SAFT
international magazine

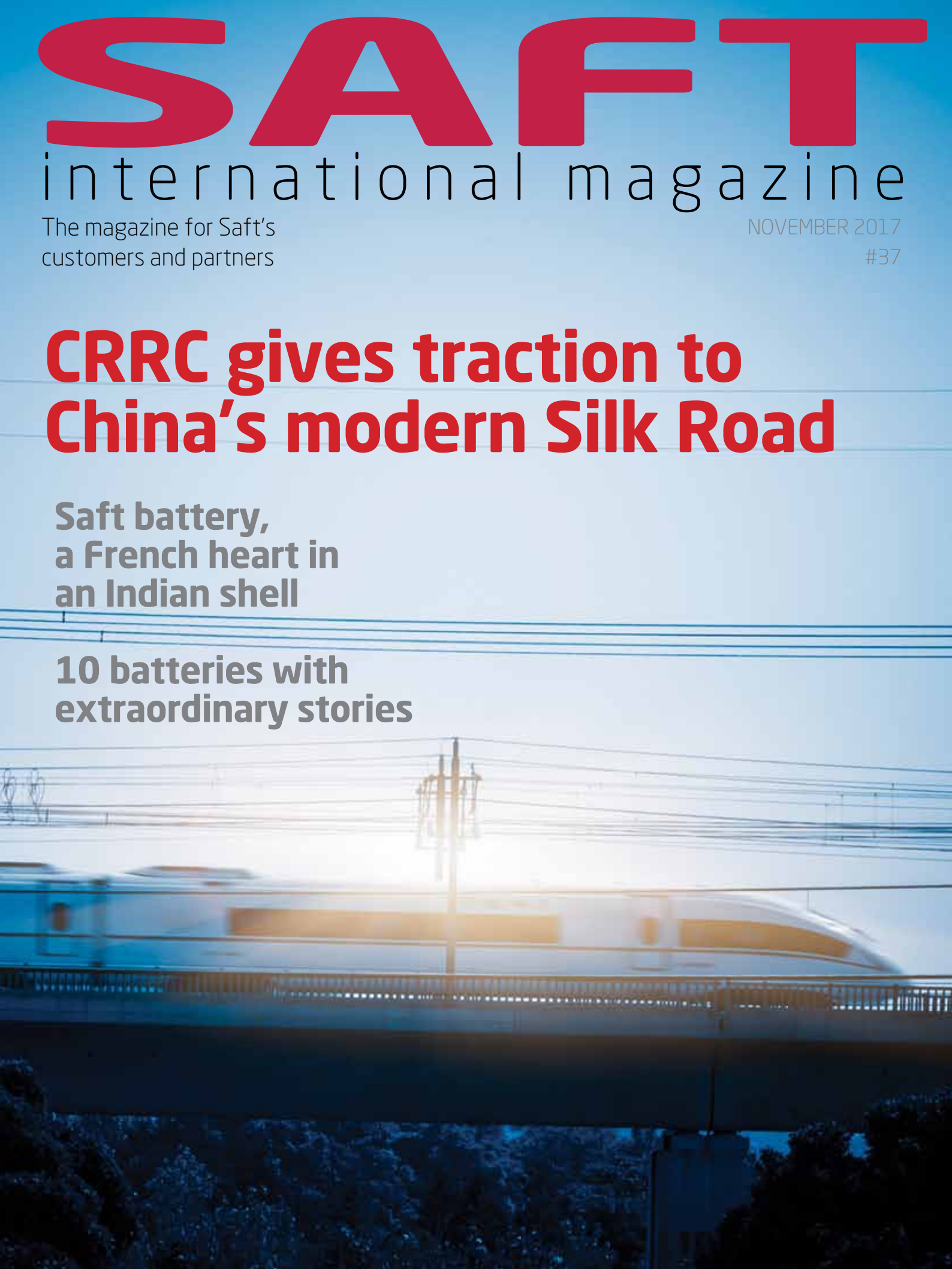
The magazine for Saft's customers and partners

NOVEMBER 2017
#37

CRRC gives traction to China's modern Silk Road

Saft battery, a French heart in an Indian shell

10 batteries with extraordinary stories



Ghislain Lescuyer,
CEO

Keeping the world of rail on track

Welcome to this special Rail edition of Saft International Magazine. Since Saft was founded almost a hundred years ago we have worked with customers in the rail industry.

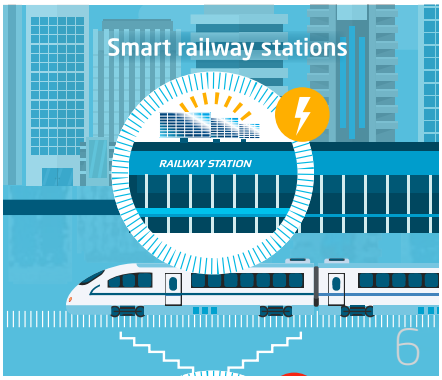
Since the 1920s, Saft batteries have been onboard trains. They were first used to power train carriage lighting. Today, they still have a role in lighting carriages, but nowadays the batteries power onboard lighting – as well as other critical safety functions - in the event of a power cut. Which means passengers need not worry about how they will get off the train in the event of a major outage.

But that's not all we do. In addition to working with many of the world's rolling stock manufacturers, we also partner with rail infrastructure providers to provide backup power for signaling, points switching and even network control rooms. Saft is also on the digital track with our new C.O.M.M. Batt devices providing real-time remote monitoring of onboard rail batteries. It helps our customers develop preventative rather than corrective maintenance programs and reduces their TCO (Total Cost of Ownership).

