 90 percent less than burning coal, and the fuel gives off virtually no SO₂. To put that in context, according to Shell, if just 20 percent of coal-fired power stations switched to gas there would be a potential saving of 680 million tonnes of CO₂ emissions annually.”

Reducing CO₂ as an international goal is much talked about. Cutting these emissions will help curtail global warming, a phenomenon that, if not curbed, could have a devastating effect on the planet. Perhaps a less well-known pollutant is NO₂, which is usually more associated with exhaust fumes. This can

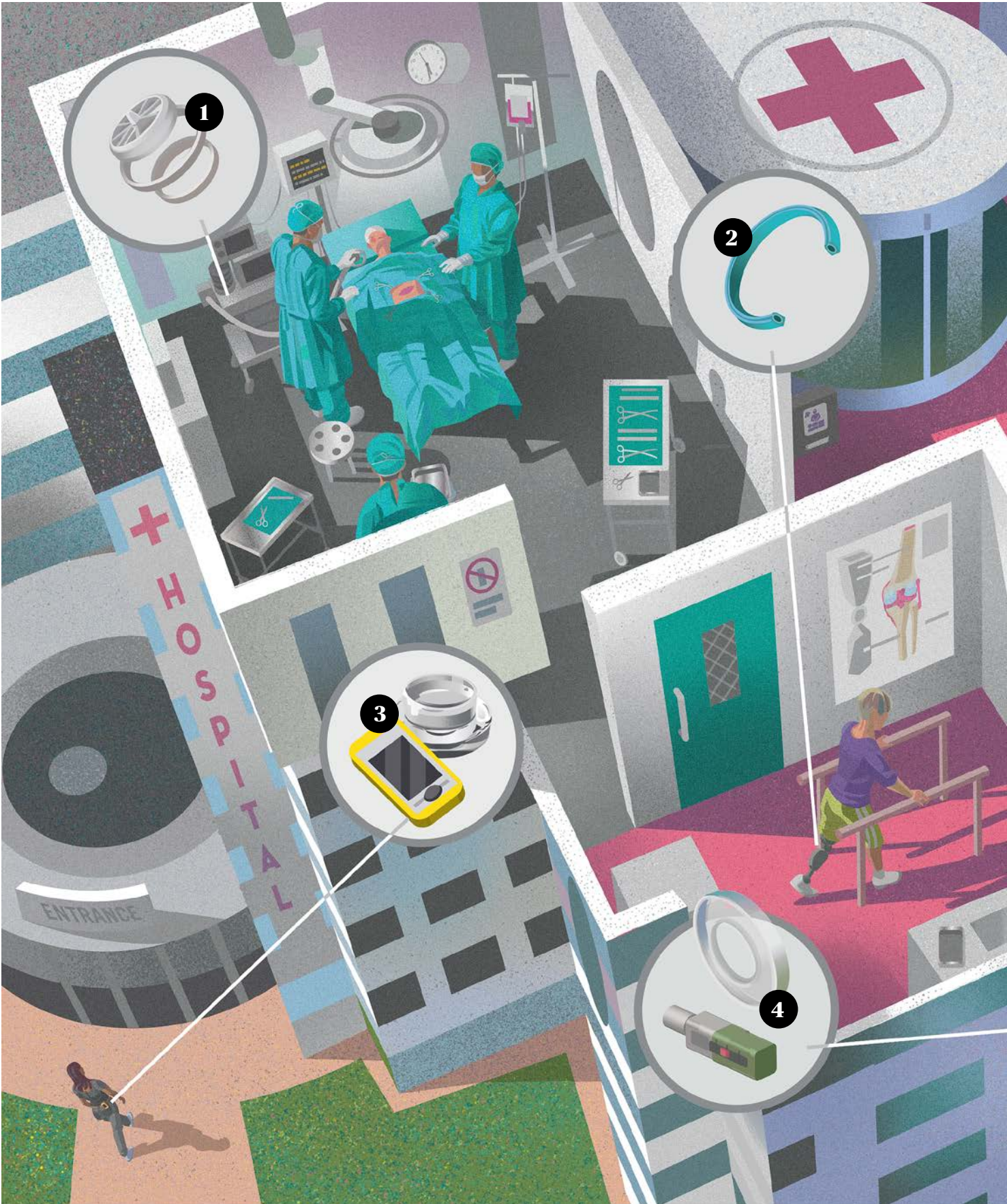
be catastrophic to human health if it builds up in the atmosphere, while SO₂ contributes to acid rain, haze and smog, causing and exacerbating respiratory conditions.

Another factor that makes LNG important in the global energy market is that it provides flexibility in supply. “LNG plays a significant role in the geopolitical landscape,” says Hepworth. “Energy is such an important commodity that fixed pipeline supply can become a bargaining platform, with restrictions on provision used to influence political decisions. Being able to ship LNG from several different sources ensures that countries can have better control of their own energy supplies.” ■

Sources:
“LNG industry rebounds in 2021 amid supply constraints and volatile prices”, Shell Global
“Global LNG tanker fleet 2020”, Statista

LNG Facts

- In 2021, trade in LNG hit 380 million tonnes, an increase of 6 percent (or 21 million tons) from 2020.
- China is the world's largest LNG importer.
- The global LNG carrier fleet at the end of 2020 numbered 642.
- The largest LNG carrier can carry 266,000 cubic meters of LNG.



TEXT KARIN LARSSON

ILLUSTRATION NILS-PETTER EKWALL

WELL-BEING FOR ALL

What is essential? Healthy lives and well-being contribute positively to social development. An aging population, as well as a desire for better patient outcomes and lifestyles, are fueling demand for engineered solutions in the healthcare & medical industry. Trelleborg products are often unseen but are found in medical devices, equipment and drug elution, bringing benefits to customers through its support in meeting key criteria, such as speed-to-market and wearability.

1. Anesthesia devices

Silicone engineered molded parts and tubing play a fundamental role in many applications thanks to their biocompatibility and physical durability.

2. Prosthetic devices

Advanced knee and ankle prosthetics have a robust sealing system for their hydraulic cylinders.

3. Wearable medication

Drugs are incorporated into silicone-based delivery devices, which release a drug directly into a patient with fewer side-effects.

