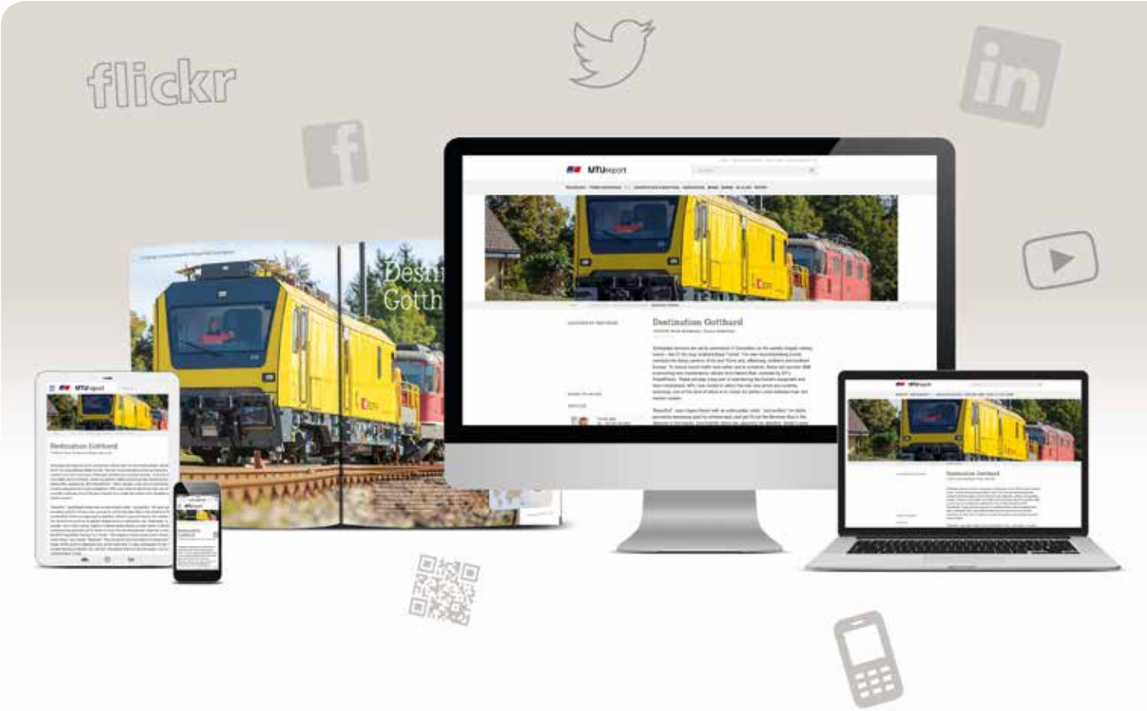

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MTU Series 8000 marine engine

Power. Passion. Partnership.

MTUreport

The magazine of the MTU and MTU Onsite Energy brands | Rolls-Royce Power Systems Brands
Issue 03| 2016 | www.mtu-report.com

Connections

Inconspicuous and boring, yet incredibly important: Bolts are the most important fasteners in any engine.

“I had a lot of reasons to be happy”

Interview with MTU President Dr Dohle on his departure

Power squared

A CHP plant in a chocolate factory

Power. Passion. Partnership.

Dear Readers,

Ever since studying mechanical engineering over 40 years ago, I've had diesel in my blood. My eyes light up at the mere mention of words like 'engine' or 'test stand', and that is not going to change when I head off into retirement at the end of this year. My close connection to the internal combustion engine is set to continue – even if it will just be engines in the classic cars I will have more time for. Engines connect us – to pick up on the theme of this issue of MTU Report. You can build the best yachts, locomotives or haul trucks, but they will not move until connected to our engines. I am very grateful and proud to have spent the past eight years in a company which, more than any other, is all about connections. I started in 2009 as Technical Director of the then independent company Tognum AG, today Rolls-Royce Power Systems. I'm an engineer at heart, and this role kept me close to where my passion lies. Four years later, in 2013, I became Company President & CEO.

At that time we were no longer independent, but part of a joint venture between Rolls-Royce and Daimler. Now we are a wholly-owned subsidiary of Rolls-Royce, and I was one of those responsible for integrating MTU into the Rolls-Royce Group – not an easy task in many respects, but being part of the Group has also opened up new avenues for us. In my view we are well placed for the future.

I wish my successor, Andreas Schell, every success and fair winds as he takes the wheel of the good ship MTU. For me, it is now time to make new connections. I am especially looking forward to spending time with my family.

I've already mentioned my classic cars, and I'll also be grateful for more opportunities to go for a spin on my motorbike. Read more about what has occupied me during my time at MTU and what my future plans are in my farewell interview on pages 16 to 19.

By the way – do you know what I regard as the most important connection devices? As boring as it may sound: nuts and bolts. They create connections, and you've no idea how much effort we put into ensuring that those connections hold.

Thank you for eight wonderful years of being connected to you, and may your connections to MTU survive and prosper.

Dr Ulrich Dohle

Dr Ulrich Dohle is Chairman of the Executive Board of Rolls-Royce Power Systems AG and Chairman of the Board of Management of MTU Friedrichshafen GmbH.

Contents

Connections

Keep up with MTU!

MTU Report always keeps you informed, whether you read the printed magazine, the online version at www.mtu-report.de or the MTUeReport monthly newsletter. In print or in electronic form – you can always get the latest stories and news about MTU and MTU Onsite Energy wherever you are. And if you want information even faster, you will find byte-size versions of all the stories on our social media channels.

CROSSMEDIA

Inconspicuous and boring, yet incredibly important: Bolts are the most important fasteners in any engine.

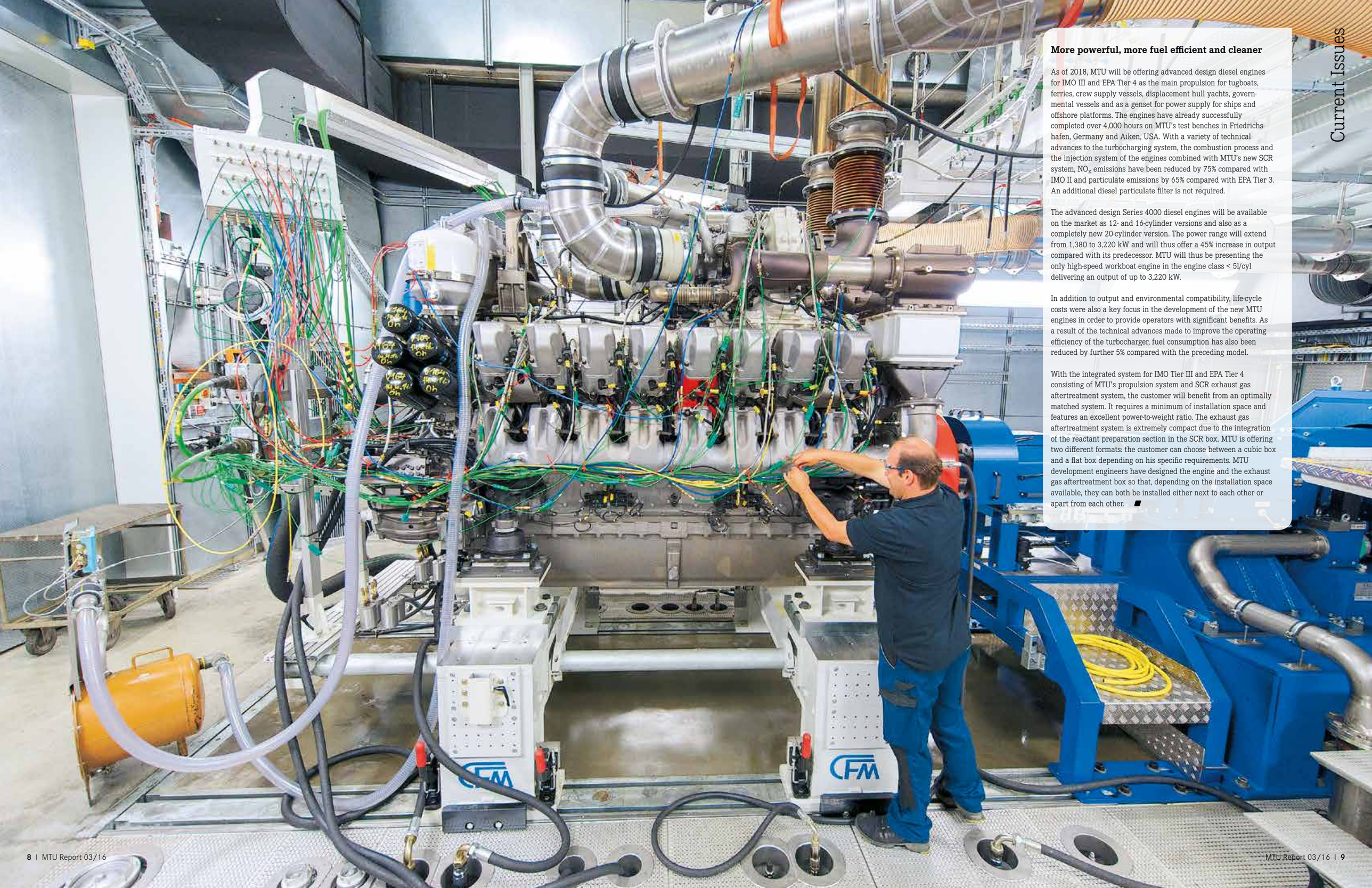
King of Speed

Racing across the Utah salt flats at 402 km per hour – what man or woman with the 'need for speed' in their genes could possibly resist? Mark Zweig recently had the honor. He had the opportunity of taking the wheel of the 'world's fastest freightliner' – as his vehicle is known in racing circles – at this year's Speed Week in Bonneville. The annual event, held each September in the US state of Utah, attracts speed junkies from all over the world who turn up with a vast range of vehicles to set speed records. Mark Zweig took his place on the starting line this year in a very special vehicle. Far from being powered by a standard truck engine, his freightliner had an 3000 HP 16-cylinder MTU Series 2000 aboard. Before its refit with the MTU unit, the 'world's fastest freightliner' was already a speed-machine, having broken several speed records by reaching 370 kph. With the new engine in place, the record-chasing continued. The new engine has larger pumps than its predecessor as well as new turbochargers, nozzles and calibrations. The engine was supplied by MTU distributor Pacific Power Group.

Reaching for the sky

Borj-e Milad, the *Tower of Birth* rises 435 meters into the sky above Tehran. It is Iran's highest tower and the sixth-highest TV tower in the world. Even from afar, Borj-e Milad, standing on a small elevation in the city's Gischa district, is an amazing sight to behold. Built on an octagonal plinth, its shape bridges the modern and traditional Iranian architectural styles. Even in the lower portion spanning six floors, the huge tower offers visitors 63 shops, 11 snack bars, a cafeteria and an exhibition area. Then you take the elevator to the top. At 250 meters' elevation, you come to the world's largest tower head. With 12,000 square meters spread over 12 floors, there is plenty of space for several viewing platforms, an art gallery, a museum featuring Iranian celebrities and a 400-seat revolving restaurant. Above the tower head is a four-stage aerial mast, itself 120 meters high. The bottom stage of the mast is used for transmitting telephone calls, with the three upper levels transmitting on the frequency used by the state-owned radio and television broadcaster.

Helping make all this possible is a 20-cylinder genset from MTU Onsite Energy which has been supplying electrical power, heat and cooling since the end of last year. The natural-gas-powered combined cooling, heat and power system with its Series 4000 MTU engine delivers 1,948 kW of electrical power with 70% efficiency. Operated as a standalone system, it first covers the tower's own power, heating and cooling requirements. When more power is produced than is needed by the tower, it is simply fed into the public grid. During realization of the project, MTU partner Tanir ESCO was responsible for complete engineering and assembly on site and also carried out commissioning. It is now handling maintenance and other services. Iran is increasingly turning to natural gas as a source of energy with a view to reducing CO_2 emissions and other pollutants such as sulfur and nitric oxides. ■



More powerful, more fuel efficient and cleaner

As of 2018, MTU will be offering advanced design diesel engines for IMO III and EPA Tier 4 as the main propulsion for tugboats, ferries, crew supply vessels, displacement hull yachts, governmental vessels and as a genset for power supply for ships and offshore platforms. The engines have already successfully completed over 4,000 hours on MTU's test benches in Friedrichshafen, Germany and Aiken, USA. With a variety of technical advances to the turbocharging system, the combustion process and the injection system of the engines combined with MTU's new SCR system, NO_x emissions have been reduced by 75% compared with IMO II and particulate emissions by 65% compared with EPA Tier 3. An additional diesel particulate filter is not required.

The advanced design Series 4000 diesel engines will be available on the market as 12- and 16-cylinder versions and also as a completely new 20-cylinder version. The power range will extend from 1,380 to 3,220 kW and will thus offer a 45% increase in output compared with its predecessor. MTU will thus be presenting the only high-speed workboat engine in the engine class < 5l/cyl delivering an output of up to 3,220 kW.

In addition to output and environmental compatibility, life-cycle costs were also a key focus in the development of the new MTU engines in order to provide operators with significant benefits. As a result of the technical advances made to improve the operating efficiency of the turbocharger, fuel consumption has also been reduced by further 5% compared with the preceding model.

With the integrated system for IMO Tier III and EPA Tier 4 consisting of MTU's propulsion system and SCR exhaust gas aftertreatment system, the customer will benefit from an optimally matched system. It requires a minimum of installation space and features an excellent power-to-weight ratio. The exhaust gas aftertreatment system is extremely compact due to the integration of the reactant preparation section in the SCR box. MTU is offering two different formats: the customer can choose between a cubic box and a flat box depending on his specific requirements. MTU development engineers have designed the engine and the exhaust gas aftertreatment box so that, depending on the installation space available, they can both be installed either next to each other or apart from each other. ■

New CEO of Rolls-Royce Power Systems

Andreas Schell has been appointed Chief Executive Officer (CEO) of Rolls-Royce Power Systems. He will join Rolls-Royce later this year, and take up his new position from 1 January 2017, succeeding Dr Ulrich Dohle who is retiring.

Andreas Schell has been appointed Chief Executive Officer (CEO) of Rolls-Royce Power Systems (RRPS). Andreas will join Rolls-Royce later this year, reporting to Chief Executive Warren East, and take up his new position from 1 January 2017, succeeding Dr Ulrich Dohle who is retiring.

Andreas has a wealth of international leadership expertise, running large complex organisations involved in high-technology engineering across a number of sectors including aerospace and automotive in Germany, the UK and US. He has experience in operational transformation programmes, strategy and the development of new business models, products and markets. He joins Rolls-Royce from UTC Aerospace Systems and will work alongside Dr Dohle until the end of the year to ensure an effective transition.

Warren East said: "I am delighted that Andreas Schell will be joining Rolls-Royce. He is an enthusiastic leader with experience in dealing with large, complex businesses. He has a thorough understanding of product and market development and a passion for outstanding engineering and operational excellence. He also understands the challenges and opportunities that are presented by digital technologies and techniques. I am looking forward to working closely with him. I would also like to thank Dr Dohle for his valuable support and guidance. He has been instrumental in bringing the business fully into Rolls-Royce and setting out its transformation agenda. We wish him all the best for the future."

Andreas Schell said: "I am very proud to be joining one of the world's great engineering companies at an exciting time in its development. Rolls-Royce Power Systems has great prospects with strong positions in global markets. It has an impressive history and an excellent track record in delivering innovative products and satisfying customers. I look forward to meeting the team and working together with my new colleagues to secure the continued success of the business."

Andreas, a German citizen, is currently Vice President, Digital Strategy, for UTC Aerospace Systems, with responsibility for creating new digital tools and services. He joined UTC in 2009 as Vice President, Engineering, for Aerospace Power Systems, before being appointed as President, Electric Systems, and then President, Actuation & Propeller Systems. Previously Schell worked at Chrysler, where he held a number of positions including Vice President, Electrical and Electronics Core Engineering and was responsible for developing and releasing electric systems for the Chrysler, Jeep and Dodge product lines. He was also responsible for hybrid development, fuel cell systems and advanced vehicle engineering at DaimlerChrysler. He began his career as a development engineer at Daimler-Benz in 1996.

Andreas has an MBA from Michigan State University and a master's degree in mechanical engineering, with a specialization in energy systems engineering, from Technische Universität Clausthal in Germany. He is a member of the Association of German Engineers (VDI) and the Society of Automotive Engineers (SAE).

The new 16-cylinder Series 8000 diesel engine with up to 8,000 kW output expands MTU's product portfolio.

Scaling the Eight-Thousander

MTU presented its new 16-cylinder Series 8000 diesel engine for naval applications for the first time at the Euronaval trade show in Paris at the end of October 2016. The marine engine will have a maximum power output of 8,000 kW. Knut Müller, head of the marine and government business division at MTU, said: "With the launch of the new 16V 8000 engine, we are expanding our portfolio in the very high power class for our customers in the naval industry and are offering at the same time a highly efficient ABS-NVR-certified diesel engine."

The new 16-cylinder engine is based on the well-proven Series 8000 engine. With a maximum power output of 8,000 kW at 1,150 rpm, the new engine has been designed primarily for government vessels, but also ferries and large yachts.

The 16V 8000 engine features low overall operating costs, high power density and environmental compatibility. Common rail fuel injection combined with the electronic engine control system make it possible to achieve fuel consumption levels of less than 200 g/kWh and very low exhaust emissions. The engine meets the requirements of the IMO Tier II and EPA Tier II emission regulations and, with additional modifications, will also meet other standards as required. Series 8000 engines are certified as marine engines in accordance with all accepted classification standards worldwide. They were also awarded Naval Vessel Rules (NVR) certification by the American Bureau of Shipping (ABS) in 2014 and are subsequently the first advanced technology engines in this power class to meet the stringent requirements of this certification. "Some of our customers are very interested in an ABS-NVR-certified engine in the power range of the new 16V Series 8000 engine. This engine meets the naval requirement profiles extremely well, also due to its ability to run for long periods in light load mode," Knut Müller explained.