Designed to provide high performance, maximum reliability, long life and efficient operation over a wide temperature range, our batteries have been successful all around the globe – from Europe to the U.S., from Hong Kong to mainland China, from India to Japan – and in many other countries too.

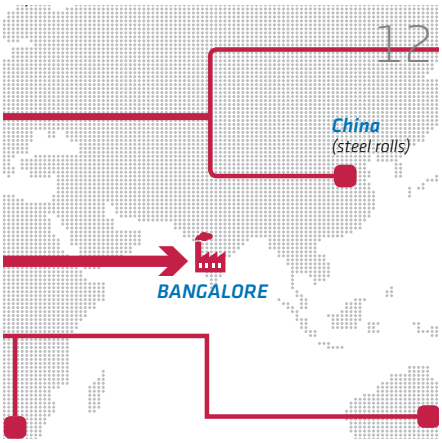
Saft is proud to work with the world's best companies in the rail industry today. We are also proud to play a role in building critical rail infrastructure, helping to move freight and products, and opening up the world to more of its people.

Saft, Groupe SA, 26 Quai Charles Pasqua, 92300 Levallois - France. **www.saftbatteries.com - Saft International Magazine**, a magazine for Saft's customers and business partners. **Editor:** Elma Peters. **Managing Editor:** Karen Hollington. **Text:** First Word, FWV and Six Degrees. **Graphic design:** ML Lanceau. **Printed by:** L'Artésienne. **Cover:** Photo ©kalafoto - stock.adobe.com
Feedback: karen.hollington@saftbatteries.com



©Cap Interactif

©Istockphoto



©Saft

©ohishifft - stock.adobe.com

Quality well on track

©Saft

CRRC Sifang, the Chinese rolling stock manufacturer, and MTR Hong Kong, the public transport operator, came to Saft's Bordeaux factory earlier this year. There, they carried out the First Article Inspection (FAI) of the battery kits that will equip the 93 new trains for Hong Kong's Kwun Tong, Tsuen Wan, Island and Tseung Kwan O metro lines. Both customers reported back satisfactorily on the FAI. The people of Saft Bordeaux were delighted to have had the opportunity to host them.

edward.wong@saftbatteries.com

Customer industry day highlights

On June 7th, Saft Space & Defense site at Cockeysville, in Maryland, U.S., hosted its Customer Industry Day and welcomed more than 70 customers from companies such as Textron Systems, Lockheed Martin, Raytheon, and various branches of the Army and Navy.

During the event, customers were able to visit the various exhibits to discover more about Saft's product lines and markets. They also attended technical briefings on battery-related subjects designed to train customers on critical factors that affect their applications such as safety, battery sizing, chemistry choice, and more. During the general session, Executive VP of Saft's Space & Defense division, Annie Sennet, made a keynote speech underlining the importance of customer relationships.

Several attendees said how impressed they were with Saft's facilities and capabilities, especially in-house testing and equipment. One summed up his experience by stating, *"this was a very well-organized and informative event. I will definitely come back next year!"*

Annie Sennet, EVP Space & Defense Division welcomes her customers at the industry day

©Saft

nicole.haslip@saftamerica.com

Farewell and thank you

In 2018, two of Saft's long-serving senior leaders will go on well-deserved retirement.
Combined, Tom Alcide, Executive Vice President, TTG, and President of Saft America and Philippe Ulrich, General Manager & Director of Sales for Asia, will have given 72 years of dedicated service to Saft.

Tom's Saft career started in 1980 when he joined Duracell as an Electronic Engineering technician. The Military & Defense business of Duracell was acquired by Saft in the late 1980s. He progressed through the engineering ranks, and later the management ranks, chalking up many achievements such as bringing lithium-ion technology to Saft in the early 1990s. He developed the Specialty Battery Group with great success and was instrumental in Saft's decision to open a manufacturing facility in China in 2006.

Tom says, *"Saft has been like a home to me for the past 38 years. I want to thank all the people who've made working here such a joy."*
Tom's last day will be 26th January 2018, exactly 38 years after his first day.

©Pete Souza

Tom Alcide and former President Barack Obama during his visit to Saft's Jacksonville factory in 2016

Philippe Ulrich (third from the right) at Saft's Zhuhai new factory opening in China in 2016

©Saft

Philippe first met Saft's sales team in 1982 at a railway seminar organized by the French Embassy in Lahore, Pakistan. At the time, he was based in Indonesia working as a field engineer for a company manufacturing train braking systems. From that meeting, he was hooked by Saft's products and teams. In May 1983, he joined the company as Railway Product Manager in Romainville, France. He held a number of senior positions within the company before becoming General Manager & Director of Sales for Asia in Hong Kong.