4. Inhaler devices

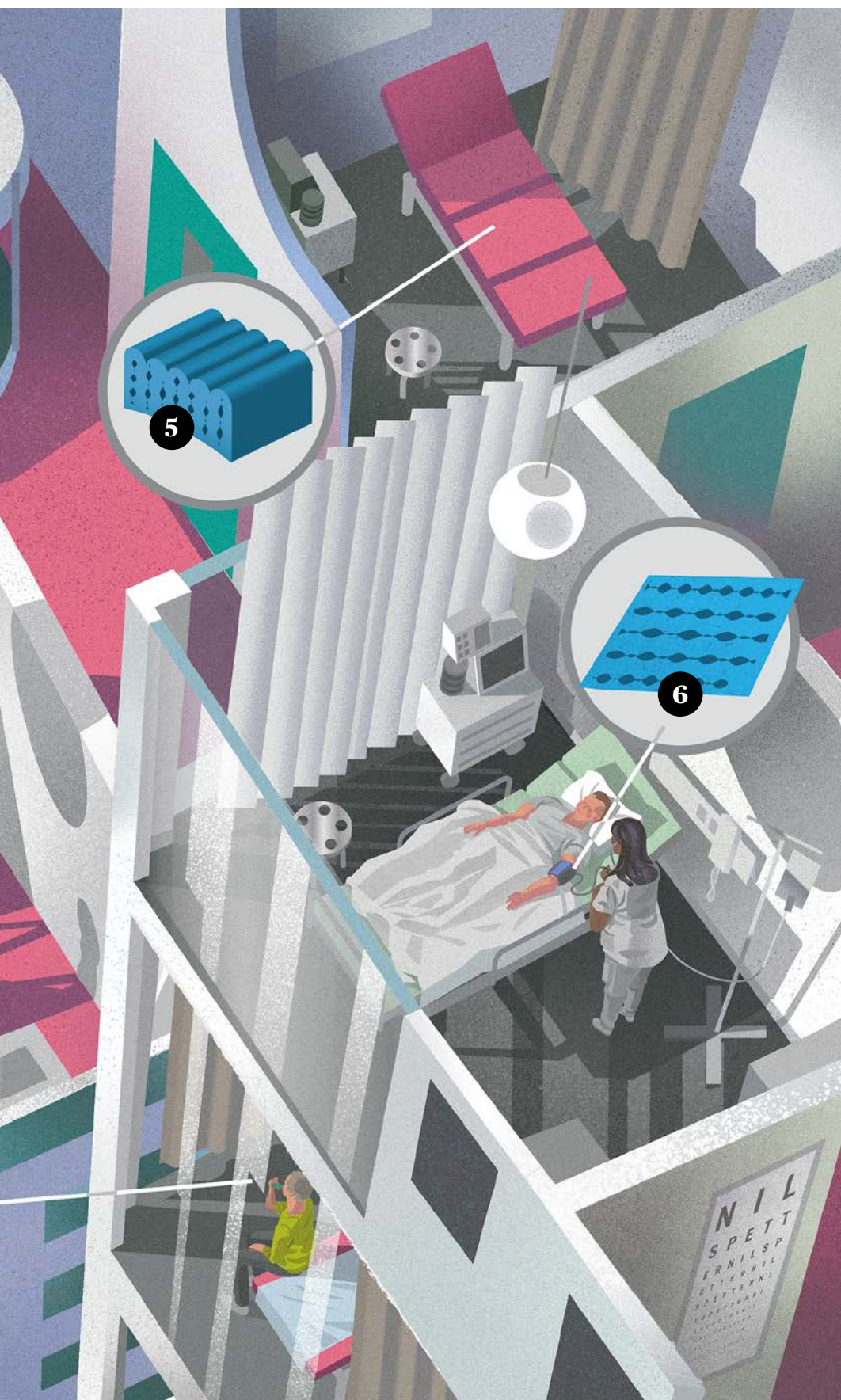
Sophisticated inhalers rely on micro-sized silicone parts that prevent medication in the dosing chamber from running back down the capillary.

5. Medical mattresses

Medical support surface fabrics are fully recyclable and help prevent pressure injuries thanks to embedded sensors.

6. Blood pressure cuffs

Accurate readings are achieved with fabrics that meet stringent quality assurance requirements.



MEDICINAL MERCURY

Mercury's toxic properties mean that it's no longer viewed as a medicine. But throughout history, doctors thought differently, prescribing mercury to treat inflammation and various diseases, cure ulcers and warts and much more. Persians and Greeks used it as an ointment, and alchemists in China thought it would increase vitality and lead to eternal life. In 210 BC, Chinese Emperor Qin Shi was said to have died after taking mercury pills.



60%

For the first time in human history, most of the world's population, 60%, will live in cities by 2030. The WHO points out that urbanization is associated with many health challenges. It recommends using urban planning to promote healthy behaviors and safety, such as designing cities to encourage physical activity.

DO YOU KNOW YOUR VEGETARIANS?

There is more than one type of vegetarian. Here are the types of vegetarians, defined by what they eat:

Flexitarians: primarily plant-based foods but also meat and animal products.

Fruitarians: mainly fruit, seeds and nuts.

Lacto-ovo vegetarians: primarily plant-based foods with the addition of dairy and eggs.

Ovo vegetarians: primarily plant-based foods with the addition of eggs

Pescetarians: primarily plant-based foods with the addition of dairy, eggs and fish.

Pollo vegetarians: primarily plant-based foods with the addition of dairy, eggs and chicken.

Raw-foodists: vegans who eat nothing heated above 46 degrees Celsius.

Vegans: only plant-based foods.



PHOTO: SHUTTERSTOCK



PHOTO: SHUTTERSTOCK

THE CARROT MYTH

One famous health myth is that carrots give you better night vision. However, according to several studies, vitamin A supplements are more effective than consuming carrots. And, as anyone who has eaten vast amounts of the vegetable knows, if you eat enough carrots your skin will turn orange.

“Self-esteem is as important to our well-being as legs to a table. It’s essential for physical and mental health and happiness.”

Louise Hart, German-American psychologist and writer specializing in families

Super Nova saves lives

Working in conjunction with firefighters, Trelleborg has developed the highest-pressure lifting bag on the market, which is also more usable and easier to handle.

TEXT DONNA GUINIVAN **PHOTOS** BLANKA KROFLIČ



Left:
Trelleborg employees and volunteer firefighters Marko Kešnar (left) and Rok Justin participated in the development of the Nova lifting bag.

Lifting bags are lightweight, portable devices that can be maneuvered into tight spaces and, through the use of air pressure, spread, fix, push or lift obstacles. In rescue situations, when every second counts, they can be the difference between life and death.

“The lifting bag has become a vital tool for firefighters worldwide,” says Dr. Marko Bratina, R&D manager at the Trelleborg facility in Kranj, Slovenia, the development and manufacturing home of Trelleborg’s lifting bags. “Reliability and power are key to first responders being faster and more efficient in any rescue scenario.”

The focus for the development of the recently launched Nova was to create a lifting bag equal in size to a standard 8-bar lifting bag, but with increased pressure capability.