EU-Stage IIIB minus 50%

MTU has signed a letter of intent with Vossloh Locomotives GmbH for the delivery of 44 ultra-low emission Series 4000 rail engines. Emissions on MTU's 12V Series 4000 R84 units are 50% lower than the current EU Stage IIIB emissions threshold. They are to be used in the 18 Vossloh diesel-electric multi-purpose locomotives being, supplied to French leasing company Akiem S.A.S. The first engines are scheduled for delivery beginning in 2017. The MTU brand is part of Rolls-Royce Power Systems. Jürgen Blassmann, Head of Rail Business and Base Engineering MTU Engines, said: "The order from Vossloh shows that our Series 4000 rail engines are genuine all-rounders: they are powerful and reliable even under the toughest conditions while being environmentally friendly." The 12-cylinder engines have a rated output of 1,800 kW and enable the locomotives to achieve a maximum speed of 120 km/h.

A special requirement of Akiem is an emissions level 50% lower than the EU Stage IIIB emissions standard, since the locomotives are also to be used for work in tunnels as well as for shunting and the haulage of freight and infrastructure trains. Emissions reduction is key to the health protection of workers in the tunnel. The MTU drive systems meet this requirement through exhaust gas recirculation, common rail injection and a diesel particulate filter. Regulated two-stage turbocharging delivers high charge air pressure to the engines to increase the power output and keep particulate emissions to a minimum.

MTU is set to deliver 44 especially low-emission Series 4000 rail engines to Vossloh Locomotives GmbH.

In brief:

New distributor in South Korea

MEST Co., Ltd. (MTU Engine and Systems Technology) has been appointed MTU distributor for South Korea. Headquartered in Yangsan, Korea, MEST has a team of 45 staff highly experienced in MTU products and with established customer relationships in Korea.

Superyacht Award for MTU propulsion

The *Galactica Super Nova* was a major winner in the Superyacht Awards presented annually at the Monaco Yacht Show. The vessel took two of the four coveted awards. The panel of judges reserved special praise for the propulsion system on board the yacht. It is propelled by two 20-cylinder MTU Series 4000 engines, each of which powers a fixed-pitch propeller.

The *Galactica Super Nova* was one of the big stars of the Superyacht Awards at the Monaco Boat Show.

1,000th PowerPack for Alstom

MTU is to deliver the 1,000th Series 1800 PowerPack designed to meet EU Stage IIIB emissions standards to railcar manufacturer Alstom. The PowerPacks are used to drive Coradia Lint railcars.

New wind farm auxiliaries

British shipping company Seacat Services is to take three new wind farm support vessels into service in 2016 and 2017. The new boats, 23 and 27 m in length, are each powered by two MTU 12V Series 2000 M72 engines, each delivering 1,080 kW. The DNV-GL class boats were built by South Boats on the Isle of Wight.

Two aluminium catamarans are to operate ferry services by Doeksen for as many as 66 vehicles and 599 passengers from 2018 between the Dutch mainland and the islands of Terschelling and Vlieland.

From left to right: Richard de Vries (operational manager Reederij Doeksen), Mark Newbold (CEO Strategic Marine) and Knut Müller (head of marine and governmental business at MTU) signed the contract for delivery of four MTU gas engines to be deployed in two new catamarans operated by Doeksen.

In 2018 MTU will deliver the first certified gas engines for commercial marine applications.

Gas for sea power

So far MTU's new gas engine for marine applications has only proven itself on the test stand – albeit for over 3,600 hours without a hitch – but MTU is already booking its first orders. Dutch shipping company Doeksen will be the next in line to endorse the new gas engine, which is to power two of its new 70-m catamarans.

Knut Müller, head of the marine and governmental business at MTU, said at the contract signing: "We would like to thank our long-standing partners Strategic Marine and Doeksen for the trust they have placed in our new technologies and are delighted that the MTU gas engine has been so well received by the market." Besides the Dutch ferries, MTU gas engines will be used to power a new Damen-built harbor tug ordered by shipping company Svitzer and a new Lake Constance ferry operated by the local utility, Stadtwerke Konstanz.

The two aluminium catamarans are to go into service for Doeksen from 2018, shuttling up to 66 vehicles and 599 passengers between the Dutch mainland and the islands of Terschelling and Vlieland. The Wadden Sea was declared a UNESCO World Natural Heritage Site in 2009 because of its unique geological and ecological value. Richard de Vries, head of operations at Doeksen, said: "Particularly on the sensitive Wadden Sea that has been officialy declared worthy of protection, it is very important for our vessels to be highly eco-friendly. With their dynamic acceleration behavior, MTU engines were exactly the right choice for us."

For main propulsion, each of the 70-m catamarans will receive twin MTU 16-cylinder pre-production Series 4000 gas engines, each delivering around 1,500 kW. The IMO Tier III-compliant engines are to power azimuth fixed pitch-propellers, facilitating an operational speed of 14 knots.

Mark Newbold, chairman of Strategic Marine, said: "This is a milestone project for us. We see an ever-increasing focus on the environmental aspects of marine transportation, with LNG emerging as the fuel of choice for many operators. We are committed to being at the forefront of developing LNG and other emission-reducing technologies further to benefit our customers and the environment. We have been working successfully with MTU for over 15 years in powering engines for patrol boats, windfarm supply vessels and ferries."

What else the ranking list in 'Boote Exklusiv' reveals: mega proportions are the trend in the yacht world – of the 25 brand-new yachts that made it into the top 200, the ten longest are all over 100 m.

MTU yacht engines more in demand than ever

When it comes to yachts, length is the all-important factor. In the German magazine Boote Exclusiv, the *Azzam* again tops the rankings this year as the world's longest motor yacht. Runner-up is the *Fulk al Salamah*, with the *Eclipse* in third place. While little is known about who the owners of the world's top 100 mega-yachts are, one thing is certain – MTU yacht engines are more popular with them than ever. Mega-yacht owners have very high expectations – not only of the dimensions of their floating palace, but of the propulsion system, which has to satisfy strict requirements. Besides spaciousness, a high premium is placed on the quietness of the vessel. Engine-incurred vibrations can be significantly reduced through various bearing and coupling configurations. Acoustically enclosed engines and special technology such as intake air silencers also enhance comfort on board by making sure that as little noise as possible is transferred to the ship's structure and does not reach the cabins. MTU yacht engines are tailored to the specific duty profiles of the vessels they propel and are low in fuel consumption. They also enable longer ranges, which is why MTU's cost-efficient diesel-electric and hybrid propulsion configurations are especially sought after. The high power density of its diesel-mechanical propulsion system based on a 20-cylinder Series 4000 unit makes it a very popular choice for yachts under 100 m.

Seastreak offers ferry services to Manhattan, Central New Jersey, Nantucket, Martha's Vineyard, and more.

New ferries in New York

Seastreak recently chose MTU to power its new Commodore-class catamaran and to repower three Seastreak-class vessels. Seastreak, a premier fast passenger ferry service in the New York metropolitan area, initiated the fleet improvements as a part of a 24 million-dollar capital program that aims to raise the bar in New York's fast passenger ferry service. The new, high-speed luxury catamaran will be the first in what will be known as the Commodore-class. It will be the area's fastest waterborne transportation option, capable of carrying 600 passengers at 35 knots and making the crossing from Wall Street to northern New Jersey in under 40 minutes. The ferry, designed by Incat-Crowther of Sydney, Australia, will feature four MTU 12V Series 4000 diesel engines offering the lowest emissions on the market, as well as four Rolls-Royce waterjets, which provide maximum uptime, exceptional reliability and redundancy. Over the next few years, MTU is also to repower three of Seastreak's existing vessels - the *Highlands*, the *New York* and the *New Jersey* - with new MTU 16V Series 4000 units and Rolls-Royce water jets.

Powerful diesel engines for the Italian Navy

MTU is to supply 14 of its most powerful diesel engines for seven new multi-purpose ocean-going patrol vessels being built for the Italian Navy (Marina Militare Italiana) by Fincantieri, one of the world's largest shipbuilding groups. The PPA-class vessels (in Italian: Pattugliatori Polivalenti d'Altura, a.k.a. multi-purpose ocean-going patrol vessels) form part of the Italian Navy's Fleet renewal plan. The 20V Series 8000 M91L engines each deliver 10,000 kW and are to be shipped from 2017. This will be the first time MTU engines have been used in newly-designed surface vessels operated by the Italian Navy. MTU will also be providing service.

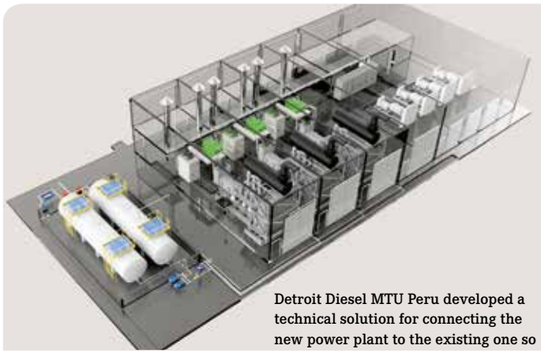
With their new, multi-module design, the vessels are able to undertake a wide variety of tasks and missions. These also include humanitarian assignments for which the vessels will be equipped with containers for use as mobile hospitals. It will also be possible to provide people on land in need with electricity and drinking water.

The Vogtland PET company specializes in the re-processing of bottles made from PET. Its cogeneration module from MTU Onsite Energy provides the extra heat and power needed for the process.

Making bottles from bottles

Worldwide consumption of PET bottles is booming. In the US, consumption is equivalent to 1,500 bottles per second, and in Germany alone, some 800 million PET bottles are in circulation at any one time. But what actually happens with the empty PET bottles? Vogtland PET GmbH in Neuensalz near Plauen is a German company that re-processes them. To provide the heat needed for this process and cover peak power demands, Vogtland PET has opted for a containerized CHP module based on a Series 400 natural gas engine from MTU Onsite Energy.

"Rather than producing heat electrically in the usual way, we have our CHP module which boasts 90% efficiency and allows us to avoid expensive peaks in electrical power consumption, which brings us a significant cost saving," explained general manager Uwe Röhn. It is not the first time that the company's management has chosen to endorse MTU Onsite Energy - it deployed its first genset back in 1990, which came from MDE Dezentrale Energiesysteme GmbH, taken over in 2006 by MTU Friedrichshafen."The very positive impression I got then of MTU Onsite Energy's cooperativeness and reliability prompted me to decide in their favor again," explained Röhn.



Detroit Diesel MTU Peru developed a technical solution for connecting the new power plant to the existing one so that both genset groups can be automated.

Backup power for Peruvian seaport

MTU Onsite Energy recently supplied three 20V Series 4000 generator sets destined for the Port of Callao, Peru's chief seaport that provides commercial and marine access to the city and surrounding areas.

The highly evolved Series 4000 generator sets offer outstanding fuel economy and best-in-class reliability and availability, delivering 3,250 kWe. In the event of a breakdown in the power supply to the seaport, an Automatic Transfer Switch (ATS) transfers the electrical load to MTU Onsite Energy's backup gensets within seconds. Dante Romero, head of energy at Detroit Diesel MTU Peru, said: "Being part of the modernization of Peru's main seaport proves the excellent reputation of MTU Onsite Energy products worldwide. All our customers in the region are extremely satisfied with these generator sets and facility managers at the Port of Callao will be no different."

Modular structure

An electrical genset as a single building block? Is that even possible? Yes. And this is exactly the principle that MTU has applied in further development of its upgraded Series 400 gas engine. Whether the need is for just a genset or a genset equipped with a heat cabinet, or perhaps an exhaust gas heat exchanger on top, the new Series 400 design brings much greater flexibility in terms of application and can satisfy the wishes of all customers. From the small biogas farm to the medium-sized industrial business, the right configuration can be put together – including combinations with an overall efficiency rating of up to 90%.

Series 400 gas engines deliver 120 to 420 kW, but take up less space and are much easier to service. "Another feature is for example the additional oil tank capacity integrated directly into the genset which allows longer oil change intervals as part of scheduled maintenance, with no need to interrupt operation for a refill," explained Frank Sonntag, Series 400 project manager at MTU Onsite Energy in Augsburg. "With this tank, the customer saves space, since no additional unit is needed externally." The Series 400 gas engine is currently available as a 12-cylinder version and can run on natural gas.

The Series 400 unit can be used for straightforward power generation or for combined heat and power generation. Three modular configurations are available: the basic version is solely for electrical power generation. This basic version plus a heat cabinet is used when the heat in the engine cooling water is to be harnessed. The third configuration is the basic unit with heat cabinet and exhaust heat exchanger, which additionally enables the heat from the exhaust gas to be utilized – an interesting proposition for supplying power to urban areas or industry. So heating can be made available to residential areas or factories. Acoustic enclosures are a further option available to customers.

The extended Series 400 MTU gas engines are available in three different modular constructions.

Connections

Finding out what keeps the world together deep down occupied the mind of Goethe's Faust, and many more as well. Connections have fascinated people all down the ages. In essence, it's all about connecting the right things in order to achieve more together than as individuals: European countries joining in the European Union, for example, or two people joining together to form a household, or turning a jigsaw puzzle into a picture. Engines, too, can only do what they are supposed to do once connected to a vehicle or generator, namely: dispense driving power. The following pages contain examples of how MTU engines can be connected up: to an electric motor and a battery to form a Hybrid PowerPack, or to wind power and solar power systems to form a hybrid power plant, or to a railway track maintenance vehicle to form a powerful driving force. To make the connection simply and efficiently, MTU also has the right automation system for every application. Making sure we all stay well connected.

#Connections

Dr Ulrich Dohle spent eight years with the Group, initially as Technical Director and, since 2013, as President. He is now taking retirement.

"I have had a lot of reasons to be happy"

#Connections

Connections were always top of his agenda. In 2009, Dr Ulrich Dohle joined as Technical Director the former MTU parent company Tognum AG, later to be re-named Rolls-Royce Power Systems. At the time, he described the successful launch of the Series 1600 family and adapting MTU's existing line-up to comply with Tier 4 final and EU IIIB emissions requirements as his greatest challenges - challenges that he mastered. As company President since 2013, Dr Dohle was also responsible for development of the mobile natural gas engine and the Hybrid PowerPack, and led the company into a new future within the Rolls-Royce Group. Now, on the eve of his retirement, Dr Dohle talks to MTU Report about his connections – to MTU, to engines, to Rolls-Royce, to test stands and to motorcycles.

You had connections to MTU even before becoming Technical Director at Tognum in 2009. What kind of connections were they?
It was a very close connection, even then, given that I had a lot of dealings with MTU engineers in my role as Chairman of the Divisional Board of Bosch Diesel Systems. At the time, Bosch was – and still is – making very high-quality injection systems for MTU, in particular for special engines. MTU was already widely known for its special solutions. MTU certainly demanded a lot of us – in a positive sense: in meetings there was no overlooking MTU's great technical expertise. Rarely have I had such in-depth discussions with customers on designing the very best technical solutions.

Did this image change when you arrived at Tognum?
No. I would say it simply broadened. It became apparent very early on that MTU was so much more than an engineering shop. I found the broad customer base and range of applications fascinating right from the start. Less than a year later I was already feeling like a real MTU man – that's pretty quick when you consider I'd just spent 25 years at Bosch. Something just went 'click' right at the outset. The Daimler spirit was still tangible at MTU: there was – and still is – a pride among employees in their company. They do outstanding work and have the very highest technical standards.

Are you going to retain your connections to the company?
I definitely intend to. I spent nearly eight years on the Executive Board and have lived and breathed MTU. I've developed a fondness for many people and also for the Lake Constance area and the hills and towns around it. Sometimes you develop a different view of things when you're outside the company, and when this perspective is called for, I'll be happy to oblige.

You have a reputation for your love of internal combustion engines. What would you say are the most important connection points inside an engine?
As boring as it sounds, it literally is the nuts and bolts. An engine is made up of over 5,000 parts, and every one of them has to be connected to something. I'm one of these engineering traditionalists who have an aversion to bonded connections. It's OK to have a weld or two, where necessity demands, but the bolts are what essentially holds everything together. It is interesting to see how many bolts we use and how important they are – especially in high-pressure fuel lines where you are forever battling to keep everything leak-tight. How to optimize heavy-duty threaded connections – also in terms of cost – is, and remains, a major issue.

And what are the most important connections on the outside of the engine?
As part of a propulsion system or power generation system, marrying the engine up to the components around it is key to creating the optimum solution for the customer. It was Socrates who said that the whole is greater than the sum of the parts.

How do you define connecting well to the customer?
Not so much in engineering terms, it's more a matter of trust. This trust is won by outstanding products and outstanding service – and, first and foremost, by keeping one's promises.

How was your connection to Rolls-Royce in March 2011 when, together with Daimler, it announced the takeover of Tognum AG?
The connection was an exciting one. Of course, I felt it was a pity for a successful independent company like Tognum to become part of a major group. Indeed, I had consciously

Dr Dohle unveiling a Series 4000 engine in February 2016 together with Yan Ping, President of Guangxi Yuchai Machinery, to mark the launch of a joint venture.