Philippe's vision for Saft's railway business and nickel-based product developments and acquisitions has contributed very strongly to Saft's success and leadership position in this very competitive market. His successor Pierre-André Nutte (see page 8), and his team, will be following in his footsteps and holding on to Philippe's favorite motto: *"Be always innovative, do not leave any stone unturned."*

While we will miss them, we wish them both the best for active, fulfilling retirements.

tom.alcide@saftamerica.com
philippe.ulrich@saftbatteries.com

New Transportation, Telecom and Grid EVP

©Saft /Gilles Cohen

Hervé Amossé joined Saft in October 2017, as Executive Vice President for the Transportation, Telecom and Grid (TTG) division. In addition to running the division, Hervé is responsible for further developing its strategy for lithium-ion. He joins Saft from Alstom, where he was Vice President for their rail signaling activities. He started his career in the telecom sector at Alcatel-Lucent and held several VP positions in the energy sector at Areva T&D, Alstom Power and GE. Hervé is taking over from Tom Alcide, who is retiring from Saft in early 2018.

herve.amosse@saftbatteries.com

Keeping the world's rail systems

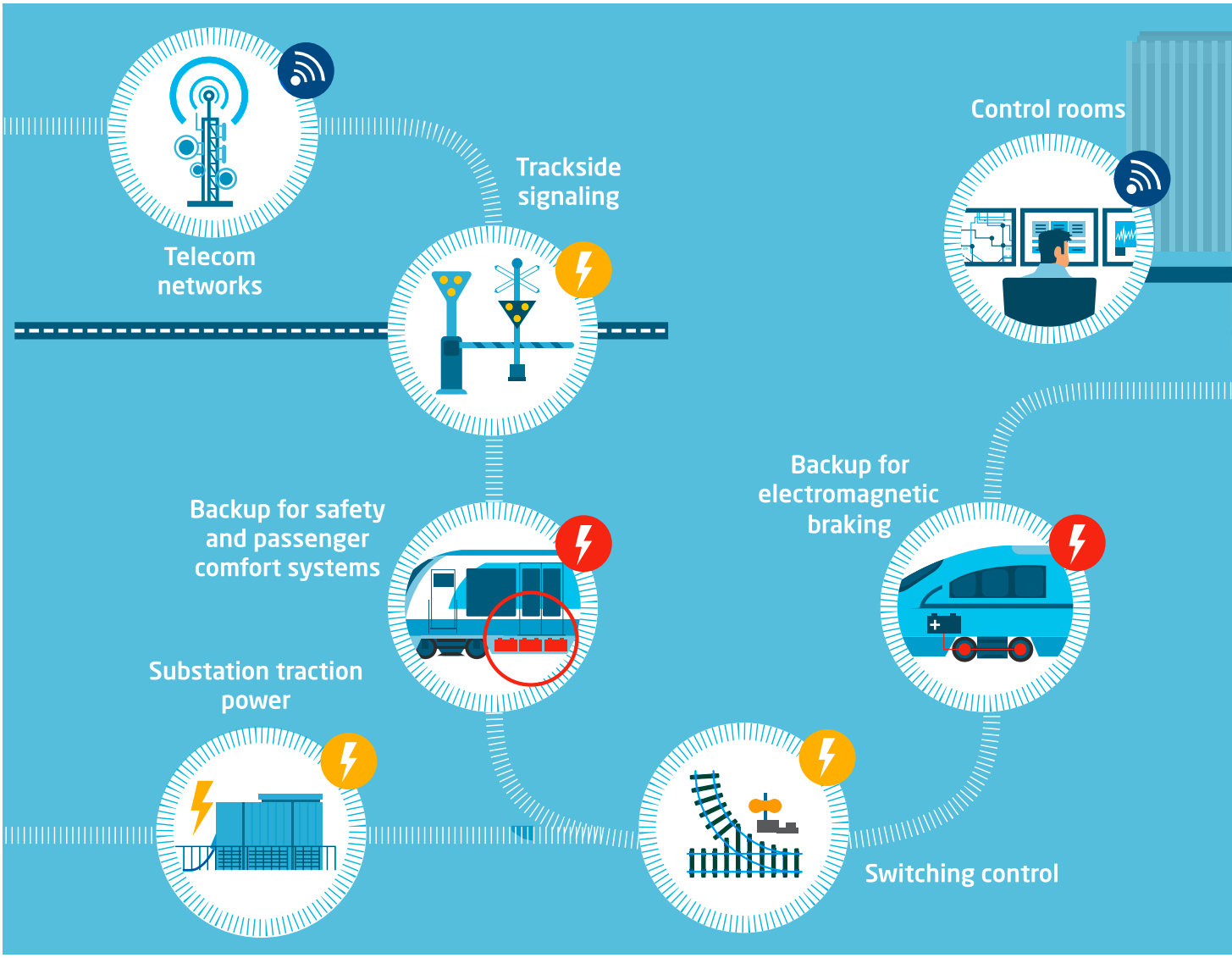
For 100 years Saft batteries have played a vital hidden role that keeps the world's train, metro and tram services running on time.

Even before a journey starts, Saft's onboard batteries are hard at work, starting diesel engines and raising pantographs*. And when the vehicle is underway they are always ready to support vital communication and passenger safety functions if the main power supply is interrupted.

At the trackside, our batteries are a vital component in signaling, barrier control and points switching applications. They are also deployed across the network in control rooms, telecom systems and smart centers.