“The higher the operating pressure of the lifting bag, the more the lifting capacity,” Bratina explains. “For the Nova, incredibly, that’s up to 100 tonnes. This contributes to significantly shortened rescue times and a greatly increased chance of survival for an injured person.”

But operational functionality was not the only criterion for the Nova. Having an inside track on the things that firefighters require from a lifting bag has been a



100 tonnes

The lifting capacity of Nova is up to 100 tonnes.

crucial consideration in the bag’s ergonomic design. The R&D team includes Trelleborg employees Rok Justin, who is a volunteer firefighter with the fire service in Begunje, and Marko Kešnar, volunteer firefighter with the fire service Cerklje, in the Gorenjska region of Slovenia. They and colleagues from the professional fire brigade GARS Kranj were instrumental in revolutionizing the usability of the lifting bag.

“Real-life rescue situations are nothing like lab environments, the usual place for development of products,” says Justin. “There may be smoke, rubble, dirt, running water, spillages of oil or fuel, and fire. People at the scene may be

Above:

Lifting bags can save lives at earthquakes, car crashes and other accidents, where there is a need to move heavy loads.



“It’s all about safety, trust in equipment and speed. It’s all about accuracy. Truly, every second can count.”

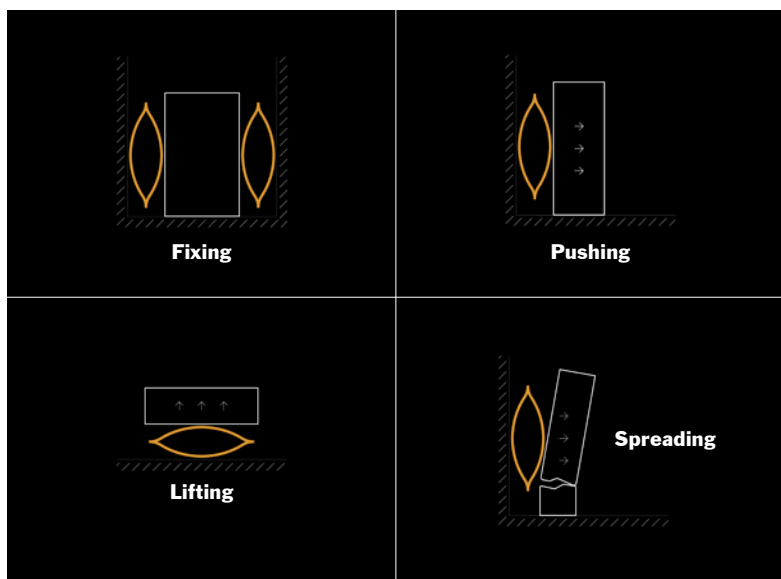
Rok Justin, Trelleborg

distressed and panicking. For us as firefighters, the adrenaline is pumping, and we know we must work as rapidly and as effectively as possible to save lives. Every firefighter will tell you that people are not rocks. The emotional factor in rescue situations will bring a significant difference to the picture.”

“Equipment needs to be straightforward to use,” he continues. “Dials must be visible even when it’s dark and hard to see. It’s vital that controls are responsive and handles easy to grip, even in heavy fireproof gloves that may be wet or greasy. It’s all about safety, trust in equipment and speed. It’s all about accuracy. Truly, every second can count.”

Creating Nova with firefighters out of the R&D laboratory in the real world of firefighting means that Nova answers the needs of first responders, such as Justin and his fellow crew members.

Left:
The Nova lifting bag has several different uses.



“Rubber inflatable products for saving and protecting lives and property will never stop intriguing our developers.”

Marko Bratina, Trelleborg

“We focused on making sure that the controller was right for the job,” Bratina says. “Robustness was key, from its case to the unit itself. There are handles on both sides of the controller and a neck strap, making it secure to use even when surfaces are moving or difficult to stand upon. Couplings are far enough apart to allow connection by users in protective gloves. Gauges are super visible and easy to read in the dark, while levers are flat for more precise setting.

“We even considered making the lifting bag more accurate to use with reflective markings,” he says, “positioning the inflation connector to prevent damage and adding an integrated carrying handle. The profiled surface of the bag makes it nonslip for better grip and stability, as well as including a lifting-height marking to rapidly assess maximum lift before putting the bag to work.”

And what of future developments?

“There are always new challenges,” Bratina says, “and we are always on the lookout for opportunities to develop new products. Rubber inflatable products for saving and protecting lives and property will never stop intriguing our developers. At the end of the day our mission is ultimately to save lives and protect property.” ■



Above:

The Nova lifting bag is easy to handle. The profiled surface of the bag makes it nonslip for better grip and stability.

Facts about the Nova lifting bag

The Nova lifting bag is compliant with EN 13731:2007, the European Standard for lifting bag systems. As with all lifting bags, it can spread, fix, push or lift obstacles, but in addition it has a superior pressure capability of 15 bar compared to other bags of its size.

The bag's surface is non-slip, giving it better grip and stability, and it is extremely versatile in any type of rescue situation. Due to an interlocking system and visible center markings, multiple lifting bags can

effectively and safely be combined into a stable unit.

To make the lifting bag system robust, heat resistant and easier to handle, the compressed air hose, which conforms to EN ISO 2398, is made of rubber rather than plastic, and the inflation connector is positioned so that there is less chance of connector damage. Integrated handles, reflective markings on the lifting bag and its cone shape allow for accurate and quick insertion of the bag under or beside a load.



CONTACT

For more information:
marko.bratina@trelleborg.com
rok.justin@trelleborg.com

NEWS



Navigation with four different operational modes.

State-of-the-art navigation tool

The latest addition to Trelleborg's SafePilot range for marine pilots and navigators is here.

SafePilot CAT PRO is a completely independent portable pilot unit. It overcomes the limitations of automatic identification systems and WIFI range by using real-time kinematic corrections to deliver Global Navigation Satellite Systems positional awareness and speed accuracy to one centimeter per second. It also has an independent heading accuracy to 0.01 degrees. This makes it perfectly suited for demanding applications that require the highest positioning and speed accuracy, such as when piloting in narrow channels and confined waters.

Sustainable lubrication

Did you know that Trelleborg's pipe joint lubrication is rapeseed-oil based? This makes the lubrication fully biodegradable. The lubricant plays an important role in push-fit joints and in keeping your drinking water safe, underlining Trelleborg's commitment to finding safe and sustainable solutions.