> «When I walk past our test stands and hear the sound of those big engines, and feel the vibration through the air, it still makes my heart skip a beat.» **Dr Ulrich Dohle**

left Bosch to work in a smaller group and to have an opportunity to help shape its future as a member of the board. When the takeover came, there was a real danger that this wish was not going to come true. Following the takeover, we have had other forces acting on us than we did as an independent company. Often, the interests of a manufacturer of large diesel engines and those of a jet engine maker are at odds with each other. We had a lot of discussions at the time, because I wanted to retain our independence at the same time as embedding the company as part of the Rolls-Royce Group. At the end of the day, our aim is to get the very best out of this connection – for us and for our customers – and I think we're well on our way to doing that.

You joined MTU as Technical Director in 2009 and became President four years later. What do you think has changed since then?
My predecessor told me at the time that, as Technical Director, I had the best job in the company. I've often recalled those words. As President, I had to pay more attention to creating balance among the various parts of the company – that was a big challenge, especially during times that were economically tough. I must admit there were times when I didn't succeed entirely in reining in my natural predilection for engineering matters. Having said that, taking overall responsibility was not really new to me, indeed, I'd been managing the Diesel Systems business at Bosch as Chairman of the Divisional Board.

In almost eight years in the Group, what was it that you have found most...
...impressive?
The superb skills and capabilities of our people, the way they identify with MTU, and their sheer professionalism. Not forgetting the great loyalty our customers have to our products, and the excellent reputation enjoyed by MTU engines worldwide.

...annoying?
The fact that we have not always met the objectives we've set for ourselves – ambitious though they may have been – and the fact that we have to put so much money into quality initiatives in the field.

...challenging?
The biggest challenge was embedding an independent listed company within a major group. This necessarily brought with it different rules of play which we had to observe.

...enjoyable?
One delight has always been whenever we've developed a new generation of engines for the next stage of emissions regulations. The incredibly successful re-start of our production facility in Aiken was also very pleasing, as was the whole issue of 'lean production' which has come a long way in recent years. I've also been delighted at the speed with which we have negotiated the Asian joint venture for engine production in China. I have had a lot of reasons to be happy.

Let's return to the subject of connections – what do you associate with ...
...the word 'development'?
Continuous improvement and around 1,000 employees working hard to produce the best solutions and make our engines that bit better every day.

...an MTU 1163 engine?
A whole new generation of engines, the Series 1163-04. We've turned a somewhat jaded, but powerful, engine into a state-of-the-art unit complete with electronic engine management systems. A lot of people thought we'd never manage to do it, but we did.

...natural gas engines?
MTU's ticket to the future. Pride in our stationary gas engines with the kind of efficiency levels that make us best-in-class. And, of course, our mobile gas engine which is going to be used to power ships and potentially other vehicles too.

...a test stand?
My student days. As a young mechanical engineering student at the Institute of Applied Thermodynamics in Aachen, I spent three years as a lab assistant to help make ends meet. But of course it also calls to mind the new MTU test facility, which we refurbished to state-of-the-art levels in recent years. And I have to say, when I walk past our test stands and hear the sound of those big engines, and feel the vibration through the air, it still makes my engineer's heart skip a beat.

...the smart factory revolution?
Where the future is. A generic term describing close intermeshing along the entire supply chain from supplier to customer, intelligent use of data within this value chain, and making processes leaner. A must for any business that wants to be fit for the future.

...motorcycles and fast cars?
My hobbies. Pleasant memories of evening motorbike rides, watching the sun set over Lake Constance, and enjoying my classic cars – most of them built in Stuttgart (but not Mercedes!).

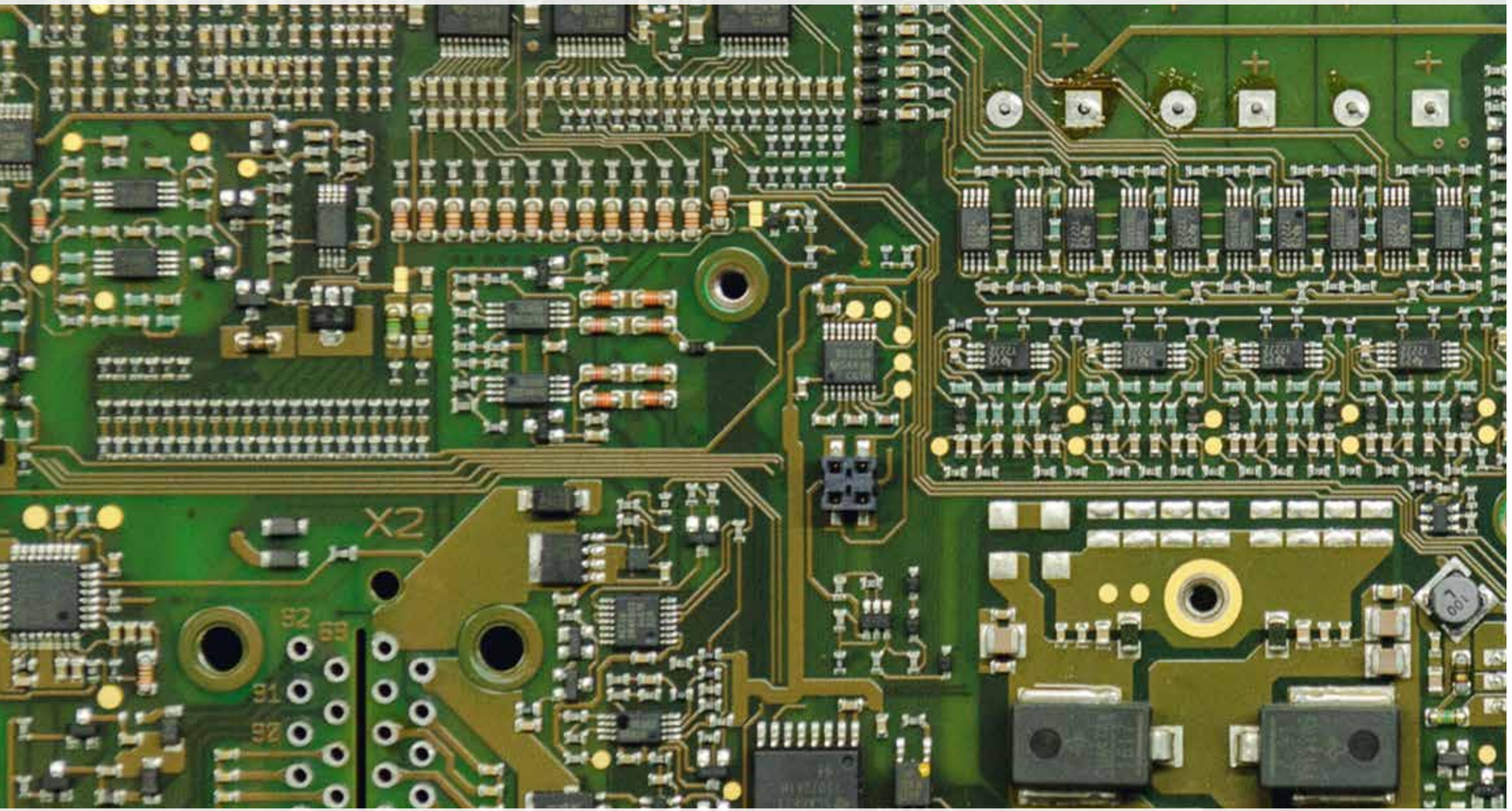
And what do you associate with the word 'retirement'?
Freedom from the constraints of a big company, and the ability to use my time as I please. That doesn't mean I'm going to sit around and do nothing, though. I've lined up a lot of things to do – including work in advisory and supervisory boards of companies in the automotive and automotive supply industries, and in mechanical engineering businesses. Also, it means a lot to me to have time for the family.

It's become a tradition for the US President to leave a congratulatory welcome note for his successor in the top drawer of his desk in the Oval Office. What tips would you include on such a note to your successor?
At MTU we don't leave a note, but we do have a sextant which has been passed from one president to the next ever since the Tognum days. It is used to help navigate the good ship MTU, a task for which I wish my successor every success and, of course, fair winds.

Interview: Lucie Maluck
Pictures: Robert Hack

1 Dr Dohle took over the role of Technical Director from Dr Gerd-Michael Wolters in 2009. **2** A highlight at Innotrans 2012: presenting a Deutsche Bahn railcar powered by an MTU Hybrid PowerPack together with Dr Kefer, then Technical Director at DB. **3** Tognum AG became Rolls-Royce Power Systems AG in January 2014. Dr Dohle unveiling the new name together with Executive Board colleagues at the time. **4** Engines are his passion: Dr Dohle was often to be found walking the production bays and asking questions on engine designs. **5** Business meets politics: SPD Chairman Sigmar Gabriel on a visit to Rolls-Royce Power Systems.

Automatically connected



What use is a top-class engine if its vehicle connection is second-rate? It will certainly fail to make the most of its capabilities. Only when all the engine's components are working in perfect harmony and are perfectly matched to the vehicle can it deliver its full potential. To ensure a first-rate vehicle interface for a first-rate engine, MTU develops specific automation systems for each application that manage, monitor and control the entire working of the drive system and other components, where the customer so requires.

MTU makes electronics components for its automation system in-house.

An air-conditioned room, employees in white coats, and a quiet humming sound. Is that the image of an engine production bay? Sounds more like a dental surgery. Yet this large, sterile room is the manufacturing facility at the MTU Electronics Center. Low clicking and clunking noises are coming from a large white robot. A pick-and-place machine puts miniature components weighing just 5 mg, such as capacitors, resistors and diodes, onto a printed circuit board with millimeter precision. Depending on the electronic assembly in question, between 1,500 and 2,000 parts are placed via large rolls onto the PCB, where they are soldered into place. Connections are made.

They are connections without which the vehicles would not be able to move independently, yet which are invisible to the train driver, haul truck driver or ship's captain. And they're not the only ones. The locomotive builder, haul truck maker and shipbuilder also benefit from the many thousands of connections which MTU supplies between engine and vehicle or vessel. "Without wishing to sound arrogant, no other manufacturer makes it as easy for vehicle manufacturers to install their engines into vehicles and vessels," said Martin Gohlke, who runs Automation Systems Development at MTU. "We are not just an engine maker, we're a manufacturer of entire drive and propulsion systems," he added. And these systems consist of an engine and the associated automation system.

One simple movement – complex connections

Here's an example: A train driver wishes his train to accelerate. In the cab, he uses the control lever on the driver's console to send a signal via the vehicle control system and the MTU interface to the MTU automation system, which receives the message, processes it and forwards it to the engine governor, which in turn passes it to the engine. That's quite a few connections already, but there are more. Within the engine, a further complex process is set in motion: Higher speed means that more fuel and more air have to arrive in the cylinder simultaneously. At the same time, the fuel pressure has to rise to ensure the fuel atomizes better. As modern MTU engines always add a certain amount of exhaust gas to the fuel/air mixture as a means of minimizing nitrogen oxide emissions, the processor also takes data from sensors in the charge-air duct to calculate how much exhaust gas is required in the combustion chamber. It then forwards this data to the actuators via a 'data bus'. The actuators convert these electronic signals into mechanical movements. In this instance, they move the air and gas valves and prolong the length of time the injectors are energized. A multitude of connections to which the train driver is probably oblivious when pushing the lever.

A machine picks and places components on the PCBs. Employees in the electronics department place the strips with electronic components into this device – also known as a feeder.

#Connections

The Blue Vision New Generation automation system controls and monitors the entire propulsion system on board ships.

An engine is made up of hundreds of different parts and technologies. Every one is important, but the real trick is getting all the components to work together. No coincidence, therefore, that the engine management system and Engine Control Unit (governor) are known as the engine's 'brain' connecting all those technologies together.

MTU automation: connecting the engine to the vehicle or vessel
However, the connections do not stop at the engine: the way it communicates with the vehicle or vessel is equally important. To ensure this runs perfectly, MTU develops the right automation system for each application – whether it be for locomotives, ships, haul trucks or electrical gensets. The Powerline automation system is available for locomotives, and for ships, Blue Vision NG and Callosum. Motivline has been designed specifically for haul trucks, and Genoline for gensets.

All the systems connect data from the engine management system to data from the vehicle control system and peripheral components such as radiators, transmissions and propellers. By so doing, they enable the manufacturer to install the engine into its vehicle or vessel with speed and ease. To help with this, MTU supplies pre-manufactured components developed in-house, which merely have to be hooked up to the vehicle control system. "The vehicle or vessel manufacturer only has to specify the scope of the automation system, tell us how long the cables should be, and then plug the drive system connector (supplied) into the vehicle control interface," said Michael Welte, Manager System Engineering at MTU. And once the engine is running, the operator is fed all the information needed to make the very best use of the engine(s) and drive system in its installation. A perfect connection.

MEMO

Connections on board ships: Blue Vision New Generation

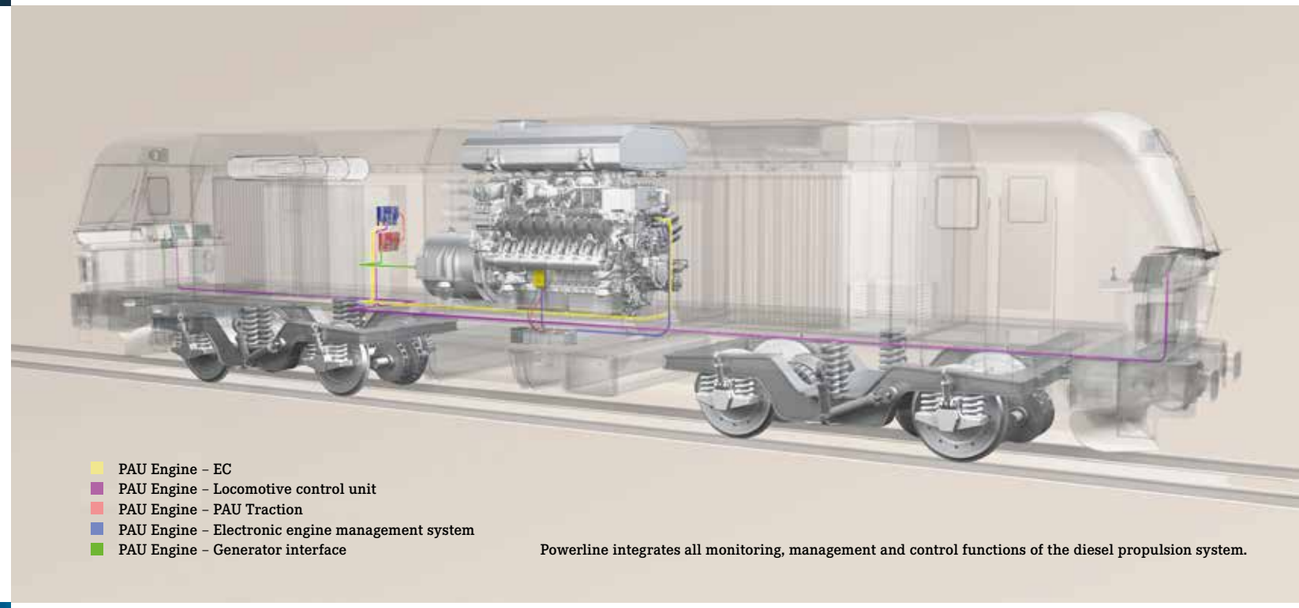
In addition to other marine propulsion systems, MTU has developed the Blue Vision New Generation ship automation system to keep the communication going between a ship's captain and the vessel's engine. Different configuration levels are available: the simple, non-classifiable version 'Blue Vision Basic New Generation' and the enhanced classifiable version 'Blue Vision Advanced New Generation'. A top-of-the-line version 'Blue Vision Basic New Generation' is to be introduced at a later date. The automation system can be connected to the existing on-board ship's system using standard interfaces such as J1939, CANopen or Ethernet. The heart of the system is the Local Operating Panel (LOP). As with the PAU in the Powerline rail system, the job of this LOP is to monitor and control the entire propulsion system. One example is when the ship is moving off: the captain moves the propulsion control lever to '50%', giving the signal to move off. This information arrives at the LOP which then sends it to the transmission system, telling it to engage gear. Once this has happened, it tells the Engine Control Unit to increase engine speed. The LOP then tells the instrumentation on the bridge at how many revolutions per minute the ship's engine is turning, how fast it is moving or how high the engine temperature is. "Our automation system could even track the temperature of a luxury yacht's whirlpool and ensure the skipper is informed," said Michael Welte.

MEMO

Gensets - Genoline

For marine gensets (engines coupled to electric generators) which are used to generate power for diesel-electric propulsion or to supply on-board equipment, MTU has developed the Genoline automation system.

Genoline monitors and controls the diesel engine and monitors the generator it is coupled up to. Here too, the heart of the system is the Local Operating Panel (LOP) which can be connected to the operator's external system by means of a standardized J1939 or CANopen interface. The modular system makes it possible to fine-tune the diesel engine to the many different operating conditions that prevail when electricity is being generated. For example, when the winding temperature inside the generator rises too high, the genset is shut down automatically to protect the generator. A corresponding message is then produced which can be filtered out of the LOP display and conveyed to the external system interface. Project Genoline NG is currently underway to develop a new generation of automation specifically for these applications. Here, among other things, the system is being adapted in line with the latest MTU 'MCS6' automation technology, for example communicating via an Ethernet interface instead of CAN, and including both the possibility of adding a specific variant to meet the high standards required by military orders and enhanced compatibility with other engine series.



Powerline integrates all monitoring, management and control functions of the diesel propulsion system.

Genoline monitors and controls the diesel engine and the generator coupled to it on board ships.