No matter how extreme the conditions, from shock loads and vibration,

Innovative energy storage powers smater railways

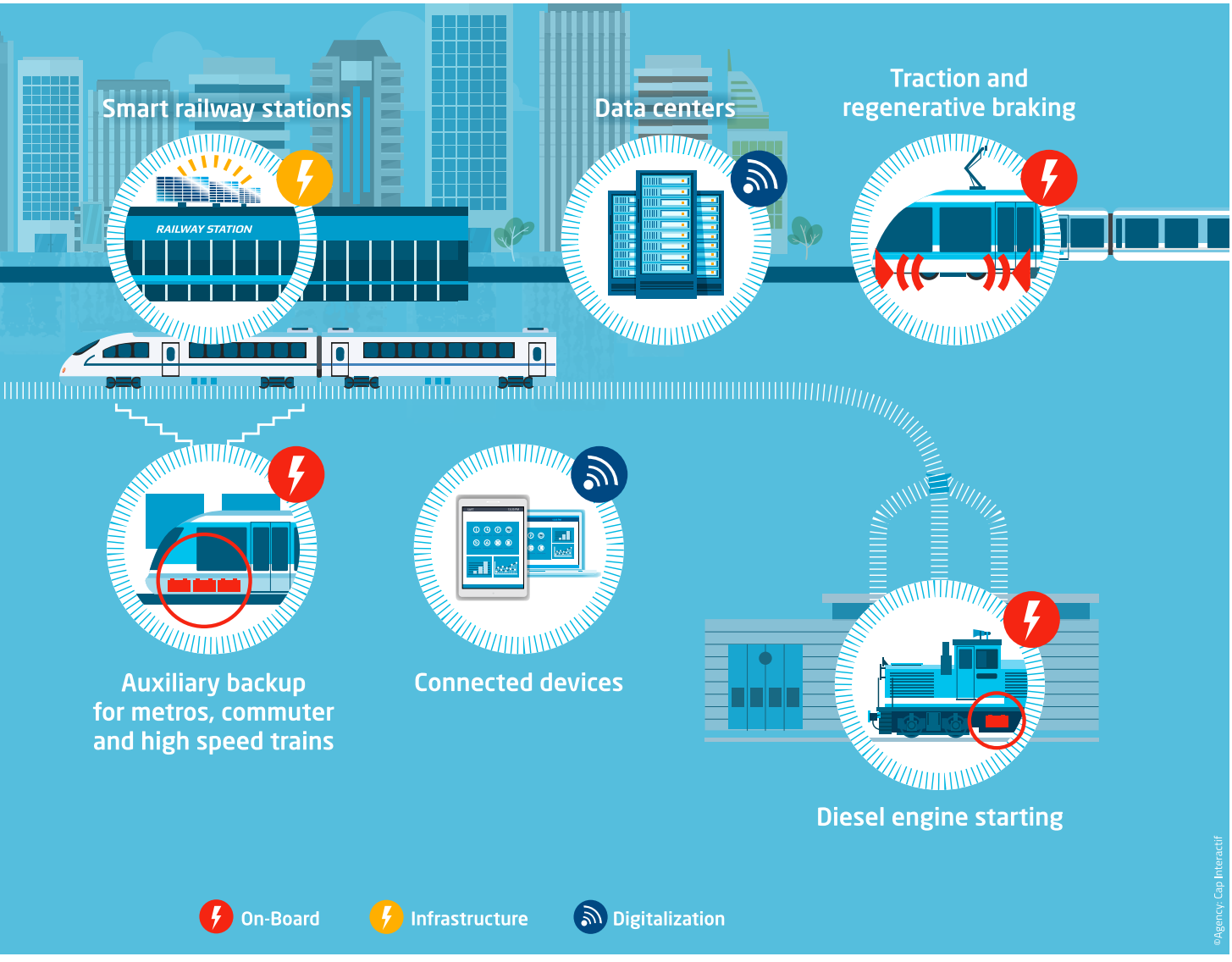


on track

to desert heat or the coldest Russian winter, our batteries keep running without missing a beat, year after year. So, it's no wonder that Saft has an exceptional track record, present on over 100 rail networks worldwide, including 75 percent of all metro systems and more than half of the world's high speed trains.

Our journey is continuing with the latest lithium-ion (Li-ion) traction batteries that enable trams to travel under their own power through city centers, with no need for overhead catenaries. Li-ion energy storage systems are also being deployed in trackside substations, where they recover braking energy that would otherwise be lost as heat and return it to the network for reuse.

* A pantograph is an apparatus mounted on the roof of an electric train, tram or electric bus to collect power through contact with an overhead catenary wire.



New Saft sales leader in Asia

In September, Pierre Andre Nutte moved into a new role as Asia Sales Director for Saft's Transportation, Telecom and Grid Division, based in Hong Kong. We took the opportunity to speak to him about the opportunities in Asia and the Railway market in particular.

" You've recently moved from France to Hong Kong – how are you finding the transition?

Saft is very international, so in terms of day-to-day business, not a lot has changed. But the city itself is extraordinary! Hong Kong has a vibrancy and energy that you'd expect from a densely-populated and cosmopolitan city. The team here could not have been more welcoming, so in terms of transitions, it's been pretty easy.

Tell us a little bit about your history with Saft.

I joined in 2005 as a Product and Marketing Manager for Railway. I was involved in lots of market studies and worked very closely with the sales team and our rail-focused factories in Bordeaux (France), Raškovice (Czech Republic), Valdosta (USA) and Zhuhai (China). It was the ideal introduction to the railway market.

I then moved into a sales role working closely with SNCF, the French railway operator. This gave me deep insight into customer requirements and an understanding of where Saft adds real value. It was fascinating to see everything I had been involved with from a marketing perspective now being applied in the real world. I was also working very closely with Bombardier, so I had the opportunity to see the market from an OEM's perspective – the drivers for railway operators and OEMs are very different, so that was invaluable.

Before I came to Hong Kong I was a Key Account Manager for Alstom worldwide. That experience was very interesting due to the global project coordination aspect, in particular with Alstom in India where we have a few important projects running.
Saft has a history of employees staying with the company for many years, so a lot of the contacts I made in those early days still remain an important part of my network today.

What does your new role entail?