PHOTO: GETTY IMAGES

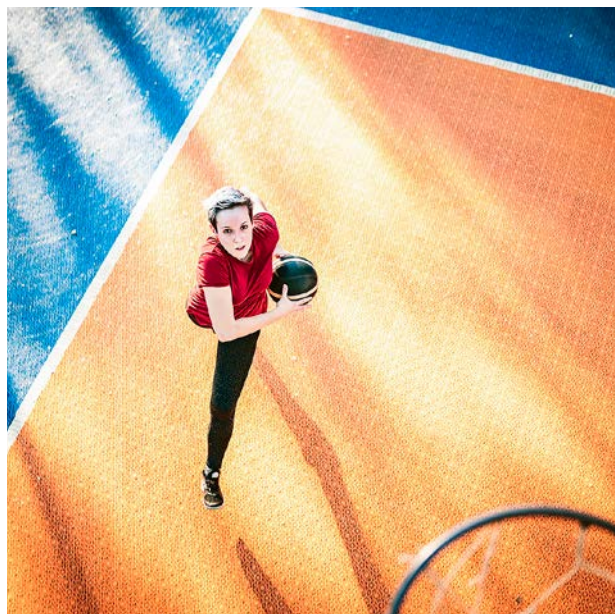


PHOTO: GETTY IMAGES

Contributing to a better society

Trelleborg Group takes an active role in social engagement, supporting activities in local communities at its facilities around the world. All workplaces with more than 50 employees must have a plan for their social engagement.

Here are a few examples:

- In India, Trelleborg supports a local foundation through academic scholarships for more than 200 children from underprivileged backgrounds.
- In the US, the Group sponsors a school basketball team by providing nutritious meals before matches.
- And in Spain, employees carry out volunteer work and provide school supplies for newly arrived students.

Trelleborg acquires US healthcare company



PHOTO: EIRMED

US-based healthcare & medical company EirMed LLC is the latest addition to the Trelleborg family. EirMed, specializes in technical precision plastic injection-molded components, which are mainly for medical devices, such as those used for in-vitro diagnostics, minimally invasive surgery and orthopedics. The company's head office and manufacturing base are in Menomonie, Wisconsin, and it had sales of about SEK 100 million in 2021.

Solar and wind power are established sources of clean electricity. But can we harness wave power as well? An exciting project off the Scottish coast aims to find out, with Trelleborg's help.

Ocean power

TEXT ANDREW MONTGOMERY

PHOTOS COLIN KELDIE/EMEC

The ability of the tides and waves to drive power generation is vast. According to USGS, water covers 71 percent of the Earth's surface, and oceans make up 96.5 percent of that. It means that the endless power of the sea's waves can play an even more significant role than they already do.

Over the past few decades, the extreme weather and sea conditions around Orkney Islands off the north of Scotland, have resulted in it serving hotspot for developing and testing wave and tidal power technology. Located between the Atlantic and the North Sea, the Orkney Islands is also home to the European Marine Energy Centre (EMEC).

The latest and perhaps most promising example of wave power is from Inverness-based company AWS Ocean Energy. Working with marine energy systems for over 20 years now, AWS is currently testing the Archimedes Waveswing;

“A platform hosting 20 units can achieve power outputs comparable to offshore wind installations.”

Simon Grey, AWS Ocean Energy



a 10-meter tall, 3.8-meter-wide submerged wave power buoy designed to generate reliable and affordable power for maritime communities and offshore applications.

The Waveswing sits three meters under the surface of the sea and reacts to changes in subsea water pressure caused by passing waves. It then converts the motion in the structure to electricity via a direct-drive generator. The system can be deployed in depths of 25 meters or more.

“With its current design, the Waveswing can integrate into submerged platforms and scale up to 500 kW per unit. A platform hosting 20 units can therefore achieve power outputs comparable to offshore wind installations”, says Simon Grey, CEO of AWS Ocean Energy.

Trelleborg's innovative technology plays an integral role in this project. It supplies a bespoke rubber membrane that helps protect and seal a part of the Waveswing developed at the company's facility in Ridderkerk, Netherlands.

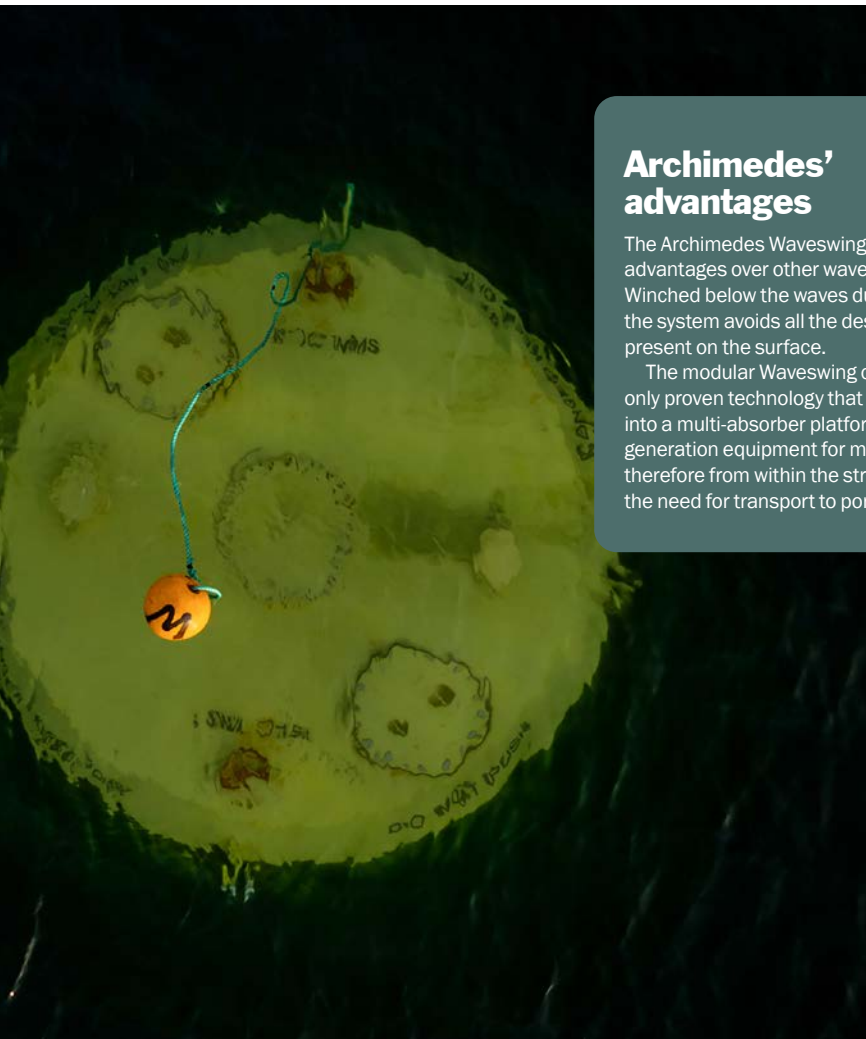
“The membrane is a cord-reinforced rubber construction that absorbs the forces from internal pressure and also helps



PHOTO: TRELLEBORG

Left: AWS Ocean Energy tests the Archimedes Waveswing in the stormy waters around Orkney.