MEMO

Simpler locomotive connection thanks to Powerline

Locomotive builders can use the standardized interfaces of the MTU 'Powerline' automation system to speed up the process of installing MTU engines in their trains. A CANopen bus interface standardized for data transfer ensures a fast connection between the engine and the locomotive's central control system. External engine peripherals such as the cooling system, fuel treatment system or limit monitoring systems are also connected to the engine via the MTU automation system. At the heart of the system is the Power Automation Unit (PAU), the central interface between the engine and the locomotive control system. This connects the various locomotive control units easily to the MTU diesel engine. Signals typically exchanged between the locomotive control system and the PAU include things like engine start-up, engine shut-down and required engine speed. Important information such as current engine speed, oil pressure and coolant temperature are also processed by the PAU and displayed to the train driver via the instrumentation on the driver's console. This all goes to make the PAU the driver's central link to the engine and the central tool helping the train manufacturer build the Powerline drive system into the locomotive quickly and easily. Valid certification of the Powerline system creates yet another connection, namely to the technical assessor acting for the German Federal Rail Authority who approves implementation of the MTU system in the locomotive.

The automation systems are all designed along similar lines, consisting of a central Engine Control Unit which collates and processes the engine data which is then connected to the vehicle control system via standardized interfaces like CANopen, Ethernet and J1939. Another element is the Diagnostics and Remote System (DRS) via which MTU engineers program data and operating parameters such as engine speed bands, alarm limits or fan operating curves to the ECU. Later, operators can also use this DRS interface to obtain system and installation data from the engine or propulsion plant via remote link.

A well-designed connection in two respects: the automation system connects engine and vehicle as well as man and machine.

Words: Lucie Maluck; Pictures: Robert Hack; Graphics: MTU

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Destination Gotthard

#Connections

Scheduled services are set to commence in December via the world's longest railway tunnel – the 57 km long Gotthard Base Tunnel. The new record-breaking tunnel connects the Swiss cantons of Uri and Ticino and, effectively, northern and southern Europe. To ensure tunnel traffic runs safely and to schedule, Swiss rail operator SBB is procuring new maintenance railcars from Harsco Rail, powered by MTU PowerPacks. These will play a key part in maintaining the tunnel's equipment and track installations. MTU was invited to attend the trial runs which are currently underway, one of the aims of which is to create the perfect union between train and traction system.

During test runs, the maintenance railcar is coupled up to a brake locomotive, ensuring speed limits are adhered to throughout.

"Beautiful!", says Hagen Kestin with an enthusiastic smile. "Just perfect." An idyllic panorama swooshes past his window seat, and yet it's not the Bernese Alps in the distance or the nearby Jura foothills which are capturing his attention. Kestin's eyes are fixed on the notebook in front of him, and it's the curve on its graphic display which is making him coo. What looks to the outsider like a heart monitor graph or a seismometer during an earth tremor is telling the MTU commissioning specialist all he needs to know: The link between the coach he is sitting in and the MTU PowerPack driving it is a winner. "The engine is doing exactly what it should do, and so is the railcar," says Kestin: "Beautiful." This moment is the culmination of a long working day for Hagen Kestin and his colleagues and, at the same time, a major prerequisite for the future smooth running of another link: the new Transalpine Rail Link and the jewel in its crown, the Gotthard Base Tunnel.

Supertunnel teamwork

The improved transport link between northern and southern Europe via the world's longest rail tunnel – cutting journey time between Zurich and Milan by 30 minutes from December 2016, and by 60 minutes from 2020 onwards – calls for a continuous program of maintenance. As a result, Swiss Railways (SBB) is purchasing maintenance railcars designed specially for the job. Hagen Kestin is now sitting in the crew's quarters of the first vehicle together with colleagues from SBB, maintenance vehicle developer and manufacturer Harsco Rail, and electric traction system supplier ABB. MTU project manager Tobias Hagg is also in attendance. Together, they have a common task: to ready the railcar for use in the Gotthard Tunnel.

Their working day begins at 07:30 in the morning at the SBB works in Biel. This is the SBB center of excellence for maintenance and repairs to its diesel-powered rolling stock, and the starting point for the trial runs taking place all week to commission the new maintenance vehicles. SBB trials manager Sepp Zimmermann welcomes the team of twelve. He briefs them with the news that some things did not go well the previous day, resulting in some engineers having to burn the midnight oil, making modifications to the vehicle control system. Today's runs between Langendorf and Gänsbrunnen will show whether these have helped. Two special points of note will be a slight uphill run of 1 in 35 (2.8%) and the section through the Weissenstein Tunnel. A mere 3.7 km long and taking less than five minutes end-to-end, this narrow tunnel built in 1906 is not really a dress rehearsal for the Gotthard Tunnel, but the necessary permission has not yet been granted to travel through the Gotthard. Everyone is happy when Zimmermann dismisses the group, because it's freezing cold. Hagen Kestin, though, is standing there, the only one in a T-shirt, exuding the calmness of someone who really knows his trade. The man who trained as a communications electronics technician has been commissioning rail projects for MTU for ten years. This has taken him to many parts of the world – from the Siberian cold to the desert heat. And, despite the routine, anyone meeting him notices right away that his love for his work has not been left on a train somewhere along the line. For Kestin, too, this new vehicle for the Gotthard Tunnel is very special.

A very special vehicle

Standing in the driver's cab of the bright yellow railcar now is Peter Gerber, the SBB Technical Project Manager responsible for its procurement. His eyes gleam, and his voice resounds with enthusiasm when his turn comes to answer questions on the vehicle known, somewhat blandly perhaps, as the 'Xem 181 011': "No doubt about it, this vehicle is certainly very close to my heart," he says, "I've been working on the project right from the ITT stage." Harsco Rail had responded to the invitation to tender with a winning design which has now been turned into reality. The design concept, tailor-made by Harsco engineers to SBB requirements, is packed full of impressive technical features – including automatic clutches at both ends and compatibility with the European Train

Where required, the MTU PowerPacks also supply electrical power for on-board equipment – such as this crane mounted at the rear.

Top: Shortly before 08:00 at the SBB Center of Excellence for Diesel Rolling Stock in Biel: final checks before the start of a long day for the commissioning team.

Left: SBB project manager Peter Gerber (right) is in continuous contact with the train driver to ensure the test runs go smoothly.

A small movement of the control lever is all it takes to bring the railcar up to top speed.

« The engine is doing exactly what it should do, and so is the railcar. Beautiful! »

Hagen Kestin, MTU Commissioning Engineer (Rail Projects)

The commissioning team has no time to admire the countryside in this popular tourist area, so many a view of the Swiss central highlands and Bernese Alps escapes them.

Control System (ETCS) standards. "But the most special feature is the hybrid traction system," says Gerber. "We can drive under electrical power or diesel power. The train driver can switch from one to the other with ease, even without stopping." Gerber points to two buttons on the control console: One is marked E (for electric), and beside it is a button marked D (for diesel) which is illuminated, indicating that the train is being powered by the MTU PowerPack – as it will be for most of the day. In everyday use, this will rarely be the case: "We're assuming that we will use diesel mode for around 400 hours per year," explains Gerber. Most of the time, the vehicles will be traveling under overhead power lines. Only if these fail or have to be powered down for maintenance purposes will the MTU PowerPack swing into action right away from its ever-ready standby mode.

On safety duty

The 57 km long Gotthard Tunnel is not just set to be the world's longest railway tunnel, but the safest too. And a lot of effort is going into this. In addition to fire-fighting and ambulance rolling stock, which are also fitted with MTU traction systems, SBB is procuring a total of 13 maintenance railcars and 18 engineless tenders with a variety of technical design-finishes for use in this record-breaking tunnel. The first of these vehicles is due to go into service at the beginning of 2017. Their main task will be to inspect and maintain the tracks, catenaries and other rail infrastructure deployed in the tunnels. "Lighting, ventilation systems, safety installations and radio systems all have to be checked continually," explains Peter Gerber. This even includes regular rinsing out of the huge drainage shafts: "to prevent stalactites from forming."

Nocturnal logistical feats

Each weekend sees one of the two tunnel tubes close at night. Once that happens, there's no hanging around: "A total of three trains are brought at high speed – up to 100 kph – from the SBB Maintenance & Intervention Centers in Erstfeld in the north and Biasca in the south. Each train is made up of three to four maintenance railcars with tenders in between, and takes up its position at a different location in the tunnel." Gerber refers to this as 'time-optimized dispatch' within the tunnel: In order to make the best use of time available within the tunnel, the teams of up to eight people per maintenance car work simultaneously at different locations. At the end of the shift, the individual cars reunite into trains, and another technical gem of the 'Xem 181' comes into play: "A lead car is able to take control of others attached to it," explains Gerber.

MTU – the driving force

In order to ensure that speeds of 100 kph – which are unusual for service railcars, but imperative given the distances involved – can also be attained when overhead power lines fail or are taken offline for maintenance purposes, each railcar is fitted with an MTU PowerPack housing a 12-cylinder 12V Series 1600 R80L diesel engine. Developing up to 700 kW of traction power, this is the most powerful engine in its series. With its built-in SCR exhaust aftertreatment system, the PowerPack meets the stringent EU Stage IIIB emissions standard. As well as the engine and alternator, the PowerPack contains all the systems needed to deliver traction power. Even the working power needed for on-board equipment – including a large crane on the rear work platform – during diesel-mode operation is produced by the MTU PowerPack.

Taking the engine's pulse

Sitting immediately above the engine, separated only by the railcar floor, is Hagen Kestin with his notebook PC, radioing his next requirements to the driver: "Move off at 50%. And have Bobo give us some push." Bobo is the Type Re 420 brake locomotive coupled to the railcar: without its braking power the maintenance railcar would exceed the 60 kph speed limit prescribed for test runs. Kestin taps into the engine control unit via his notebook, whose display lights up with brightly-colored graph curves. "The amplitude tells me how the engine is doing," says Kestin. He is, so to speak, taking the drive system's pulse. He monitors various temperatures – of the engine, the coolant and the exhaust – and the pressures (charge air, oil and fuel system) and, finally, the oil and AdBlue levels and the status of the ventilation control system. All these curves have to be brought into a kind of harmony with each other which laypeople do not really follow – but Kestin has very clear ideas of what the image has to look like: "That point is not so great," he suddenly says, his voice tinged with dismay.

The paramount objective of Kestin's work is to adjust the engine's electronic control system in such a way that the engine always runs in its sweet spot. This means the engine is using as little fuel as possible, giving off as few emissions as possible and building up maintenance requirements which

Commissioning specialist Hagen Kestin boards the railcar. His job is to create perfect harmony between the MTU traction system and the railcar.

MTU project managers Tobias Hagg and Hagen Kestin can see at any time on their laptop how the PowerPack is behaving.

are, similarly, as low as possible. Before leaving the factory, the MTU PowerPack has already been put through its paces at great length on the company's own test stand. "That's where 90% of all issues come to light," explains Kestin. But, once installed, what the engine wants to do has to be brought into harmony with the demands and characteristics of the vehicle in question. How traction system and vehicle get on together in real life is something that only comes to light once they have been married together and the driver has pressed the red start button for the first time.

Heavy-duty test heaven

Time and again, Kestin has the driver move off under a variety of loads. And then stop. Move off. Stop. Then the engine is switched off. The engineers from Harsco Rail load new software into the electronic control system. They had fine-tuned this in line with readings taken during the trial run. It is at such moments that you understand why good teamwork is an important part of any successful commissioning. "Now let's get the PowerPack right up to full working temperature," radios Kestin to the driver. The driver is only too happy to oblige and shifts the drive lever to 100% traction power. Kestin has his eyes on the laptop, seeing the charge-air temperature rise slowly. And then something happens that propels him straight to seventh heaven: when a temperature limit is reached, the engine management system responds suddenly by reducing engine power. Simultaneously, the train control system demands more electrical current from the alternator. You can see now on Kestin's screen how the charge air temperature drops back, a tenth of a degree at a time. And, as suddenly as the temperature curve dropped below its limit, engine power is boosted again, accelerating the railcar because the train asked for more current. "Beautiful!" shouts Kestin. As recently as yesterday, this test had caused the engine to shut down – resulting in much burning of midnight oil – but today vehicle and PowerPack are communicating perfectly.

Commissioning brings people together

Harsco engineer Lorenz Trachsel, too, breaks into a smile in his seat behind Kestin. The next thing one might expect to see would be the two colleagues high-fiving each other – but that would perhaps be a little too euphoric for our two commissioning gurus. Lorenz Trachsel has been working with a group of specialist engineers for two and a half years now, working on fine-tuning the vehicle and meeting with his MTU colleagues several times during this period for meetings in Aachen, Friedrichshafen and Switzerland. They have long developed a close working relationship in this time, and you notice how they are all really pulling together. "It's great fun taking care of a project like this and making progress," says Trachsel.

Later, during the wash-up session at the SBB works in Biel, Engineering Project Manager Peter Gerber will talk of the "best day" of the trials (and not in reference to the weather or the views). Nevertheless, the technicians still have quite a bit of work ahead of them, with more trial runs the very next day. Shortly after that, it's off to Lötschberg mountain to test the railcar's instrumentation and control system, after which it will see the inside of the Gotthard Tunnel for the first time. The temperatures there are very different to today. So Hagen Kestin will once again be perched atop the MTU PowerPack, opening his laptop and continuing the search for sweet spots. His quest for the perfect union between railcar and PowerPack is not over yet.

Words: Rolf Behrens; Pictures: Robert Hack

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MEMO

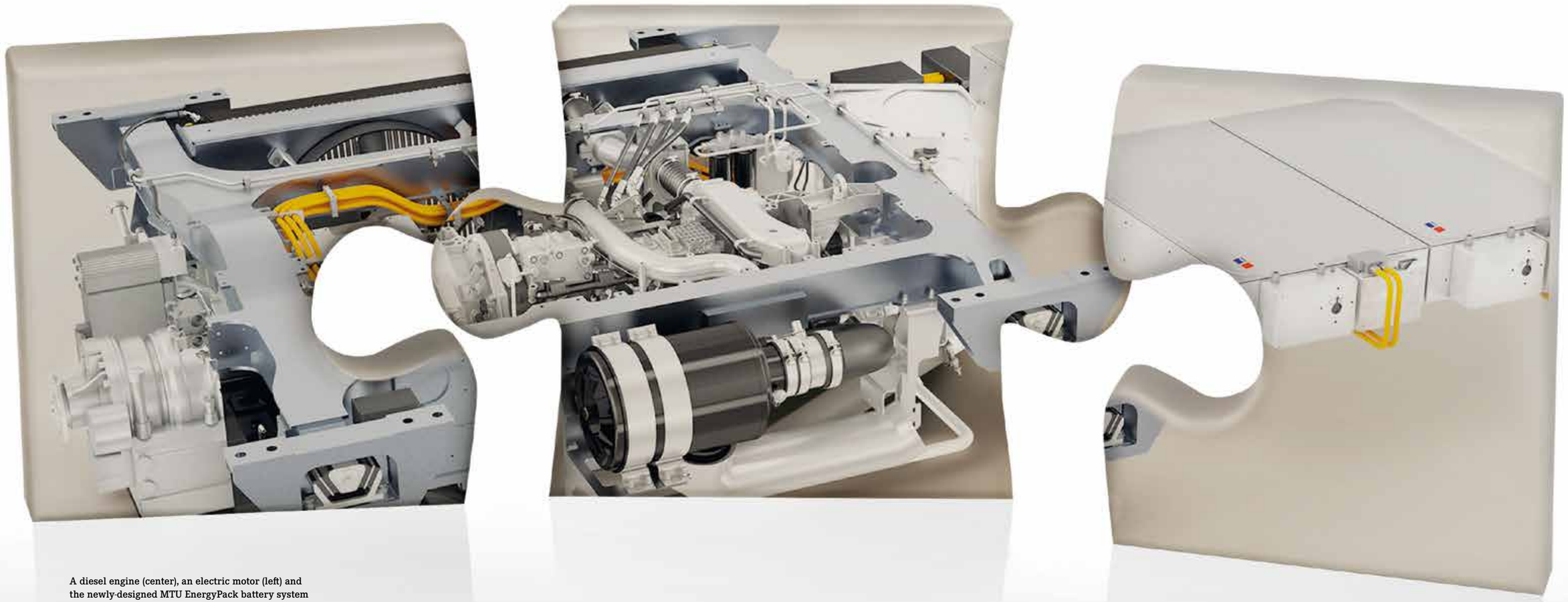
A worldwide hit with its yellow rolling stock

Harsco is a US company in the iron and steel, rail, energy and environmental technology industries. Its Harsco Rail Division was formed in 1999 following the merger of two leading track making and track maintenance equipment businesses. The company designs and builds innovative solutions for maintaining railroad track assets. Harsco Rail is one of the largest suppliers of its kind anywhere in the world. Its product range comprises construction and maintenance rolling stock for a wide variety of applications. Harsco Rail has sales and service facilities in 27 countries across the world, including Germany, Switzerland, the US, UK, Australia, Brazil and India.

Talbot Services GmbH in Aachen is building the SBB maintenance railcars under a contract from Harsco Rail. The Talbot coachworks were established in 1838, making the company one of the oldest German rolling stock manufacturers still in existence.

Hagen Kestin checks the MTU PowerPack's sensor equipment after completing the test runs. This equipment also has to feed Kestin's notebook with valuable information on the traction system the next day: Then the commissioning engineer's job continues.