I am responsible for sales in Asia across Rail, Telecom and Grid. One of my priorities is to continue to develop the synergies in our commercial network, so that we can remain competitive and deliver what our customers need. This means maintaining a culture of transparency and open communication – something I am passionate about, given my history with the business. It's quite unusual for a company of our size to be so international – it gives us extraordinary insight into markets and technology developments globally. We can use this to find innovative solutions that will ultimately benefit our customers.

Rail is a large part of our established business in Asia and is growing significantly. There are incredible opportunities for Telecom and Grid too. In Asia, the infrastructure is often installed in demanding conditions — high temperature and humidity — and is often combined with poor reliability of the grid or no grid at all. This calls for robust technologies such as our nickel-cadmium and lithium-ion batteries to deliver the highest reliability over a long service life. Also, with so much of the Asian market made up of small islands there's an enormous opportunity when it comes to microgrids. In particular, our hybrid solutions for off-grid sites with batteries and solar panels running in tandem with diesel generators are helping microgrids to cut fuel costs and also CO_2 emissions.

The Saft team here in Hong Kong is very engaged. We've got great relationships with existing customers

©Saft

" Culturally, things move quickly here and we need to be able to keep pace. This is both our greatest challenge and a significant opportunity. "

Pierre Andre Nutte

and are also focusing on building solid relationships within potential new ones.

What do you see as the greatest challenges and opportunities you will face in the coming years?

The Railway market in Asia is huge. Not only that, but it's continuing to grow and the competition between Asian, European and North American rolling stock manufacturers is fierce. In fact, the recent Memorandum of Understanding signed between Alstom and Siemens* is a direct reaction to that competition. Chinese rolling stock manufacturer CRRC represents more business than Siemens, Alstom and Bombardier combined. That is why we take this market so seriously.

Culturally, things move quickly here and we need to be able to keep pace. This is both our greatest challenge and a significant opportunity. Having a local presence in Asia means we can react instantly to customer requirements. But the international nature of our business, with factories all over the world, means we need to be smart about how we deliver on our customer demands.

Our greatest opportunity is that we are well-established, recognized for the quality of our products and services, our technology innovation, and our local presence. Being now part of Total, a group known and respected throughout the world, is also a real advantage.

You've been in this business a long time. What are some of the greatest changes you've seen in the last decade?

There have been a lot of changes – both in terms of the market and the technology. If you take Asia, 12 years ago we were just starting to hear about the emergence of Asian train manufacturers. Now CRRC has grown to the point where they set the rules of the game, in many ways.

In terms of technology evolution, we have seen significant improvements in maintenance, and an increasing transition from lead-acid to our nickel based batteries. In some cases, railway manufacturers are using nickel batteries for up to 80 percent of new trains. There is also great potential for lithium-ion batteries. We're also seeing trends like the Internet of Things impacting just about every industry, especially for remote monitoring of battery status and condition. I'm proud to say Saft is ready not only to support these developments, but in many cases, to lead them. ”

*Latest agreement between Alstom and Siemens at the time of the magazine publication.

pierre-andre.nutte@saftbatteries.com

CRRC gives traction to China's modern Silk Road

©Fotolia

In 2013, Chinese President Xi Jinping launched his country's 'One Belt and One Road' initiative. This ambitious development program, worth an estimated 4 trillion euros, aims to create a modern Silk Road, stimulating trade and kick-starting economic growth in more than 60 countries across Asia, the Middle East, Europe and Africa. Together with China, these countries account for 62 percent of the world's population and 30 percent of its economic output.

The initiative is founded on massive infrastructure projects covering transport and energy, including roads, railways – such as a 3,000 km high-speed connection between China and Singapore - ports, bridges, pipelines and power plants.

One of China's key assets in the Belt and Road program is China Railway Rolling Stock Corporation (CRRC), the state-owned rolling stock manufacturer and one of the country's great industrial success stories. With an annual turnover of 28 billion euros, CRRC is bigger than its main rivals - Alstom, Bombardier, Hitachi, Kawasaki and Siemens - combined. It has more than 180,000 employees and 46 subsidiaries across China, and exports to 102 countries, selling products that cover the full spectrum of rolling stock - subways and metro trains, railway trains, TGVs and locomotives.

To understand how far China's rail industry has grown in a short time, in the past 15 to 20 years it has completed the world's largest high-speed network, which at a total length of 22,000 km is 11 times the size of the French rail system.

In addition to its domestic market, CRRC is now a major global player, especially in urban and suburban trains. For example, it has recently won an order to supply 846 new rail cars for the Chicago Transit Authority. At over 1 billion euros this is the largest contract ever won in the U.S. by a Chinese company in this sector. To fulfil the contract, CRRC is setting up its own assembly plant in Chicago.

Saft's successful track record with CRRC

As part of our own ongoing initiative in China, we have a long-standing working relationship with CRRC. This has seen the successful delivery of Saft batteries for major metro projects such as Chengdu and Nanchang, Beijing Metro Line 6 and the new West Island Line on the Hong Kong MTR system. Saft batteries have also been integrated in CRRC export projects including metro trains for Ankara in Turkey as well as commuter trains for Malaysia.

In the high-speed sector, our batteries feature on the CRH5 Bullet Electric Multiple Units destined for the new Lanxin line that traverses three provinces in Northwest China.