Left: A bespoke rubber membrane protects and seals a part of the Waveswing. It continues Trelleborg's more than 100 year tradition of tailor-made sealing systems.



Archimedes' advantages

The Archimedes Waveswing has significant advantages over other wave energy concepts. Winched below the waves during storms, the system avoids all the destructive forces present on the surface.

The modular Waveswing concept is the only proven technology that can integrate into a multi-absorber platform. Access to the generation equipment for maintenance is therefore from within the structure, removing the need for transport to port.

Left: The Waveswing sits three meters under the surface of the sea and reacts to changes in subsea water pressure. It converts the motion to electricity via a direct-drive generator.

prevent seawater from getting into Waveswing's generators," explains Dirk Jan van Waardhuizen, Manager for Research and Development at Trelleborg.

Trelleborg also provided similar industry-leading polymer solutions, to the European Union-funded WETFEET project (Wave Energy Transition to Future by Evolution of Engineering and Technology) from 2015 to 2018. And as far back as the mid-1990s, it worked with Dutch-based Teamwork Technology, the early originator of the project that evolved into AWS.

"At the end of the WETFEET project, AWS expressed its interest in using our polymer membrane solution for its new Orkney test project," says van Waardhuizen. "It was a delight to work closely on

a project of this scale and offer our expertise again. I'm looking forward to visiting Orkney in the future and seeing the new device in action."

"We are really pleased to have found in Trelleborg such an experienced and reliable partner for the development of this critical component in Waveswing," says Grey. "Its practical approach to solving issues and ensuring delivery of a quality product has helped the success of our project. We look forward to working with Trelleborg to explore how to increase the scale of the membranes to allow us to capture the full potential of Waveswing technology."

"Our extensive design and engineering capabilities enable us to be the trusted partner for our customers, delivering solutions that

meet their specific needs," says van Waardhuizen. "In fact, the largest Extremely Large Telescope (ELT), part of the European Southern Observatory currently under construction, will utilize Trelleborg's advanced sealing systems."

Trelleborg will manufacture and supply handmade inflatable and compression seals that will keep the ELT's classic dome-shaped enclosure pressurized and airtight, protecting it from water, heat, and dust, while ensuring there is no UV exposure within the enclosure.

While wave power will further enable the transition to clean energy, Dirk Jan van Waardhuizen is conscious that there is still a long way to go.

"I have observed this market since 2009. It is true that wave energy has tremendous potential, but much of the technology required to extract it is not yet price-competitive. That's probably because, unlike Waveswing, which is subsurface, most wave energy converters are placed on the surface of the water. This means they may not necessarily withstand rough weather conditions, severe ocean storms, and unusually large waves; often resulting in device break down. This increases capital costs," says van Waardhuizen.

However, van Waardhuizen believes that the technology involved in the AWS project could prove to be a breakthrough solution.

"From a technical point of view, the potential of the technology used in WETFEET and this AWS project is very well-advanced and unique. It sits under the water and absorbs the wave power better, and in my view, it's a viable concept," he says. In a time of sharply rising energy prices and the increasing need for sustainable solutions, we need all the power sources we can get, so let's wave hello to AWS and ocean energy. ■



CONTACT
For more information:
dirkjan.van.waardhuizen@trelleborg.com

Sasan Shaba has founded eight companies. Now he works in a non-profit company that matches startups with big companies.

Igniting startups

Startups and large corporations are increasingly collaborating to develop new, game-changing technologies. Sasan Shaba at Ignite Sweden shares the secrets behind his non-profit company's methods, why some startups fall short, and why he's optimistic about the future.

TEXT PATRICK GOWER PHOTOS JOHANNA HANNO

Startups and large corporations each have skills the other needs. Startups are small and agile, with cultures that foster creativity. Often staffed by recent graduates from top universities who bring with them the freshest thinking in important emerging fields, some are developing products that could revolutionize industries.

Large corporations, meanwhile, have resources. They also have connections, extensive supply chains, regulatory know-how and legal knowledge, all of which are needed to bring new products to market on a significant scale.

On the face of it, there are few avenues for the two to collaborate.

"Knowing where to begin is a big obstacle," says Sasan Shaba, Chief Operating Officer at Ignite Sweden. "As a startup, if you're looking to approach a company with 150,000 employees, who do you contact? How do you even reach out?"

Ignite Sweden is the answer. The nonprofit company was set up in 2017 by Swedish Incubators & Science Parks (SISP) with the aim of matching large companies and public sector organizations with the most innovative Swedish startups. Shaba also holds a position at SISP as Director, International Cooperation.

A man with dark hair and a beard, wearing a dark blue suit jacket over a white button-down shirt, is seated. He is holding a peeled yellow lemon with both hands in his lap. He is looking off to the side with a thoughtful expression. On his left hand, he wears a gold ring on the ring finger and a watch with a metal link bracelet. The background is dark and out of focus.

**“If we generate the right
collaborations, startups get
traction, then investment,
then momentum.”**

Its matchmaking mission, by almost any measure, has been a success. The group has set up more than 5,000 tailored matchmaking meetings since April 2017, involving almost 1,000 startups, 255 corporations and 40 public-sector organizations. From the initial meeting, about half progress to a second phase, Shaba says, and one in six startups ends up walking away with a commercial collaboration.

Shaba is a veteran of the startup world. An engineer by training, he founded eight companies and spent 13 years working within what he calls the “Swedish innovation ecosystem,” with stints at a mixture of early-stage incubators, accelerators and science parks. He spent part of that time teaching university students how to take their ideas to a larger audience.



PHOTO: UNSPLASH

Above:

An example Sasan Shaba points to is the collaboration between Coor, one of the leading providers of facilities management in the Nordic countries, Spotscale, a startup specializing in using drones to obtain three-dimensional images of buildings, and Flir, a world-leading thermal camera manufacturer.

“A lot of startups raise money too early, often without a customer, and they crash,” he explains. “If we generate the right collaborations, startups get traction, then investment, then momentum.”

This is particularly the case for “deep tech” startups – startups that are using new technologies to overcome significant scientific or engineering challenges, notably in the clean energy and life sciences sectors. These often require vast resources to get off the ground.

There is a lot more to Ignite Sweden’s methods than just knowing who to contact. Ignite follows a strict process, one that began as a national initiative in Sweden and is now rolling out globally. So far, it’s in 10 countries.