A great fit

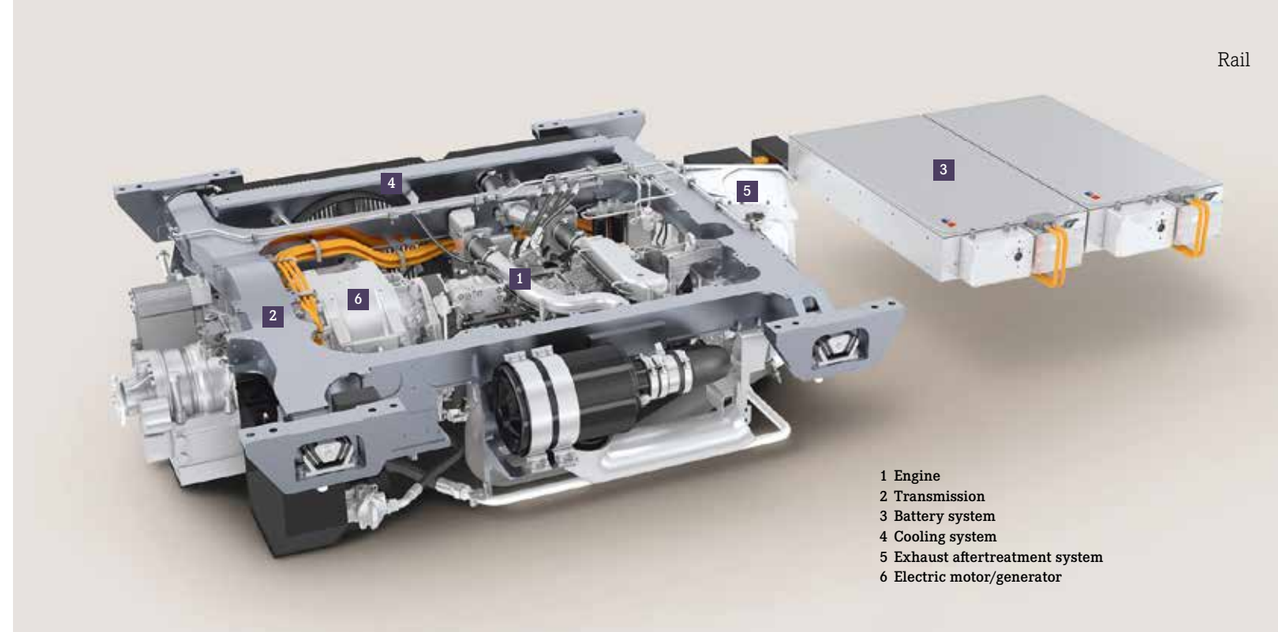


A diesel engine (center), an electric motor (left) and the newly-designed MTU EnergyPack battery system (right) are the three components combined to form the MTU Hybrid PowerPack.

A diesel engine, an electric motor and the newly developed MTU EnergyPack battery system – three components making one unique product which is now available to order. The benefits: up to 25% less fuel consumption, much lower emissions, quieter trains and shorter journey times.

#Connections

Launched at Innotrans, the world's biggest rail exhibition: the new MTU Hybrid PowerPack. It can be used to help operators make fuel savings of up to 25%.



The MTU Hybrid PowerPack combines a diesel engine with an electric motor also able to be used as an alternator. Braking power is converted into electricity which is then stored in the battery pack.

Rarely has an MTU product attracted so much attention at a trade fair as the Hybrid PowerPack at Innotrans, the world's biggest rail exhibition. The Hybrid PowerPack combines a diesel engine with an electric motor which is also able to act as an alternator, converting braking power into electricity which is then stored in the battery pack, giving operators fuel savings as high as 25%. "After years of pioneering work, we are now proud to be able to supply rail customers with a well-engineered product meeting all the necessary rail standards and offering customers a wide range of benefits," said Bernd Krüper, Vice President Industrial Business at MTU.

> « We are proud to be able to supply rail customers with a well-engineered product meeting all the necessary rail standards. »
>
> Bernd Krüper, Vice President Industrial Business at MTU

Newly-developed battery system

Fitted to a Type VT 642 Deutsche Bahn railcar, a prototype Hybrid PowerPack racked up 15,000 km of trials conducted initially by Deutsche Bahn and subsequently by MTU itself. The tests revealed that the biggest Achilles heel was the battery, so MTU engineers then made major improvements to it with the help of a design partner. The new MTU EnergyPack consists of 180 individual Li-Ion cells and has a capacity of 30.6 kW/h while weighing 350 kg. Two or more EnergyPacks can be harnessed together to meet specific customer power requirements. MTU guarantees that the rail-certified battery system will keep going for 28,000 hours – equivalent to around eight years and a longer life span than that of a diesel engine.

The MTU Hybrid PowerPack has been put through 15,000 km of trials fitted to a railcar. It is now ready to go into production.

These flexible installation options and compact design make the Hybrid PowerPack equally suitable for use in newly-designed rolling stock and for repowering existing assets. Used in conjunction with a pantograph and overhead power lines, the Hybrid PowerPack can also be upgraded to create what is known as a triple-mode traction system, since the electric traction system, complete with electric motor, is already in place. This opens up a whole range of application potential for operators and may also help rolling stock retain its value when the track is subsequently electrified.

Calculating life cycle costs

MTU is able to calculate very precisely whether it makes financial sense for an operator to fit Hybrid PowerPacks to its trains. The company has a range of simulation tools and a 'hardware-in-the-loop' test stand which can be used to simulate the use of a PowerPack in a train. Using accurately simulated data for the rolling stock and the profile of the track sections involved, MTU engineers are able to calculate life-cycle costs and pinpoint in advance the best traction type for the customer's needs.

This all goes to make the Hybrid PowerPack a leading-edge variant of the MTU PowerPack, which has enjoyed a 20-year success history. These are compact traction systems which, in addition to the engine and transmission, contain all the ancillary equipment – such as cooling and exhaust aftertreatment systems – necessary to propel the train. Twenty years ago, MTU was the first vendor in the world to produce this design and has since shipped over 6,000 PowerPacks to rail customers all around the world.

Words: Lucie Maluck
Pictures: Robert Hack
Graphic: MTU

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MEMO

The Hybrid PowerPack benefits at a glance

Fuel savings through recovery of braking energy
A hybrid traction system converts braking power into electricity which is then stored in the battery and used as a power-boost on inclines or to aid acceleration, thereby saving up to 25% on diesel consumption. This hybrid technology is especially economical when used on local transportation and commuter routes which involve more braking and acceleration cycles, thereby enabling large amounts of braking power to be captured and recycled. Hybrid traction systems pay for themselves within just a few years in such scenarios.

Major emissions savings by optimizing the load point
Significant emissions savings can be made by running the diesel engine at a more energy-efficient power setting (or switching it off entirely) when under modest loads: per kilometer this produces up to 230 g less CO_2 and up to 0.92 g less NO_X than conventional systems.

Faster journey times using 'boost mode'
Acceleration is even better when the diesel and electric systems are used in combination. When tight timetables need to be adhered to or delays compensated for, the electric motor can provide an extra boost. This can be used to power the train uphill faster or to enable the railcar to reach its chosen cruising speed more quickly. For example, journey time over a distance of 72 km can be cut by more than five minutes.

Significant noise reduction
The electric motor can be used as the primary source of power whenever a train is required to run as quietly as possible – say, when traveling through residential areas or tunnels, or when halted at stations. The noise level when halted can be reduced by as much as 21 decibels.

Flexible use of rolling stock and easy to retrofit
Naturally, a railcar fitted with a hybrid traction system can also be run in diesel-only mode, allowing the operator to retain high flexibility as its trains can be used on electrified and non-electrified lines alike. Indeed, the Hybrid PowerPack can easily be upgraded to a triple-mode traction system – with an added pantograph – as the electric motor is already in place. This gives the operator a lot of freedom in deploying its rolling stock – a major benefit when juggling the demands of diverse track sections and when responding to invitations to tender.

Hybrid PowerPack – a true trail blazer
With its Hybrid PowerPack, MTU has done some real pioneering work over the last five years. Key centers of emphasis in the project were the development of the electric motor, the battery and the converter and designing the fit of the entire system into the PowerPack.

Superferry
finds a home

The Canadian province of Nova Scotia is a popular destination for tourists visiting its countryside, sandy beaches and picturesque coastal resorts.

#Connections

Almost completely surrounded by the ocean, the Canadian province of Nova Scotia is an outdoor enthusiast's paradise. Miles of hiking trails wind through the highlands, offering dramatic views from coastal cliffs. Fertile soils produce lush hillsides dotted with award-winning wineries. Warm salty air and miles of sandy beaches await sun-worshipping tourists every summer. From the vibrant capital city of Halifax to charming, historic fishing villages, there is much to explore.

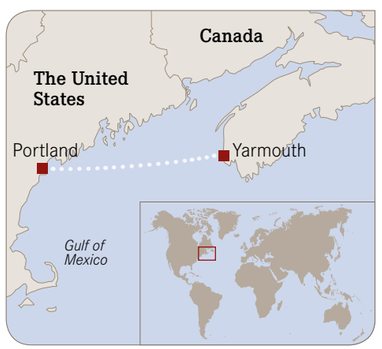
The seaport town of Yarmouth on the west coast of Nova Scotia is a popular tourist destination. Stunning sea captain homes from the late 1800s serve as reminders of a maritime history that runs hundreds of years deep. Vacationers gather every summer at Yarmouth's quaint seaside inns and bed & breakfasts, strolling to the nearest wharf for the daily catch of fresh lobster. Meanwhile, just a short distance away, a dock awaits a haul that plays a crucial role in the prosperity of Yarmouth – a huge ferry loaded with hundreds of passengers and vehicles.

Many visitors make the trek to Nova Scotia from the northeastern United States. It's a long, winding drive, so many opt for the convenience of arriving by ferry. Since 2013, the 528-foot *Nova Star* had provided ferry service, making the voyage across 212 miles of the Atlantic Ocean from Portland, Maine, to Yarmouth, Nova Scotia, in 10 hours. Unfortunately, the service was shut down in October 2015. To maintain that important ferry connection for thousands of American visitors and stay competitive with other nearby tourist destinations, Nova Scotia needed to find a new vessel. The best chance for success would be a smaller ship that was less expensive to operate and could make the crossing faster.

Making the connection

Tourism is key to Nova Scotia's economy. The local communities value and support the industry by extending a warm welcome to visitors. When an opportunity to improve and grow the Canadian tourism industry presents itself, the government pitches in as well. Thanks to a federal initiative to promote tourism, the connection was funded for another two years. A new operator, Bay Ferries, was named, and the search was on for a new ship.

Fast-ferry catamaran *The CAT* is powered by four MTU 20V Series 8000 engines.



The perfect solution was found 600 miles away, sitting idle in a Philadelphia shipyard. The 349-foot *USNS Puerto Rico* high-speed catamaran utilizes the same hull concept used by the U.S. Navy in its Spearhead-class Expeditionary Fast Transport vessels. Capable of transporting 700 passengers and 200 vehicles, its aluminum-hull design and four MTU Series 8000 engines help the vessel travel at speeds up to 40 mph, nearly twice as fast as the Nova Star. The ship seemed like a perfect fit for Bay Ferries.

Previously, the *USNS Puerto Rico* went by the name of the *Alakai*. Operated by Hawaii Superferry, the *Alakai* spent two busy years transporting passengers and vehicles between the Hawaiian islands of Oahu and Maui. However, due to legal complications, its service was shut down and Hawaii Superferry went bankrupt. The U.S. Navy acquired the *Alakai* and it was sent to the naval shipyards in Philadelphia for storage and preservation.

Renamed the *USNS Puerto Rico*, the vessel resided in "mothball state," awaiting the call to get equipped and deployed for military service. To keep the engines in good condition, the Navy contracted with Seaward Services to perform weekly test runs, upkeep and required maintenance. For five years, the *USNS Puerto Rico* was ready to run but never left the harbor. It would take a lot of work to get it ready for tourist season, but Bay Ferries had found its ship.

A new lease on life

On March 24, 2016, Bay Ferries announced it had reached an agreement with the U.S. Navy and the U.S. Maritime Administration for a two-year lease of the *USNS Puerto Rico*. Bay Ferries planned to rebrand the vessel as *The CAT*, with ferry service to start just a few short months away in June. The ship was towed to a shipyard in Charleston, South Carolina, for an extensive refit.

Bay Ferries contacted the MTU America Large Engine Service (LES) Group to get the massive Series 8000 engines ready for heavy commercial work again. The ferry operator had one objective for the group – 100% engine reliability, every run, every day. Delaying or denying a hard-earned vacation for hundreds of eager tourists waiting on shore would be disastrous for the new ferry service. The captain, staff and crew depend on the vessel, along with the people of Portland, Yarmouth and the province oaf Nova Scotia. With so much at stake, including a lot of tourism revenue, missing a departure would not an option. The task and deadline weren't going to be easy. Massive engines like these don't just roar back to life after sitting mostly idle for five years.

Born to run

The LES group was up for the challenge, and in May assembled in Charleston to get *The CAT* ready. This group covers the US East Coast, and travels to service Navy vessels all over the world. James Moore was part of the team of technicians in Charleston. "MTU engines are designed for hard work. Putting loads on the engines helps keep them clean. Most of the basic problems happen when the engines aren't worked hard enough, and that says a lot for MTU. These engines are at their best when they're in continual operation," said Moore. "Mothballed" for five years, *The CAT*'s engines would need a lot of preparation.

At the dry-dock in Charleston, Moore and other LES technicians meticulously worked on the four engines. With each engine nearly 11 feet-tall, there was a lot to cover. Service included performing inspections, cleaning components, identifying potential issues and making repairs. "We used our resources to go over the engines with a fine-toothed comb. We had to make sure there was no room for error," says Larry Oberti, Service Manager, LES Group. "If the military asked us for the same scope of work, we would have performed the same process."

Meanwhile, technicians from Wajax, an MTU distributor in Canada, were on site to monitor the process and train on the engines. The LES Group was contracted to perform day-to-day service duties for the first six weeks after the vessel's official launch. After that, Wajax was slated to take over. *The CAT* represented something new for Wajax, since it was the first vessel in Canada to be powered by the Series 8000, the largest and most powerful engine produced by MTU.

While the service technicians were busy deep inside the engine room, workers prepared the rest of the ship for action. The exterior was repainted, replacing the *Alakai's* giant stingrays on the hull with *The CAT*, its new logo, and American and Canadian flags. The interior was cleaned, refitted and updated with a host of onboard amenities.

Yarmouth is an important fishing harbor and ferry port in the Gulf of Maine in the south of Nova Scotia, Canada.

In summer, thousands of Americans travel to the Canadian province to enjoy the breathtaking scenery.

Fresh lobster can be bought straight from the fishermen in the harbor.

Pointe Fourchu lighthouse is a popular destination for tourists.

Making waves

All the planning, teamwork and hard work paid off. In a few short weeks, *The CAT* was ready to exit dry-dock and hit the open water. Technicians from the LES group and Wajax traveled on *The CAT* from Charleston, South Carolina, to Portland, Maine. To save time, the vessel made the 33-hour journey without stopping. After a series of crossings and dockings between Portland and Yarmouth, the Coast Guard certified the vessel for service. On June 15, right on schedule, *The CAT* made its first official crossing. The entire town of Yarmouth welcomed and celebrated its arrival.

Since the ferry journey is part of the vacation fun, great care was taken to ensure passengers could sit back, relax and enjoy the ocean views, along with the occasional whales and porpoises. *The CAT* is fully appointed with amenities such as a gift shop, cafeteria, live entertainment, movie area and kids' play area. The rear observation deck provides scenic views along with a not-so-gentle hint at the sheer power of the Series 8000 engines rumbling below, blasting four huge columns of water high in the air, like a gigantic jet ski.

"Looking over the back of the water jets is quite impressive. People have no idea what's pushing the ferry at this kind of speed. I always thought they'd attract even more passengers if they its schedule without interruptions also works behind the scenes. *The CAT* departs daily from Portland at 2:30 p.m. and arrives in Yarmouth, Nova Scotia, at 9 p.m., taking only about half the time of its predecessor. After the hundreds of tourists and cars leave the ship, it's time for the night shift. Working a ten-hour shift, a team of mechanical and electrical technicians services *The CAT*, providing oil and filter changes, maintenance and inspections. The routine is repetitive, and the hours aren't great, but it's necessary to keep the ship running on time, every time. The next morning at 8 a.m., the ferry makes the trip back to Portland.

All hands on deck

One night, during a routine nightly inspection, a technician spotted a coolant leak. A cylinder head needed replacement before it caused bigger problems. "In a matter of a few days, we rounded up resources and parts and tooling and brought them to Yarmouth. It was all hands on deck," says Oberti. "We worked together with Wajax and Bay Ferries technicians, and we removed a power unit, exchanged heads and reinstalled it back in the engine, all in a single evening."

In Charleston, USA, *The CAT* and its four Series 8000s are made ready for sea again.

Yarmouth is a typically picturesque small town whose source of income is fishing, lobsters and the tourist trade.

The call for assistance went out to Dubai, where James Moore, MTU America LES Group, was servicing a Series 8000 for a similar high-speed catamaran built for U.S. military use. As part of the crew in Charleston, the team needed Moore's expertise. He boarded a flight to Nova Scotia and quickly got to work, joining up with Bill Rinehimer and Dominic Monica from the LES Group and Paul Mitchell from Wajax.

"It was an adventure, to say the least," says Moore. "We got as much done as we could overnight. Then we went along with the ship on its morning crossing. We worked on the way while the ship ran on three engines. By the time we got to Portland, the engine was ready for full usage. And it ran perfectly all the way back."

A nonstop success

For the rest of the season, it was smooth sailing for *The CAT*. It never missed a departure. That's a good thing for thousands of tourists who made the voyage to enjoy the natural splendor of Nova Scotia. And that's a very good thing for the people of Yarmouth, who are perhaps *The CAT's* biggest fans. You can see it in their faces every time the ship arrives at the dock.