©Istockphoto

©Fotolia/kalafoto

Maintaining a world-class service for the Hong Kong MTR metro

Most recently, we were awarded a five-year multi-million euro contract to supply specialized SRM nickel-technology batteries for new eight-car MTR metro trains under construction by CRRC. The batteries will maintain a world-class service for passengers on the new trains. Should a train lose its main power supply the batteries will take over seamlessly to power lighting, air conditioning and door-opening systems as well as new dynamic route maps.

The Hong Kong MTR carries over 5.5 million passengers every day. It is regarded as one of the world's leading metro systems for safety, reliability, customer service and cost efficiency. To maintain this exceptional level of performance, 93 new trains have been ordered to replace all the first-generation trains on the Kwun Tong, Tsuen Wan, Island and Tseung Kwan O lines. The new trains, featuring more modern operating systems and equipment, will be delivered between 2018 and 2023.

"We have specified Saft batteries to provide the onboard backup due to their proven capability in even the most demanding rail applications worldwide."

Zhang Xiaoming, CRRC Sifang

Zhang Xiaoming, Deputy General Manager Overseas business division of CRRC Sifang Co. Ltd, says:

"We are building the new MTR trains to offer world class levels of performance, reliability and safety. That is why we have specified Saft batteries to provide the onboard backup due to their proven capability in even the most demanding rail applications worldwide."

The Saft batteries will provide the new MTR trains with up to 60 minutes of backup power to support vital control and safety functions. The SRM cells are designed for extreme reliability as well as enabling the batteries to be 20 percent smaller and lighter than lead-acid batteries of similar performance. Their nickel-based technology does not suffer "sudden death" failure and can provide a long service life of up to 15 years while requiring minimal maintenance. MTR has specified the SRM cells in a steel casing that meets the highest fire-proof standards.

"This prestigious project for the Hong Kong MTR confirms that Saft rail batteries are the first choice when safety, reliability and performance are critical factors" said Philippe Ulrich, Saft General Manager & Director of Sales Asia. "The contract extends a long-running association with the Hong Kong MTR as we have previously supplied batteries for trains on the West Island line and are currently delivering a contract for refurbished trains in the New Territories."

Saft's cells for CRRC are designed and manufactured in our Bordeaux factory in France, and the batteries are assembled locally in the Saft Zhuhai factory in China.

Saft battery, a French heart in an Indian shell

This article was originally published in "Le Figaro" on August 26th, 2017 - www.lefigaro.fr

For its high-end batteries, Saft buys its raw materials throughout the world. While the final assembly of the batteries is increasingly carried out in the countries where they are sold, the most sensitive manufacturing stage still takes place in France.

@AnnelotHuijgen

INDUSTRY - Since the beginning of the year, the Indian employees of the Saft factory in Bangalore have been learning to handle a new product: large batteries to be used in trains, trams or metros, to open doors for example, in the event of a power outage. The French manufacturer has decided to add this model to the batteries already produced on site for planes and energy storage, in order to tap the growth of this vast market of 1.3 billion people.

"We are currently in the process of hiring an Indian project manager and an Indian designer to show our batteries to future customers and customize the batteries with them on site, since practically every model is unique", explains Philippe Tigier, Project Manager at the Bordeaux factory. He supervises the upscaling of this distant site, inaugurated in 2013 with the local partner Amco.

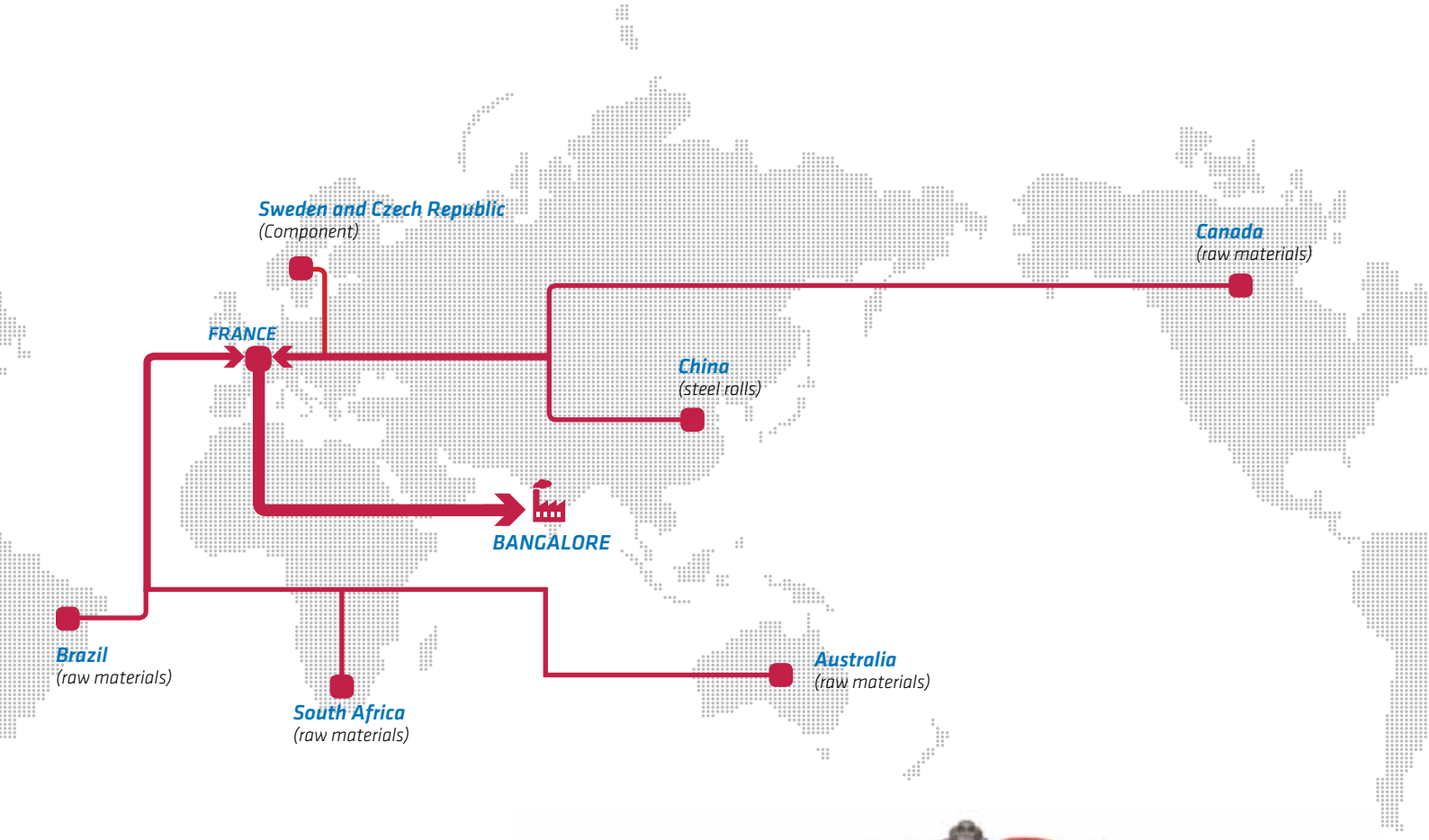
"The number of requests – whether formal or otherwise – from our customers and governments to localize production in their home countries has increased sharply over the past decade"