At the root of everything is trust. Before working with a corporation, Ignite checks to ensure that

whoever they are dealing with has both the budget and the mandate to pursue a collaboration, should things progress. Ignite then conducts a deep dive into the challenges the corporation is seeking to overcome. Those challenges usually drill down to some three to five priorities.

Ignite then scouts Sweden to find an optimal match, drawing up a shortlist of about 25 companies before the corporates choose who they would like to meet.

“They decide which startups they want to meet,” Shaba says. “We don’t push them. Sometimes we’ll have a discussion, but in the end it’s their decision.”

The startups know they are dealing with executives who have both the budget and the mandate to make important decisions, because Ignite has vetted them. Ignite then preps them for the meeting, with

a particular focus on the key challenges and how to initiate the first steps of a commercial collaboration.

The meetings themselves are just 20 minutes and have a minute-by-minute agenda, Shaba says. Once a collaboration progresses, Ignite is able to shepherd startups through the process, providing negotiation skills, legal support and properly designed, startup-friendly nondisclosure agreements.

In many of the best cases, collaborations will depart from the initial discussions into areas nobody had considered, Shaba says.

“This is an open innovation process,” he says, “and we want everybody to approach the process with open eyes. Typical matchmaking involves matching problems with solutions, but we also tell parties that we want them to explore

“Increasingly, we’re seeing game-changing solutions that actually force industries to go in a specific direction that push whole markets into new directions.”

other possibilities. We know from experience that startups can at times adjust their solutions quite quickly.”

An example Shaba points to is the collaboration between Coor, one of the leading providers of facilities management in the Nordic countries, Spotscale, a startup specializing in using drones to obtain three-dimensional images of buildings, and Flir, a world-leading

thermal camera manufacturer.

The three companies met in 2017 at Ignite matchmaking events in Linköping, Sweden. Spotscale believed its product could improve by collaborating with Flir and began working to integrate thermal imaging to its drone product. It wasn’t until 2019 that it became clear to Coor that the product had huge potential to spot heat leakage from buildings. Building owners are

Ignite Sweden

Ignite Sweden is a non-profit initiative that aims to foster innovation and accelerate commercialization by connecting startups to large companies and public organizations. Ignite Sweden is an initiative part of SISP – Swedish Incubators & Science Parks.

Since it began in spring 2017, Ignite has connected more than 980 startups with 250+ corporate and 40 public organizations, resulting in 5,000-plus meetings and, most importantly, more than 350 commercial collaborations.

Earlier this year, Trelleborg took part in the Swedish Innovation Days, which were organized by Ignite Sweden, Sweden’s innovation agency (Vinnova), the Swedish Energy Agency and AI Sweden. Trelleborg met seven start-ups and three companies are now under evaluation for possible future cooperation.

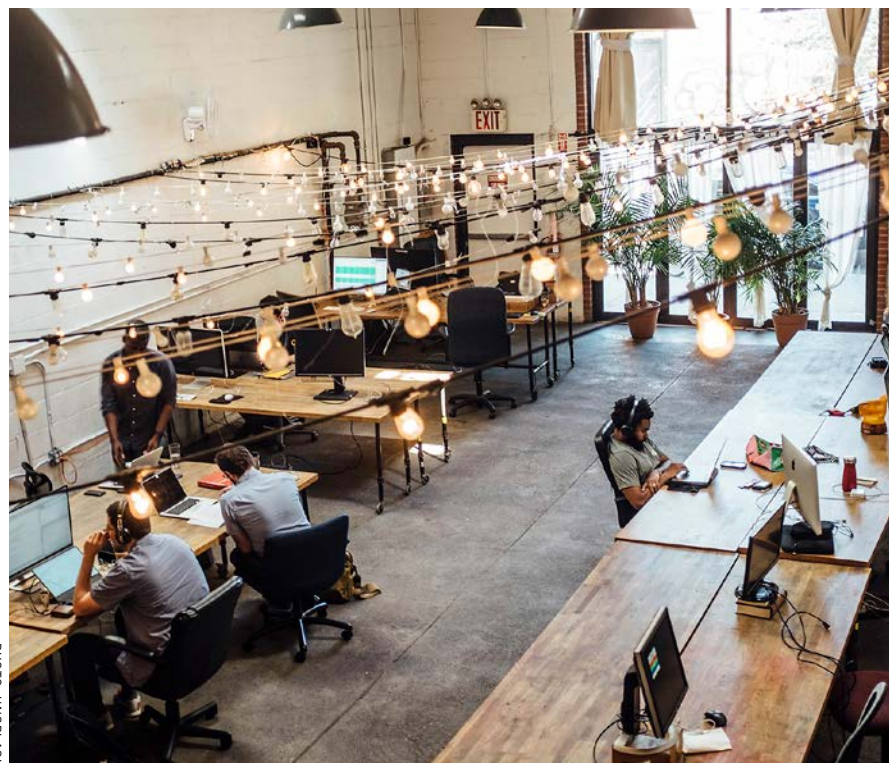


PHOTO: UNSPLASH

under significant regulatory pressure to cut emissions, making the new product an exciting prospect. The companies signed their official partnership in February 2020 before rolling out the product in September.

Shaba is brimming with optimism and is clearly driven by the prospect of facilitating the next innovation that will change the world for the better. It could be small, but it could also address the next pandemic or conflict, climate change or food shortages. Solutions will be found through new technologies that are in their early stages right now, he says.

There are obstacles, but Shaba sees them as manageable. For example, he says, Swedish authorities could do more to accelerate the commercialization of startups emerging from universities. But most important are the attitudes of Sweden's largest municipalities and corporations, because without their desire to adapt and change, great ideas will fall through the gaps and they risk being left behind.

"Increasingly, we're seeing game-changing solutions that actually force industries to go in a specific direction that push whole markets into new directions," he says.

"I think it's important for companies to realize that they need to join this movement to work to find new solutions, because otherwise doing business will only get more and more complicated. It's something everybody should want to be a part of." ■

"I think it's important for companies to realize that they need to join this movement to work to find new solutions."

Sasan Shaba

Lives: In Eskilstuna, about an hour from Stockholm, Sweden.

Jobs: Director, International Cooperation, at Swedish Incubators & Science Parks (SISP) and COO of Ignite Sweden, part of SISP.

Which piece of technology are you most excited about? "Technologies in deep tech and sustain tech/clean tech that can create and push behavioral change and that can make a difference for our global society are very close to my heart."

What motivates you? "People and team – everything is about it, joining vision and forces together to make clear and tangible actions."