While MTU engines may supply the power for *The CAT*, the ship powers the town of Yarmouth. "The Yarmouth community is rooting for the success of *The CAT*," says Moore. "They rely on the income coming off that ship. So every evening, when that ship comes in, half the town gathers on the piers and docks to give it a warm welcome. It's pretty neat. And it's been great to be a part of it."

Words: Chuck Mahnken
Pictures: Bay Ferries Limited

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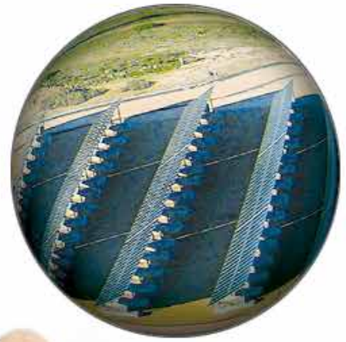
Triple Mix



Juggling energy: Depending on whether the wind is blowing, the sun is shining or it is night-time, a different power ball comes into play.

No full-coverage power supply? For many, that may seem inconceivable but it is still a common problem at mines located in remote areas. Often, diesel gensets are the only solution. Generating electricity from renewables like wind and solar would obviously be a more sustainable approach but what happens when the sun is not shining and there is no wind? In La Muela, Spain, Spanish power plant manufacturer Gamesa is currently testing a combination of these three sources of energy. The company's hybrid power plant consists of a photovoltaic system, a wind-powered plant and diesel gensets based on Series 1600 units from MTU Onsite Energy assembled and delivered by MTU Ibérica – a sustainable, ecologically sound configuration.

Why do we need a hybrid power plant?
If needed, diesel gensets will provide reliable power around the clock, 365 days a year. At the same time, current trends are towards alternative and sustainable power generation technology employing sources such as solar and wind power. Although these are environmentally friendly as well as virtually inexhaustible, they are neither continuously available nor predictable. At night, without sunlight, photovoltaic cells do not produce power. And with no wind, turbine rotors do not turn. That leads to supply fluctuations – and diesel gensets provide a solution. "If we combine solar, wind and diesel power, we can generate electricity economically and reliably," said Alfonso Jaquotot Elorriaga, Offgrid Marketing Manager at Gamesa, summarizing the concept behind the hybrid power plant.

How does a hybrid power plant work?
Whenever the sun is shining and the wind is blowing, the aim is to meet actual demand using the more economical solar and wind sources. When this is not possible, the diesel gensets fill the gap. If solar and wind produce surplus power, this can be temporarily stored in batteries designed by Gamesa. "These batteries are already installed and provide a power rate of about 500kW/h," explained Alfonso Jaquotot Elorriaga. To achieve the best possible balance between the current demand for electricity and the amount of power available, Gamesa has developed an extremely sophisticated system of control electronics.

What do the diesel gensets do when they are not in operation?
The diesel gensets operate continuously because photovoltaic modules do not provide their own autonomous power network. They only run in conjunction with an existing network. Obviously, the engines are set to operate at the lowest possible level, and to do this over extended periods, they need low-load capability. When supplies from the renewable sources fall short, the diesels ramp up immediately.

What is 'low load capability'?
The diesel genset is operated at its actual rated power level. In the long term, this can damage some electrical generator sets because the diesel engine never reaches its optimum operating temperature and the best possible combustion process is never achieved. However, diesel gensets based on MTU's Series 1600 engines were designed specifically for this type of low load operation. "We opted for MTU Onsite Energy because their Series 1600 gensets can run for up to twelve hours at low load levels between 0% and 20%," said Alfonso Jaquotot Elorriaga from Gamesa. "So far, no other manufacturer has been able to offer comparable performance values." In this segment, standard values are around 30%. To achieve these low load performance levels, the gensets subsequently have to run for at least an hour at a minimum of 60% to prevent the engines oiling up due to low-temperature operation. The low load capability offered by MTU Onsite Energy gensets means that during this period, mine operators can generate up to 100% of the energy needed from wind and solar sources thus maximizing fuel savings," explained Alfonso Jaquotot Elorriaga. In addition, Series 1600 gensets offer outstanding load step-up characteristics. If photovoltaic generation fails (due to dense cloud, for example), the diesel genset must be capable of taking on the increased load as fast as possible to maintain consumer supply.

How have tests gone so far?
Up to the present, the hybrid power plant has been operating successfully since January 2016, and Gamesa is very satisfied with the outcome. "We believe that this concept provides the ideal solution for remote regions. On the one hand, customers will make significant savings over conventional diesel-based generation and on the other, the combination of sustainable sources of energy means we are able to reflect ongoing trends."

Words: Yvonne Wirth
Pictures: Gamesa, MTU Onsite Energy

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Spanish power plant manufacturer Gamesa is now testing a hybrid power plant in La Muela, Spain, consisting of solar panels, a wind turbine and an MTU genset.

Family affair

The Rodman 55 patrol boat leans into the curve in the bay between Vigo and Moaña. Its speed makes it ideal for sea rescue operations and coast guard duty.

“We’re a perfect match,” says Oscar Rodríguez with a grin. By ‘we’ he means Rodman Polyships and MTU. 90% of all vessels built by Rodman Polyships leave the shipyard with an MTU engine. “We’ve been partnering with MTU for over 30 years now. This long-term relationship has honed us into a seasoned team,” he adds. Oscar is CEO of the Spanish shipbuilder. Rodman Polyships has five locations in Spain and Portugal and is one of Europe’s biggest shipbuilders. Whether it’s lifeboats for the Spanish Red Cross, patrol boats for Oman or catamarans – the Spanish shipyard can build anything from 2 up to 200 m long. “There’s no boat we cannot build,” says Oscar.

"MTU and Rodman Polyships are a dream-team," says Oscar Rodríguez, CEO of Rodman Polyships. The two businesses have been in close collaboration for over 30 years.

Rodman Polyships has its head office in Moaña, right on the Atlantic coast. Here, 200 employees work on boats from 2 to 200 m in length. Rodman Polyships has five locations in Spain and Portugal and is one of Europe's biggest shipbuilders.

Oscar's working day starts at 07:30. "I'm a Spaniard with a German mentality," he says. "Punctuality, trust and quality – German virtues that are our standards too." Dressed in a white shirt and beige slacks, he sits in his office on the second floor of the shipbuilder's five-story head office in Moaña, a small industrial town in the west of Spain. From here, he has a good view of the shipyard – and his own harbor. It's on this narrow peninsula between the Ria de Vigo and Ria de Pontevedra estuaries that ships are built to ply waters the whole world over. The yard's proximity to Vigo gives Rodman Polyships in Moaña a direct link to a city which boasts the country's largest fishing fleet. The port of Vigo is the most important in the world when it comes to fish and seafood. "We've now got ships bearing our logo on all five continents, and that's a great feeling," explains Oscar's father, Manuel Rodríguez, founder and Executive Director of the family business. What started in 1974 building fishing boats has now grown into a business with global reach. The name Rodman comes from the first syllables of the father's name, Manuel Rodríguez. Rodman started fitting MTU engines to its craft in 1980.

Down-to-earth – the shipyard's recipe for success

"MTU builds engines you can trust," says Oscar. "And we build ships designed for MTU engines. That's just a perfect match," he adds. "MTU understands what we need, and there's a great mutual trust between us. That's important in today's fast-moving world of business," interjects his father, Manuel.

Being down-to-earth is part of the shipyard's recipe for success. Neither Oscar, his sister Silvia, nor the other workers have forgotten where this successful family business has come from. Manuel Rodríguez and the current head of production, Julio Martínez Coba, founded the yard in 1974 with the dream of being able to build boats using any material. Today, Rodman has over 400 employees. Rodman Polyships is part of the Rodman Group. The founder, Manuel, was also responsible for getting the other divisions up and running: Neuvisa builds tenders, Metalships & Docks builds yachts and platform supply vessels, and Rodman Lusitania in Portugal produces sophisticated composites used in applications such as wind turbine components, submarine decks, and covers in buses and trains. Four companies are spread across five locations in Spain and Portugal, occupying a total of 250,000 square meters.

These five yards are what it takes to have global reach. The yards have an impressive level of high-tech development, quality control and safety, and are environmentally-friendly. "As a business person, you cannot afford to limit yourself to one sector of industry. You've got to have a broad base," says Manuel. Rodman is one of the few shipbuilders building so many vessels for a wide span of different applications. "As you would expect, the economic crisis of 2008 hit the shipping industry too. Spain spent a long time in the doldrums, not buying any ships, but despite that, we are continuing to grow slowly. We'd rather grow slowly than too quickly," says the 37-year-old. He loves a challenge. To date, Rodman has built roughly 14,000 vessels and is currently producing around 500 per year. Until a few years ago, Rodman still had over 50 competitors in Spain – today there are only two. "The economic crisis forced them out of business," adds Manuel, his tone serious.

Almost like a vacation

Moaña, in the west of Spain, is not somewhere that immediately springs to mind when you think of vacation resorts. Yet the cloudless sky, crystal-clear water and light breeze tell a different story. Oscar casts his blue eyes over the water. Even though sea trials follow a uniform pattern, each one is different. Oscar knows this. "We assume everything is working – in theory. But it's only when you're on the water, cruising along at top speed, that you see the relief spreading across the engineers' faces." he says. The water is glistening on this hot summer's day: there could be no better weather for sea-trialing a Type 55 patrol boat. Oscar starts the engine, and a few minutes later the Rodman shipyard is falling quickly astern. There is a smell of salt and sea water in the air. Seagulls circle overhead, and the patrol boat powers past the mussel farms. "Sea, sun and a boat trip – feels like vacation, wouldn't you say?" says Oscar, the sun lighting up his tanned face. As all Rodman boats undergo sea trials on the Atlantic, Oscar knows every bay along the Spanish-Portuguese coast. The Spaniard holds a Master Mariner's license – "valid for any vessel," he emphasizes. In open water now, with Vigo in our sights, Oscar powers the boat up to 35 knots, and the sea – impressively calm just a few moments ago – is churned up into large waves. Far from avoiding them, Oscar deliberately crosses the waves, making the boat jump up and down. "Everything's working as planned," he says in a loud voice, trying to rise above the noise inside the boat.

"We can do everything"

"Whatever the boat, whatever the material, we can do everything," says Oscar at the end of our foray, piloting the boat back into the shipyard harbor. Whether a patrol boat or a passenger ferry: with characteristic calmness, Oscar takes every vessel out onto the Atlantic and safely home to port – including a patrol boat he recently

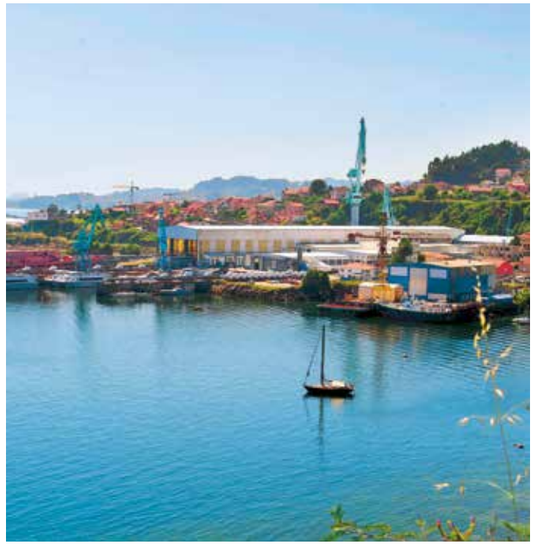
1 At Rodman Polyships, each vessel is designed by the yard's own staff.
2, 3 Employees fix ultra-light blue plates in place, one after the other. These reinforce the vessel's interior.
4 Then the resin infusion commences: here, a vacuum draws resin into the reinforcement fiber matting.
5 A hull, as far as the eye can see: the new Rodman is taking shape.

6 An employee working on the hull lamination.
7 Two Series 2000 engines are being installed in this hull.
8 MTU engines are fitted to 90% of vessels built by Rodman Polyships.

The Rodman 84 catamaran can take up to 350 passengers. It is powered by two 10V Series 2000 M84 engines. 25.5 m long and 9 m wide, it has an average cruising speed of 22 to 24 knots, equivalent to 40 to 44 km per hour.

Alfonso Saavedra is an engineer at Rodman Polyships. He is checking the engine room to see that everything is working.

Oscar Rodríguez takes the opportunity of personally putting the Rodman 84 through its sea trials.



"It's a great feeling, having vessels with our logo on every continent," says Oscar Rodríguez.

Manuel Rodríguez founded Rodman Polyships in 1974 and is the company's Executive Director. He had the dream of building boats from 2 to 200 m in length.

tested for the Moroccan coast guard: eight hours at full throttle, from north to south and back again – all of it along the Spanish coast. It is important to Oscar to be there when the vessels are launched. "I want to see how the boat moves, and the things we've spent months working on." Sea trials, he says, are an important part of understanding what Rodman builds. "A lot of customers have special requirements we have to incorporate," says Oscar. "We also owe our success to the ideas and requirements of our customers. Indeed, nothing drives us more than turning demanding requirements into reality," adds his father, Manuel.

Specialization in fast patrol boats

The family business led by Oscar's father, Executive Director Manuel Rodríguez, has specialized in building fast patrol boats. "Irrespective of which government agency in Europe you ask: when the discussion comes round to patrol boats, the name Rodman Polyships will be mentioned," says Pablo Vivancos, Head of Sales at MTU Iberica. He is on site regularly at Rodman Polyships. Five new Rodman 111 patrol-and-intercept boats will be handed over to the Royal Oman Police for coast guard duties: the 35-m high-speed vessels are each powered by two 16V Series 2000 engines. The Rodman workforce put 7,000 hours of work into each vessel. "Someone from MTU Iberica is there each time a boat with our engines is launched," says Pablo. "The demands made of the boats destined for Oman are especially high: The water can be up to 40 °C and air temperatures even higher – not somewhere you want the engine cooling to fail. And that's why we choose to bank on MTU," says Oscar. The Royal Oman Police is to deploy the 35-m-long boats on coast guard duties and search-and-rescue work. The vessels are due to go into service in the first half of 2017 – they are the largest patrol boats Rodman has ever built.

Major contract for catamarans

For Oscar, expertise and design are the keys to success. Rodman Polyships is also demonstrating this with a major order for catamarans. In all, ten Rodman 84 catamarans are to be supplied – with 12,000 hours going into each vessel. Each cat is powered by two MTU 10V Series 2000 M84 diesel engines. The vessel is able to accommodate up to 350 passengers - "in seats like Lufthansa's, not a budget airline's," grins Oscar. The catamarans are 26 m long. "What makes this craft special is that it's extremely light and compact. This gives it a top speed of 30 knots, around 56 km per hour," he adds. Their reliability and efficiency make the MTU Series 2000 marine diesels perfect for use in catamarans. They are capable of covering distances of over 600 miles. "By signing this contract, Rodman is establishing itself as one of the premier shipbuilders worldwide for all types of vessels," says Oscar. Away from work, Oscar willingly settles for something a little smaller than a catamaran for several hundred passengers or a 35-m patrol boat. "I just have a sailboat for days out with the family – that does me fine," he laughs. At vacation time, he even turns his back on the water and heads inland – where he finds the peace and quiet he needs away from the yard – and looks forward to his next spin in a patrol boat.

Words: Caren-Malina Butscher
Pictures: Robert Hack

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Green power is anything but square

Sold in 100+ countries, the world is its oyster – yet 'home sweet home' for every bar of Ritter Sport that tickles the palate anywhere in the world is the little German town of Waldenbuch in the rolling hills of southwest Germany near Stuttgart. Here, some three million bars roll off the production line each day. Whether Alpine Milk, Whole Hazelnuts or Marzipan – after Germany, the square bars are consumed most avidly in Russia, the US and Italy. When it comes to producing over 70 thousand metric tons of chocolate per annum, Ritter Sport chooses to trust a combined heat and power (CHP) plant from MTU Onsite Energy – used to generate a third of its total power requirements.

Ritter Sport is known not just for its delicious chocolate, but also for the different colors used in its packaging - a real eye-catcher in supermarkets and at the factory shop.

Warm chocolate, at 29°C, is poured into a pre-heated square-shaped mold.

Markus Maurer is Production Manager at Ritter Sport. 350 metric tons of raw materials are processed here each day.

There's an old German saying: 'chocolate makes you happy'. Serotonin, the neurotransmitter responsible for feelings of happiness, must surely not be in short quantity among the Ritter Sport workforce. Walking towards the production bay, your nostrils are filled with a pleasant, chocolaty aroma which intensifies as you approach the door to this hallowed space. Chocolate made here travels to destinations the whole world over. Whether that Alpine Milk bar is enjoyed in Belgium, the US or Russia: it was poured and cooled in Waldenbuch. Chocolate production requires both heat and cold, and the energy to deliver this comes from the powerhouse located inside the production building – which, since the middle of 2016, has been equipped with an MTU engine. At its heart is a CHP plant fitted with a 16V Series 4000 gas engine from MTU Onsite Energy. The co-generation module does not just supply power to liquefy chocolate, it is also used to air-condition the production bay.

Production temperature: 29°C

"Chocolate production runs 24 hours per day in a three-shift system operating around 300 days per year," explained Markus Maurer, Production Manager at Ritter Sport. The production facility consists of six high-power units and an enrobing plant. "Whether Mini bars, 65g 'Bio' organic, or 100g or 250g bars: the entire range is produced on these six lines," said Maurer. Ritter Sport has 1,400 employees, around 500 of whom work in production. "We make our own chocolate – using cocoa beans, sugar, milk powder and secret Ritter Sport ingredients," he said. In fact, 350 metric tons of raw materials are processed every day, and Ritter Sport produces 2.7 tons of chocolate per hour.