Jean-Baptiste Pernot, Operations Director at Saft.

In the same way as dresses are made to measure, this company, which used to make fixed and traction batteries, now tailor-makes high-tech high-power batteries. The Group, which will be celebrating its one hundredth anniversary next year, is even included in the Guinness World Records for having made "the world's most powerful battery", installed in Alaska. Fifty years ago, Saft equipped the Concorde prototypes, and thirty years ago, La Poste's first electric cars. Today, its batteries are used in military vehicles, planes and on oil platforms. They are also used in special projects, such as the Philae robot, which woke up at the end of its ten-year journey on board the Rosetta space probe, thanks to Saft's energy.

This DNA – which is akin to that of haute couture – is something that Saft CEO Ghislain Lescuyer cherishes. While the Group does not produce as much as giants like LG, Panasonic and Samsung (see opposite), its profit margins are higher. This model caught the eye of Patrick Pouyanné, CEO of Total, and convinced him to acquire Saft a year ago in order to conquer the renewable energy storage market. For his first visit, the oil company boss went to Bordeaux, where Saft's research activities, as well as its most strategic industrial activities, are based. *"The electrochemical heart is the most complex part of the battery and represents up to 40% of its value"*, states Philippe Tigier. Saft has fourteen factories in nine different countries, including three in France and four in the United States. They are specialized and are not all equally dependent on the flagship factory in Bordeaux. Operations Director Jean-Baptiste Pernot is tasked with managing this network in the best

©Saft



possible way. *"The number of requests – whether formal or otherwise – from our customers and governments to localize production in their home countries has increased sharply over the past decade"*, Jean-Baptiste Pernot, Operations Director at Saft. Such requests, which sometimes disregard WTO rules, are often submitted to train or aircraft manufacturers, who pass them on to their suppliers. In the same way as it has been seen in the United States for a long time, India with its "Make in India" campaign and, most significantly, China, can now wield their influence with the weight of their immense needs and more mature ecosystems. *"Over the past fifteen years, our Chinese customers have become increasingly demanding and are asking for local supply"*, adds Jean-Baptiste Pernot.

©Saft

New metro will help Lucknow breathe more easily

The Times of India once described Lucknow as "gasping for breath" because of its congestion and traffic pollution.

The reason is that the capital of Uttar Pradesh, India's most populous state, has grown to over three million people – with more than 1.4 million vehicles cramming its roads. Now, relief is at hand as September 2017 saw the public opening of the first 8.5 km stretch of the rapid transport Lucknow Metro system, from Transport Nagar to Charbagh railway station.

Eventually, the Lucknow Metro will cover a route of 23 km with 22 stations. With so many of the local population desperate to get off the roads and on to an environmentally-friendly mass transit system, the number of locals using the metro is predicted to be huge. From the start, the metro will carry 430,000 passengers per day, increasing to over 1 million by 2030.

With so many people riding the metro, ensuring continuity of passenger services is vital. That's why Alstom India, manufacturer of the 20 Metropolis four-car trainsets, is installing Saft nickel-based batteries to provide on board backup power if the main power supply is interrupted.

The SRM+ battery systems will deliver up to 90 minutes of autonomous power to support critical control and passenger safety functions such as door operation, lighting and communications. The battery systems were designed and engineered by Saft's team in Bordeaux, France and assembled locally in Bangalore by Amco Saft.

The Lucknow Metro will be the fastest and most economical high speed rapid transit system project in India. Alstom India specified Saft's rail batteries because they have proved their reliability and long life in a number of previous Alstom projects around the world.

"The Lucknow Metro project further reinforces our global cooperation with Alstom on major rail projects."