Cheers to sustainability

Brewing is Kim Dalum's passion and his start-up company focuses on reducing the carbon emissions in craft breweries. Trelleborg contributed to make his dream a reality.

TEXT MEGHAN CLOUD BRAUNGER
PHOTOS KRISTOFFER LINUS LAURITZEN

Craft breweries are relatively small, independently owned, employ traditional brewing methods, and emphasize flavor and quality. Alongside making great beer, it's about much more: creativity, innovation, passion and stepping outside the box. Brewers are fun to work with, motivated and passionate about what they do.

The craft brewing industry also has a lot of potential. The sector is continuously growing, both in value and in volume, globally at over 14% annually. Alongside offering exciting new flavors and tastes, breweries are expanding their distribution networks locally and internationally. Consumers are increasingly preferring craft over mainstream beers because they offer new styles



“We were looking, not only for someone to supply sealing components, but also one with expert know-how.”

Kim Dalum, Dalum Beverage Equipment

and flavors, and use premium quality ingredients, which are often locally sourced.

“The craft segment is where all the growth is; it’s exciting and so much is happening there. That is the main reason why I decided to focus on craft beer when I started my company. I’m now trying to help craft brewers save money and become more environmentally friendly by reducing emissions,” says Kim Dalum, the founder and CEO of Dalum Beverage Equipment.

Upon founding his company, Dalum approached several craft breweries with different ideas for new equipment and collaboration, based on his previous experience with large commercial breweries. The craft breweries showed interest in the creation of an affordable, small system to capture and compress CO₂.

In 2019, Dalum started a partnership with Ørbæk Brewery to develop a piece of equipment, which would capture CO₂ emitted during the fermentation process

and compress it for storage and reuse at a later stage.

“We quickly realized there was no existing technology available, so we would have to completely build everything ourselves,” says Dalum. “This was a true development project with a lot of turbulence and changes based on trial and error.

“We knew we would need a seal supplier to help develop a sealing solution for the compressor unit and reached out to a number of companies. We were looking, not only for someone to supply sealing components, but also one with expert knowhow and a partner who could help us evaluate and specify seal designs and materials for our equipment. Trelleborg



Andres Gyes (left), Sales Engineer, Trelleborg, and Kim Dalum, CEO of Dalum Beverage Equipment, who spent over 20 years developing equipment and technical solutions for the food and beverage industry.



Sealing the CO₂ compressor

Mikkel Moerup, Global Segment Director, Food, beverage & potable water, Trelleborg:

"We knew this would be a challenging but rewarding project. Dalum's CO₂ Recovery Plant is an especially difficult application for seals and sealing materials, as compression of CO₂ is a dry application.

The temperatures in the compressor rise to a high level. Since an engineered plastic cannot withstand this, a polytetrafluoroethylene (PTFE) material was required. The sealing materials also needed to be compliant with food and beverage standards.

Materials and seal designs were tested in parallel to identify the optimum solution. We tested, analyzed and created the optimum sealing solution for the equipment."

expressed a lot of interest in collaborating with us."

Collaboration with the local Trelleborg solution center in Denmark and the Helsingør manufacturing site was easy. The Trelleborg team provided guidance throughout the entire process, analyzing the seals after testing to understand how they were functioning in the equipment and what adjustments needed to

Turcon® MF6 is the optimum material in the compressor's challenging operating environment.

be made, both to the seal and to the hardware.

Dalum recalls: "One story from early on in our partnership highlights the important role Trelleborg played. Analysis on a Zurcon® engineered plastic seal, a standard material for applications such as ours, showed that CO₂ was forming carbonic acid somewhere inside the compressor. This caused the stainless steel in the equipment to rust and build a black slurry, which was damaging the seals. The discovery led us to add additional filters to the system to make the equipment run cleaner."

In March 2020, after just over one year, Dalum's first CO₂ Recovery Plant was up and running at the Ørbæk Brewery. This was a big milestone.

"While I was familiar with similar systems in large breweries, it was very challenging on such a small scale," continues Dalum. "Many things had to be rethought and redesigned along the way and we were limited with price constraints, which

is precisely why something like this had not been possible before in medium and small breweries."

After installation of the first system, Dalum was ready to sell the equipment. October 2020, saw the installation of a second CO₂ Recovery Plant at the Svaneke Brewery on the Danish Island of Bornholm. After implementation of the CO₂ Recovery Plants at two breweries, Dalum sees two next steps for Dalum Beverage Equipment.

"First, we want to create a version of the Recovery Plant, designed for smaller microbreweries. And, at the same time, we want to scale up production of the existing Recovery Plant, so we can make it available to a larger number of breweries in a smaller span of time. With this, we need to shift to design for manufacturing and serial production," says Dalum. ■

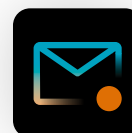
A carbon neutral brewery

In 2018 Svaneke Bryghus brewery on the Danish Island of Bornholm moved to 100% organic ingredients and in 2020, after partnering with Dalum Beverage Equipment, they achieved the next goal of CO₂ neutral brewing.

Jan Paul, brewmaster at Svaneke Bryghus says: "You add carbon dioxide when bottling the beer, and carbon dioxide forms when the beer ferments. Now, we recycle this during the filling process."

Since 2021, the brewing process at Svaneke has been CO₂-neutral.

"Less CO₂ improves the working environment. 'CO₂ headaches' are not unfamiliar to brewers. Also, Svaneke condensates and captures other fumes from the fermentation, thereby eliminating the smell that often spreads to the brewery's surroundings."