Heating the pipework

All chocolate is derived from cocoa beans, and at Ritter Sport the dry beans are cleaned, roasted and ground all in one large machine to produce a brittle mass, which employees then mix with cocoa butter, milk powder and sugar – although it does not yet have that delicate, chocolatey aroma. The machine kneads all the ingredients together for ten minutes at 40°C. Only at the conching stage does the cocoa mass become delicate and chocolatey. The liquid chocolate is held in large storage tanks, waiting to be pumped through large-diameter pipework to the various lines. The pipework is actually one pipe inside another, and the heat generated by the MTU CHP plant heats both the inside pipe, which carries the chocolate, and the water in the water-jacket formed by the outside pipe. This prevents the chocolate from solidifying before the end of the production process. But to make perfect Ritter Sport, you have to have the right temperature as well as the right ingredients: Held steady at 29°C, the chocolate develops its full taste potential and gets its color and its appetizing, glossy surface.

Constant energy needs

"The waste heat given off by the engine coolant is used to heat the factory," said Dirk Rozema who is the Energy Manager in charge of the Ritter Sport CHP plant. "The CHP plant is perfect for our needs," he explained. He has worked at Ritter Sport for 26 years and also spent many years as a ship's engineer. "I know my way around engines. The MTU Series 4000 was the one I wanted. I knew in my heart it was the right one. Everything's nice and tight – you can sense that if you have a feel for the engine," Rozema smiled contentedly. "We've got a steady energy requirement all through the year, and the generated power and heat are used right here on site," he said. The plant has an efficiency level of 90%. The CHP plant supplies 1,280 kW of electricity and 1,580 kW of thermal energy. "The CHP plant is perfectly designed for our needs. It runs at 100% of its rated power all year round," said Rozema. The project was planned by Midiplan from Bietigheim-Bissingen, just outside Stuttgart, and Bosch Co-Generation Systems supplied the natural gas engine and ancillary equipment to Ritter Sport in its role as MTU systems integrator.

A center for every taste

Peppermint, strawberry yogurt or hazelnut cream: When it comes to Ritter Sport fillings, there is one to suit every taste. But how do the centers get inside the chocolate? To do this, the warm chocolate is piped onto the production belt, and machines pour the warm mass into a pre-heated, square-shaped mold, which is immediately flipped over so that part of the mass flows back out, leaving a thin layer of solidified chocolate on the walls of the mold - this is the chocolate shell. Marzipan or biscuit squares are then set into

A member of staff monitors production.

1 An employee checks the quality and appearance of chocolate bars before they are packed.
2 The chocolate wrappers vary from country to country, and look different in the US or Russia compared to Germany.

1 Dirk Rozema is responsible for the energy projects at Ritter Sport.
2 At the heart of the Ritter Sport powerhouse is a CHP plant featuring an MTU Series 4000 natural-gas V16 engine supplied by MTU Onsite Energy.

Ritter Sport's energy needs remain constant all year long. The power and heat generated are used right there on site.

the shell, and liquid masses such as yogurt or chocolate cream are injected through nozzles. The freshly-made chocolate is then refrigerated at 8°C to await further processing.

Ritter Sport makes 23 varieties of its 100g bar, six varieties of whole nut, and eight varieties of the 250g bar. Complementing these are three seasonal special editions – in spring, summer and winter – varieties sold for limited periods only. Ritter Sport staff are never short of ideas for flavors – be they delicate and fruity or tangy and strong – and they work on new varieties behind closed doors. The development kitchens see a lot of testing, experimenting and tasting. The trial chocolate is put into uncharacteristic white wrappers and sold to fans and bargain-hunters at the Ritter Sport factory shop in Waldenbuch. At the end of the day, it is the customer who decides whether a new creation is set to be a retail hit or a one-bar wonder.

15 minutes of fridge time

Once the filling has cooled and solidified, the employees pour on the underside of the bar. Energy generated by the CHP plant warms the edge of the chocolate mold so that the liquid chocolate coats the contents all round. The machine then removes the excess chocolate. The freshly cast chocolate bar is now almost finished – and is taken off to be cooled. Exhaust heat from the CHP plant is passed through an absorption cooler to produce refrigeration power, which is used to keep the product cool during production and storage. The chocolate stays in the refrigerator for 15 minutes at 8°C. The final stage in the production process is the twister, a machine, that turns the square chocolate bars over, allowing them to be removed from the mold safely and undamaged. A hammer then taps the bars out of the mold. To ensure the chocolate arrives in the supermarket in one piece, the conveyor belt whisks it to the packaging machine which puts it in air-tight wrappers and prints the relevant best-before date for the country of sale.

Green power is anything but square

The Ritter Sport energy scheme is based on two mainstays. One portion is produced by the company's own combined heat and power plant from MTU Onsite Energy and by solar panel arrays, with the rest sourced from Schönau Electricity Works, Germany's eco-power pioneers in the Black Forest area. Ritter Sport has operated its own CHP plant since 2002. "At the time, we were trailblazing CHP in the food industry and drew smiles from people who said it wouldn't pay. But it quickly became clear that generating your own power is an extremely attractive proposition, given the major rises in electricity prices in recent years," said Ritter's CHP boss Rozema. At Ritter Sport, sustainability is not simply a project that gets wrapped up at some point, but is rather an ongoing process. In spring 2016, the former CHP plant was getting somewhat long in the tooth and was replaced by an MTU genset. "We're conducting what is a very green project costing 10% more, but which is much more eco-friendly," explained Rozema. "That helps not just our energy costs, but the environment too," he continued. Indeed, even the company founder, Alfred Ritter, believed that only sustainably-run businesses survive, and that is one of the principles followed by the family business to this very day.

Ritter Sport chocolate bars are sold in over 100 countries. The 'Minis' are available in ten varieties, and there are 28 varieties of 100g bars.

Power – squared

Whether it's Cocoa Mousse, Corn Tortilla Chips, Chopped Hazelnuts or Raisin-Cashew – at Ritter Sport, it's all about 'inner values'. The aim is to create as much taste as possible, the right consistency, and chocolate that simply melts in the mouth. Ritter Sport connoisseurs, understandably, are too preoccupied to consider that these inner values also come thanks to a perfectly-tuned combined cooling, heat and power plant, but it is a fact worth knowing all the same.

Did you know? Alfred and Clara Ritter did not hit upon the idea of making square-shaped chocolate bars until 1932, 20 years after the company was founded. It was intended to be a bar that would fit easily into any sports-jacket pocket without breaking and weighs the same as the normal rectangular bar. Little-known fact: At the time, the chocolate factory in Waldenbuch was located next to an amateur sports ground, and soccer players always took a bar of chocolate with them to training sessions. Now that's how to inject fun into any fitness regime!

Words: Caren-Malina Butscher
Pictures: Robert Hack

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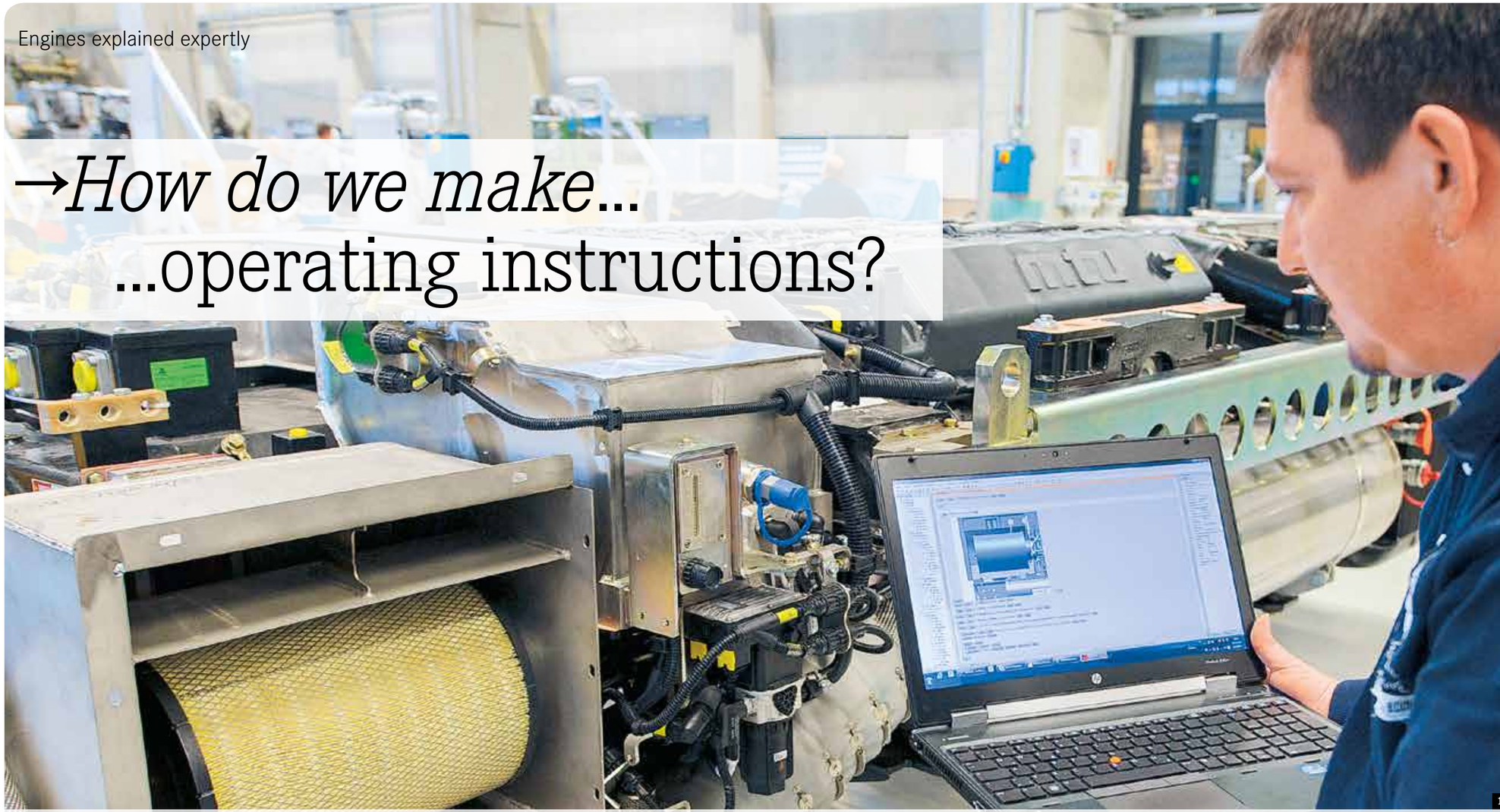
→*How do we make...*
...operating instructions?



1 Jürgen Bockewitz comparing a PowerPack illustration with the real thing. Will the description of this component make sense to the user?
2 Bockewitz asks a plant technician to explain the various connectors on the wiring harness for the PowerPack.
3 He is checking the operating instructions together with Jochen Ebser. Is each process step explained correctly?
4 Customers are still receiving operating instructions in hard-copy form or as CD-ROMs. Operating instruction apps will soon be available.

They make some people frown, some studiously ignore them, and others study them in great depth: operating instructions. Whereas a coffee machine can be explained in a matter of five pages, things like cars and engines have entire manuals. Jürgen Bockewitz produces operating instructions for MTU engines and systems – each set as individual as the engine itself. Such a manual typically covers between 150 and 300 pages. "Operating instructions are part of the scope of supply, like the engine itself. In fact, they are prescribed by law," explains Bockewitz.

"When writing operating instructions, you have to leave your creativity at the door," said Tomaso Magoni, Team Leader in Technical Documentation. The content is defined by the product and the target audience. This means the technical author must describe the product in such a way that the user understands it and is able to use the product as intended. Off-the-wall terminology and flowery phrasing are not called for. What is important is for the author to have a certain technical understanding: "The user must be able to read the instructions and understand how to change a filter as per the maintenance schedule, which fuels and oils can be used in the engine and, when problems arise, what things he can do himself and what things are better handled by our service technicians." As a result, the technical author always has one eye on the user. Like Bockewitz and his colleague Jochen Ebser, all technical authors are regularly to be found in Assembly, on training courses or beside the test stands, learning how certain procedures are performed properly.

They then produce the instructions using a modern content management system (CMS). "The CMS allows us to create new text or graphics modules or reuse those from other engines or systems," explained Bockewitz. The CMS also checks wording. This ensures uniformity and clarity even where several authors have been working on the same document. Deliberate use of specific wording is key to avoiding misunderstandings. In the series systems business, standard operating instructions are provided, since the scope of supply does not really change from one order to the next. In the project systems business, however, technical documentation is custom-written by the authors, e.g. for a PowerPack (a rail engine plus accessories for use in railcars). "Each order is different, and we have to take account of that," said Bockewitz. Thanks to the modular approach taken by the CMS, operating instructions for a rail PowerPack take only around a week to produce. Instructions for a new product, where the technical author is involved right from the design stage, can last several weeks.

Operating instructions mainly go to the customer in hard-copy form or as CD-ROMs. "We can already supply interactive HTML documentation complete with text and video animations, where the customer so requires, and soon we'll even be able to offer customers operating instructions in the form of apps or via web portals," said Tomaso Magoni.

Words: Katrin Auernhammer; Pictures: Robert Hack

To find out more, contact:
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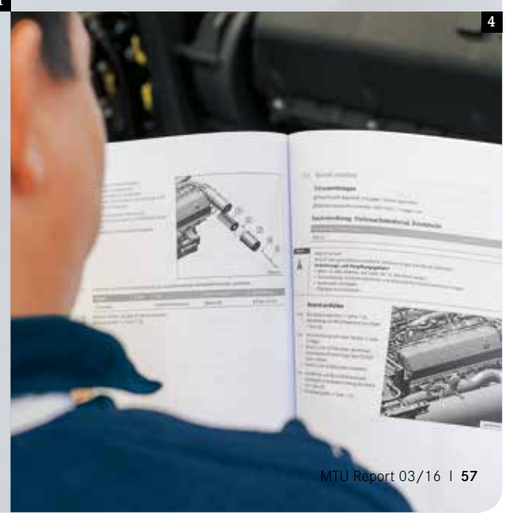
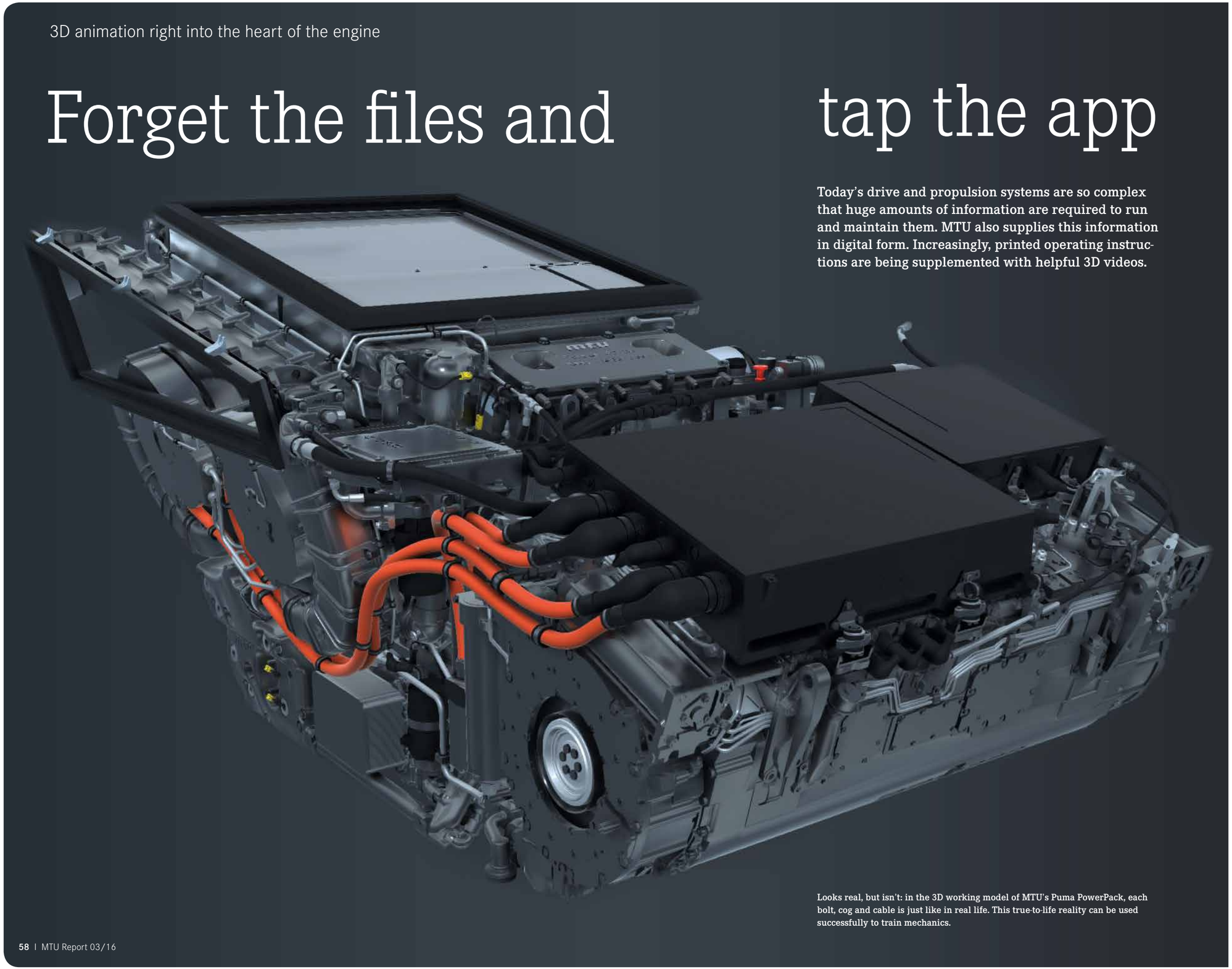


3D animation right into the heart of the engine

Forget the files and tap the app

Today's drive and propulsion systems are so complex that huge amounts of information are required to run and maintain them. MTU also supplies this information in digital form. Increasingly, printed operating instructions are being supplemented with helpful 3D videos.



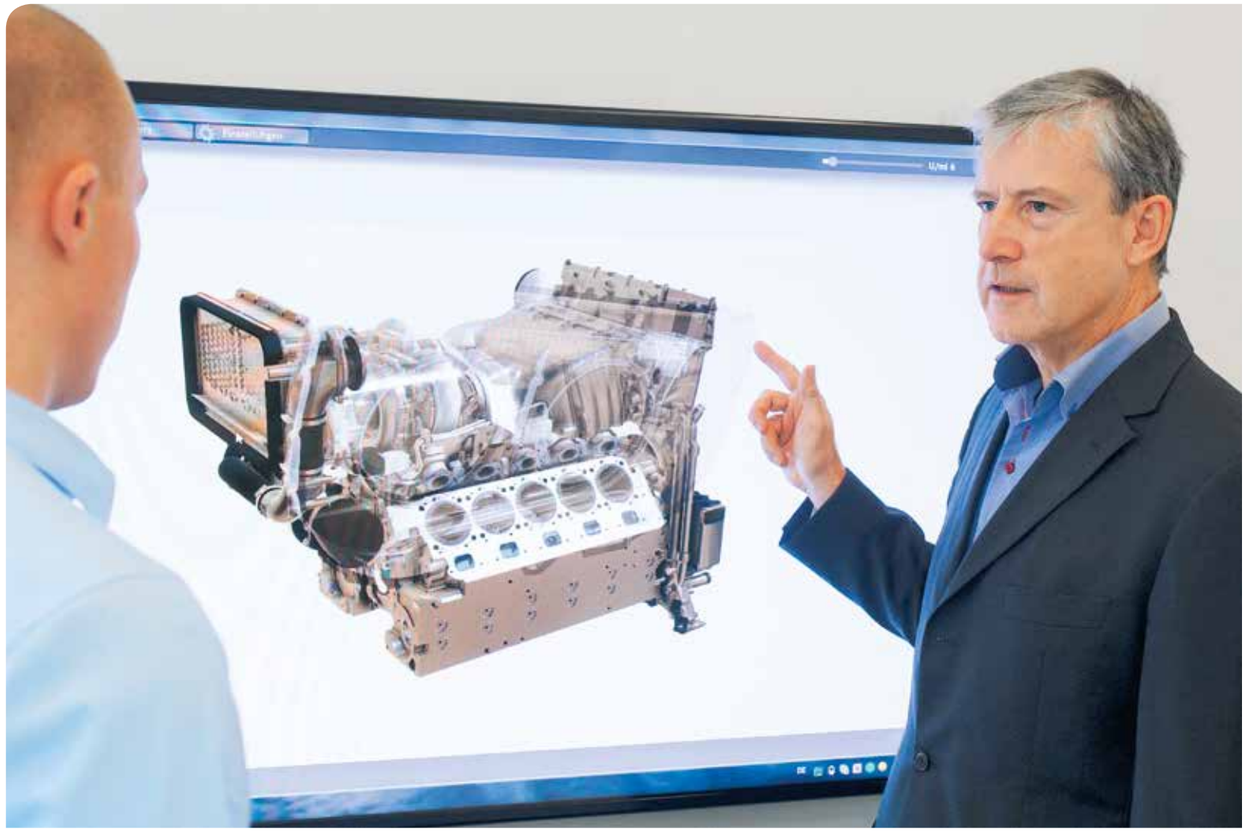
Looks real, but isn't: in the 3D working model of MTU's Puma PowerPack, each bolt, cog and cable is just like in real life. This true-to-life reality can be used successfully to train mechanics.

A very ordinary flat-screen display stole the show from the genuine PowerPack in the Puma infantry fighting vehicle at the 'Eurosatory' military equipment trade fair in Paris. The powerful drive system was actually the dominant feature on the MTU stand. But for visitors from near and far, the star of the show was a display on the monitor behind it: a highly detailed, almost hyper-realistic 3D animation of the Puma PowerPack, which was making its world début at the fair. It was giving a kind of x-ray view, drawing the audience into an amazingly true-to-life journey through the inside of the engine. Delegates from all over the world were able to follow the flow of air through the various components and view, in amazement, the movements of pistons, valves and turbine blades which otherwise remain hidden from view. Despite weighing many tons, the drive system was able to be moved around on-screen and flicked over in any axis, and individual sub-assemblies enlarged.

Learning more effectively with 3D

The latest product from the team run by Ulrich Korioth – responsible at MTU for technical documentation for government projects – really caught the imagination of many visitors to the trade fair. "The interactive model showing the workings of the Puma PowerPack was something we created for the German Armed Forces," explained Korioth. "They are using it at the Land Systems Engineering Training Center in Aachen for training soldiers in the maintenance corps." The software

The sophisticated animation captured many people's imaginations at the Eurosatory military equipment fair in Paris, where the product made its début.



Ulrich Korioth and his team use Smart Factory revolution principles to create leading-edge working images and operating instructions.

enables incredibly vivid explanation of how the drive system works – with details and perspectives which would never be possible using the physical machinery. In addition to showing the working principles, the dynamic processes at work inside the engine can also be depicted, for example, at various different engine speeds. Future projects will also include showing what happens when malfunctions occur. Learning efficiency is boosted, as every single bolt and cable looks exactly like it does "in the flesh" and is shown in realistic detail hitherto unknown.

3D videos support heavy-duty strategies

However, Korioth and his team are able to do much more than just demonstrate how a drive system works in 3D: maintenance and repair of MTU engines are also made simpler and easier for the customer using products created by Technical Documentation. Used as part of a maintenance system like Callosum MT, developed by MTU for the shipping industry, ships' crew can perform scheduled maintenance or necessary repair activities after watching them in 3D videos: say a coolant pump has to be replaced, the system shows the mechanic exactly which bolts need to be removed and where, and which tools, spare parts and consumables will be needed.

Like a YouTube tutorial

These instruction films are sure to remind younger mechanics of tutorial videos on YouTube and other video websites, because that is where they go for easy-to-follow instructions on practically everything – from changing a bicycle tube to making car repairs, or even knotting their neckties. Thanks to such films, even less experienced naval mechanics are able to carry out quality maintenance work without losing much time. These MTU maintenance animations are the modern answer to challenges facing many customers. Financial cuts and skills shortages mean that the same number of vehicles and machines have to be run and maintained by fewer and fewer people – at the same time as dealing with growing system complexity and what are often restrictive working hours policies. The German Navy, for example, is operating a heavy-duty strategy on its new Class F125 frigates, deploying the vessels for two years without interruption and with crew changes every four months. This is made possible, among other things, by the long maintenance intervals of the MTU engines aboard – and by the use of Callosum MT with its 3D maintenance tutorials.

The Smart Documentation revolution

Conveying knowledge about how a drive or propulsion system works and how it should be maintained is both a conventional and a highly up-to-the-minute task for the MTU Technical Documentation unit: "What we're doing is the epitome of the Smart Factory revolution," said Ulrich Korioth. "We connect customer and information, ensuring it is to hand at the right moment in a form he can actually use." For the customer, this is often a key aspect when purchasing a drive system.

On request, MTU provides all data in digital form in such a way that it can be transferred to customer systems and connected to other sources of information – such as a vessel's master logistics system. The conventional hard-copy operating instructions are now just an ancillary item to be used as backup. Very soon, MTU instructions could become available as apps for mobile cell phones and tablets, etc. This carries a lot of customer benefit: I nstructions do not just become easier to follow, they can also be integrated with digital systems used by the customer – not to mention making today's pallet loads of paper a thing of the past. "When creating digital documentation, the number one rule is to take a standardized approach to capturing the data," explained Ulrich Korioth. Each piece of information is specified – "keyworded", you might say – using a consistent system. Indeed, ever since the year 2000, MTU has been observing international digital standards used in industrial and military environments such as the German Armed Forces. Observing uniform specifications ensures information can be reused easily within various different digital systems and is able to be fully integrated as required. The same goes for the 3D models mentioned above.
This reusability is one of the key prerequisites for making the Smart Factory revolution work. "This technological development means MTU's technical documentation is right up there at the cutting edge," said Korioth.

Words: Rolf Behrens
Pictures: Robert Hack, Rolf Behrens
Graphics: MTU

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MEMO

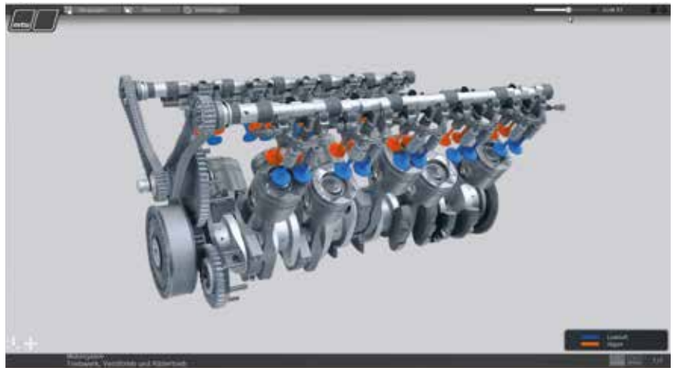
3D at MTU

MTU has a long tradition of 3D illustrations: With its Virtual Reality Center in Friedrichshafen, which has been up and running since 2003, the company has been leading the way in this discipline for many years. In the Virtual Reality Center, you can wear a pair of 3D goggles to see life-size engines and use a special mouse to dismantle and rebuild them. This capability is used in a wide variety of applications, mainly for design and development purposes: Engineers, for example, can study an engine's airflow characteristics in 3D long before it is ever built, and analyze ways of avoiding costly in-life modifications. Engine assembly and maintenance work can also be simulated long before the real-life product comes into existence – and can even be shown in the hull of a ship that has yet to be built. This allows the soon-to-be product to be optimized against what the customer needs. Components which have already been manufactured can be included in the simulation during technician training sessions for MTU and customer personnel alike, combining reality and virtual reality into a single world. 3D conferences can be – and are – held with colleagues in other locations such as India and the UK.

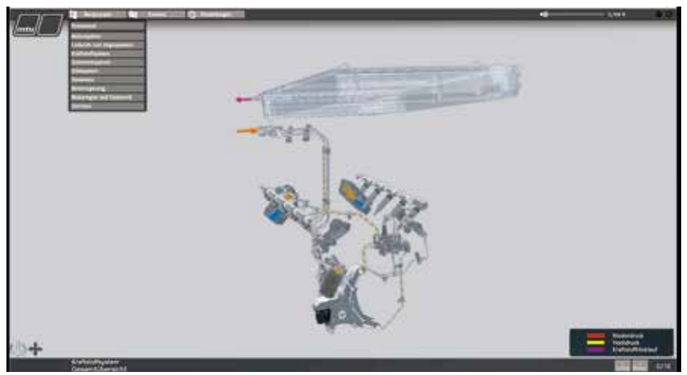
"Virtual reality is not just fashionable hype, it's a key element of tomorrow's tech," said Friedrich Schley, Manager of the MTU VR Center. "I am convinced that VR is set to become an indispensable method of communication over the next few years."

The German Armed Forces are using the interactive program to train soldiers. It helps explain all the workings of a drive system in an easy-to-follow way – including x-ray views of the interior.

As if the rest of the engine were made of glass: individual sub-assemblies can be enlarged and animated while running at different engine speeds.



Even the fuel can be followed all the way from the tank to the combustion chamber. Pipework turns see-through at the click of a mouse button, with different fuel pressures shown in different colors.



Afterthoughts

Rolf Behrens visited Switzerland and saw how an MTU engine is married up to a rail maintenance vehicle.

Two Aacheners in Switzerland

Anything in common? The Harsco railway maintenance vehicle and I actually have a lot in common: We both came into the world in the city of Aachen in the very west of Germany, so we're both far from home. A shared destiny, you might say. And then there's the paint scheme: yellow and black – the colors of my beloved hometown soccer club, Alemannia Aachen. Surely no coincidence! To cap it all, the press release featuring this order was my very first task as a new recruit to MTU Corporate Communications. So, unsurprisingly, it was with some anticipation that I headed off to our first meeting. As the gates of the SBB engine shed opened in the first light of dawn, and the Xem 181 011 bathed me in its bright headlights, I knew we were going to get on just fine. That feeling was confirmed when the MTU engine started purring contentedly somewhere inside it. At the end of an exciting day together we can't wait to meet up again – ideally in the Gotthard Base Tunnel.

A journalistic visit to shipbuilder Rodman Polyships saw Caren Butscher take the wheel herself.

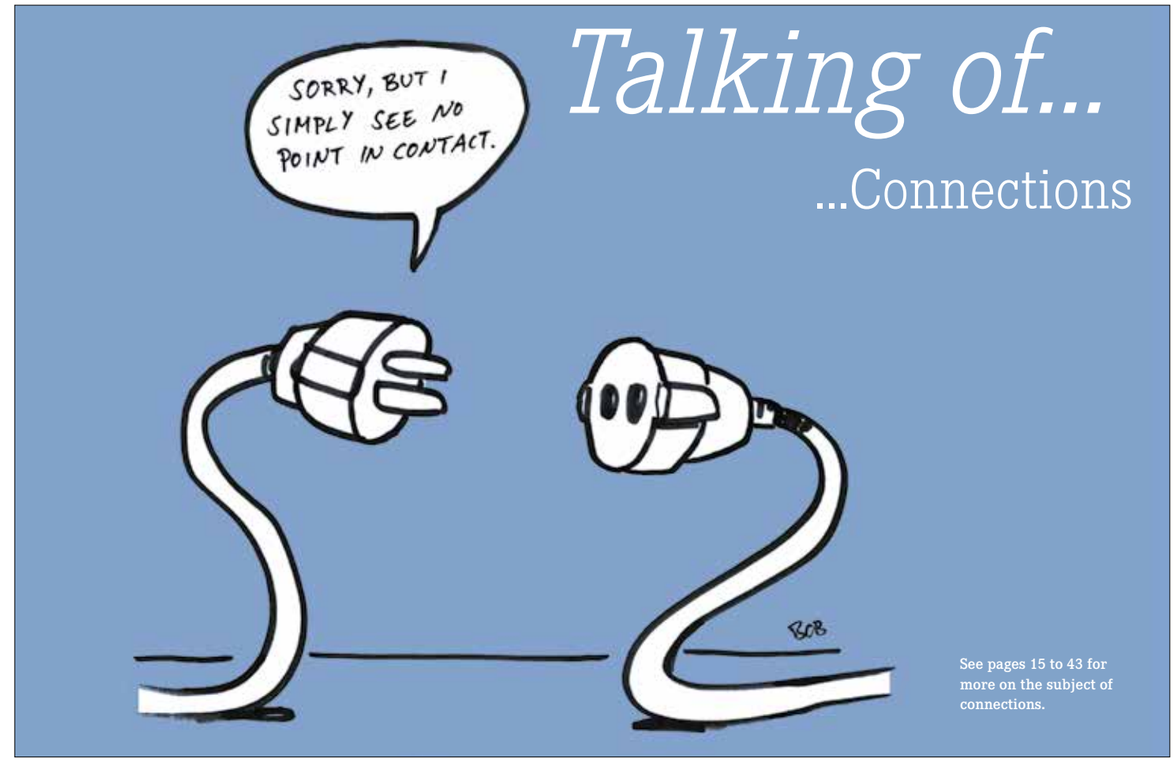
Aye, aye, Captain!

"Want to have a go at steering?" asked Oscar Rodriguez as we were sea-trialing a patrol boat built by Rodman Polyships. He didn't need to ask twice. How long would it be before I had another opportunity to take the wheel of a ship, standing beside the boss of the shipyard which had built it, and steer it along the Spanish coastline as captain of all I surveyed? Anyway, it can't be too difficult – a bit like driving a car? Not! Halfway through my first turn to the left I thought we were going to keel over. I'd turned the wheel a bit too enthusiastically, and now my male passengers were finding it hard not to laugh. "Looks easier than it is," I countered. After a few more turns, accelerating and slowing down, I was beginning to get the hang of it – and didn't want to hand the wheel back. We were charging through the sea at around 20 knots – and I was experiencing the raw power of an MTU engine on the water.

Robert Hack on a visit to Ritter Sport – every child's dream.

A visit to the chocolate factory

One book I've always wanted to read is *Charlie and the Chocolate Factory* by Roald Dahl. Unfortunately, as I've not seen any of the film versions either, I cannot really say how many parallels there are with a real chocolate factory. But I imagine the story involves a lot of little elves in funny hats stirring chocolate all day long while singing songs and, for purposes of time-saving efficiency, swinging from one liquorice rope to the next. Everyone's hard at work, there's an aroma in the air which takes you zooming back to your own childhood and, most important, there's a chocolate fountain that never runs dry. Just the way you imagined paradise to be as a child. It was with no small surprise, therefore, when – having been asked to cover a story as photographer – I turned up at the Ritter Sport factory and discovered that, actually, that's exactly the way it really is! Without the elves and the hats, mind you.



See pages 15 to 43 for more on the subject of connections.

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