CONTACT

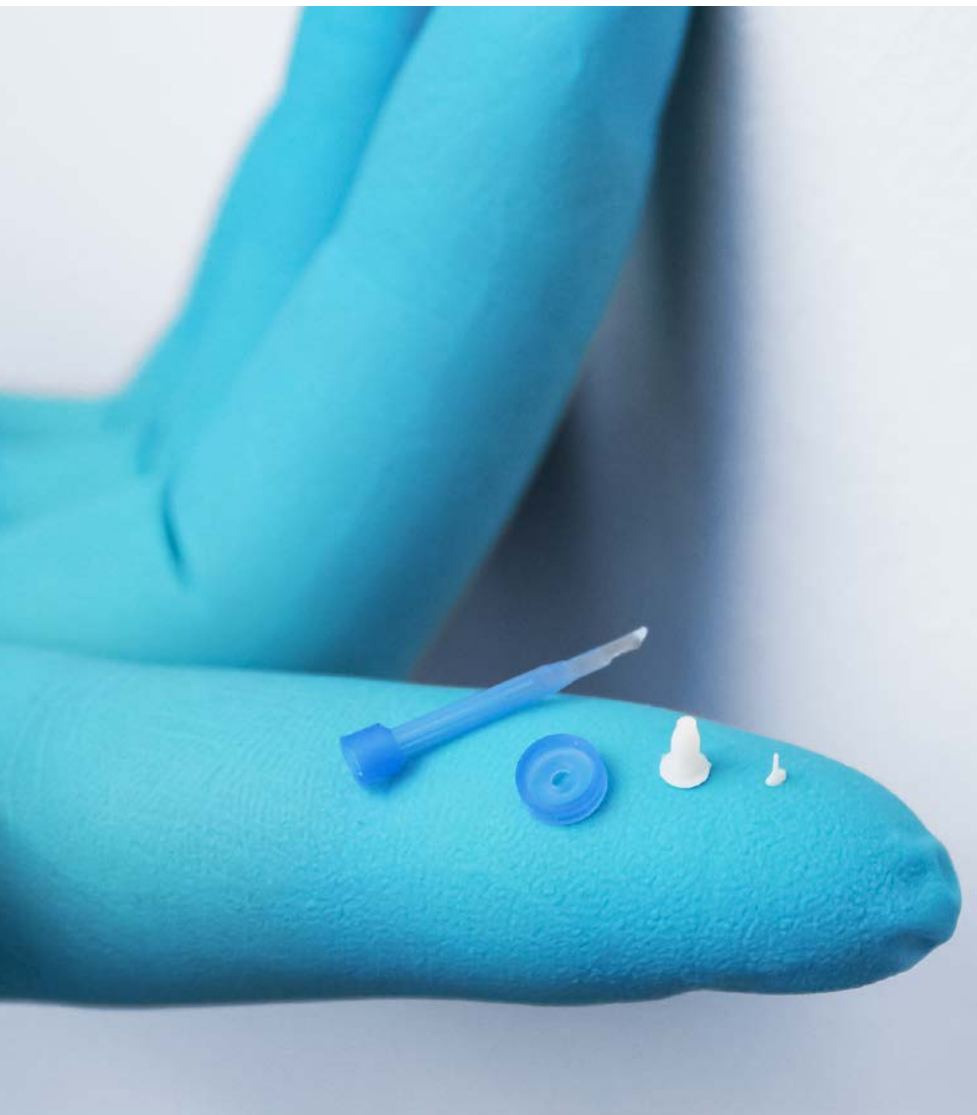
For more information:
mikkel.moerup@
trelleborg.com

Little miracles

Micromolding has become a vital process in manufacturing of tiny medical devices and components. Here we explain how the process works and why it is so important.

TEXT PATRICK GOWER

PHOTOS TRELLEBORG



From pacemakers and neuro-stimulators to diagnostic sensors, medical devices are becoming increasingly smart and compact, providing patients with a level of efficacy and comfort that would have been thought impossible only a few years ago. The technical revolution is underpinned by advancements in manufacturing technologies at the micro and nanoscale that enable the miniaturization of devices.

Polymer manufacturing processes that are key to the production of medical devices on the micro scale include molding, extrusion, machining and assembly. The expertise required, though, goes far beyond the manufacturing techniques themselves.

“In the case of microinjection molding, particularly with Liquid Silicone Rubber (LSR), Trelleborg stands as a world leader in specialized toolmaking and process automation. This goes back to the early days of silicone being introduced as a liquid injectable material,” says Ursula Nollenberger, Product Line Director at Trelleborg. “Micromolded parts require precision tooling on a new level to achieve the desired outcome. In-house toolmaking is one of the key areas of expertise within Trelleborg.”

Just handling microparts from component manufacture through to device assembly poses challenges that require planning from the beginning of a product design.

“For instance, features of micromolded parts tend to be much smaller dimensionally than the flash, the excess material attached to a molding, of conventionally molded parts,”

Nollenberger explains. “Parts, tools and processes need to be designed so that no flash is created in the first place. Removing flash from such small and often delicate parts, if this is even possible, is difficult and costly.”

Florance Veronelli, Segment Manager Europe, Healthcare & Medical, adds, “We are increasingly being sought by leading Original Equipment Manufacturers, OEMs, as an expert development and manufacturing partner for microcomponents and complete devices for patient-critical applications. The trend is for multicomponent solutions to be combined with other polymers, in particular plastics, metals or electronic sensors, to meet the demand for more compact and smart medical devices.”

Microinjection molding is not new. Specialized equipment, toolmakers and processors to produce microparts from thermoplastics or thermoplastic elastomers have been around for some time.

Specialist know-how in toolmaking can facilitate increasingly complex geometries, which is becoming a prerequisite in medical devices. Hot molding polymers, LSR and elastomers also pose unique challenges in comparison to broadly available off-the shelf technologies, and therefore tend to require a tailored approach.

“Trelleborg offers expertise and solutions across the wide range of polymers and aims to serve as a one-stop shop for OEMs that seek solutions for their new medical device applications – particularly those that can benefit from Trelleborg’s capabilities and expertise in polymer processing for complex, high-precision components,” says Nollenberger. “We support and collaborate with our customers from the concept phase through to series production. Early involvement of a component manufacturer in product design with the customer is well-established as an important step to help optimize the total cost of quality and accelerate time to market.”

“A full toolbox of offerings assists the customer through the product development process,” says Veronelli. “These all come to fruition in complex application challenges such as micro parts. Design expertise is



Micro capability has become a prerequisite at a multitude of design levels for medical device manufacturers.

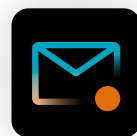


How it works

Production of components below 10 milligrams in weight is possible through needle-point injection technology and fully automated parts handling. All micromolded parts are virtually flash-free and do not require secondary deflashing thanks to Trelleborg’s high dimensional flashless and wasteless design principles.

Multicomponent molding can extend design opportunities as no other technology can, giving medical device developers options that would otherwise be impossible.

coupled with finite element analysis, the virtual functional modeling under application conditions to anticipate and address weak elements in a product design early in the design stage. Design for manufacture as a routine process, identifies manufacturing risk and the means to alleviate it in collaboration with the customer. This helps to achieve the desired product outcome at the lowest cost of quality at the design phase.” ■



CONTACT

For more information:
florance.veronelli@trelleborg.com

Protecting the essential

OPERATIONS

COMPLIANCE

SOCIAL
ENGAGEMENT



PROTECTING THE ESSENTIAL

Protecting the essential is about minimizing our negative impacts and maximizing our positive impacts, making sustainable changes vital for the planet and for society. Our focus areas stretch from the environment to health and safety; from compliance to ethical relations with all our stakeholders and society as a whole. While considering the big picture, we also need to focus on areas where we can make a genuine difference.