Guy Patrick de Broglie, Saft General Manager India, says:

"The Lucknow Metro project further reinforces our global cooperation with Alstom on major rail projects. It also continues Saft's substantial penetration into India's metro sector that has already seen our batteries specified on rolling stock in cities including Delhi, Kolkata, Bangalore and Chennai. The approach taken, with cells produced in France for local assembly into battery systems, is an important step towards more localization of key elements of our rail projects in India."

guy-patrick.debroglie@saftbatteries.com

Eliminating sudden death battery failure at the trackside

Holger Schuh, Saft's North East European Sales Director for Industrial Standby Batteries, explains why nickel-based batteries are the best choice for safety-critical trackside applications.

© Fotolia /7maru

Uptime is critical for railway control and communication equipment, both for safety and to ensure smooth operation of rail networks. Level crossing signals, barrier controls and points must be able to rely on a continuous supply of electrical power, even when their main supply is interrupted. That's why it's vital for operators to select the right rechargeable backup battery technology for their trackside cabinets.

Generally, it's a choice between lead-acid and nickel-technology batteries. Lead-acid batteries are relatively inexpensive but require regular testing and maintenance. And, most importantly, they can suffer 'sudden death' failure. This means the battery can stop working from one day to another without any warning.

In contrast, nickel-technology batteries such as Saft's Tel.X or Uptimax batteries have a robust design that ensures a long and predictable service life. Even if a cell should fail, the battery will still support the load.

Optimizing total cost of ownership

Battery choice often comes down to the operating philosophy of the network operator. Some operators manage the risk of sudden death in their lead-acid batteries by installing a fully redundant second backup battery. Other operators carry out capacity testing every six months – a grueling task that requires either a constant round of site visits for maintenance engineers or significant cabling for remote testing.

For those who prefer to optimize their total cost of ownership (TCO) taking into account maintenance and replacement costs, nickel-based batteries have a clear advantage in the long term. That is because they will last as long as a typical trackside application, which is generally over 20 years. Over that time, a lead-acid battery will have been replaced at least twice.

A major difference when the heat is on

High temperatures cause premature aging for all battery chemistries. However, nickel is better at handling hot conditions. At 30°C, lead-acid batteries will last five years, compared with 16 years for a nickel battery, and the gap gets wider as it grows hotter. So, in some cases it might be possible to eliminate air conditioning and ventilation inside cabinets.

Nickel batteries also have the edge over lead-acid in the cold. As the temperature drops, the power available from a battery will fall off. Engineers overcome this by oversizing the battery so that it will deliver the power needed even on the coldest night of the year.

However, because nickel batteries better perform at lower operating temperatures, they require less oversizing. This allows for a smaller cabinet, with fewer batteries to maintain and no need for a heater.

holger.schuh@saftbatteries.com

Czech and Slovak operators switch to nickel technology

Recently, SŽDC and ŽSR, the railway infrastructure operators in the Czech Republic and Slovakia, switched to nickel technology for their trackside installations. The reason is they have delivered major programs of modernization, including the introduction of a new crossing design concept with a slimline trackside cabinet. However, they had reliability and maintenance issues with their original lead-acid batteries.

In 2016, both operators specified Saft nickel-based Tel.X batteries after a successful trial. The Tel.X battery is a reliable, maintenance-free 'drop-in' replacement for the original batteries and is expected to operate for more than 20 years in this application.

Swissloop win podium spot in SpaceX competition

Swissloop, a team of the brightest math, physics and engineering students at ETH Zurich, have beaten hundreds of rivals to come third in a competition to design and build a prototype for the Hyperloop, Elon Musk's vision for the future of transportation.

©Swissloop

Yet this fantastic result nearly didn't happen; the group had been working tirelessly for more than a year on the high-speed pod – a futuristic transport capsule designed to travel at 270m/sec and capable of taking passengers 250km in 15 minutes.

Members travelled to Los Angeles this summer to take part in the 2017 competition, trying out their design on the Hyperloop track at SpaceX's California headquarters. Their pod's lithium-ion battery was also held up in customs in LA and it looked like it wasn't going to arrive in time for their first test.

Building a battery in a day

Luckily, the battery was made by Saft, who partnered with the team earlier this year. Saft engineers in the US came to the rescue, building and shipping an entirely new battery system in just one day.

"This battery is not built on the production line because it's a prototype," says Ryan Bunge, applications engineer for Saft's Civil Electronics Division in the US. *"Through a collaborative team effort, myself and a few colleagues managed to complete the battery build in a matter of hours, which is extremely aggressive."*

In the words of Christopher Timperio, Swissloop's technical project lead: *"It was epic, you guys really saved the day!"*

Swissloop first approached Saft because they were searching for small, lightweight yet high-powered battery packs for their design. The customized battery system is made up of seven lithium-ion MP 176065 XTD cells and is fundamental to the operation of the team's prototype pod. It enables braking, which is safety-critical because of the speeds involved in Hyperloop, as well as allowing data transfer to both the SpaceX team and controlling sensors that measure temperature, acceleration and operate the propulsion mechanism.

> *"Saft batteries really helped," says Carl Friess, a Swissloop's Avionics team lead. "We plugged it in and it just worked perfectly – and that was actually really cool."*

During the SpaceX competition, the battery's reliability also gave Swissloop the edge over rivals: the prototype pods are tested inside a large vacuum chamber and, unfortunately, many teams' battery systems failed due to the low-pressure environment in the Hyperloop. Saft's customized battery solution was fit for the challenge.

"Saft batteries really helped," says Carl Friess, a Swissloop's Avionics team lead. *"We plugged it in and it just worked perfectly – and that was actually really cool."*

A tough selection process

Thousands of teams had expressed interest in the competition, and approximately only 30 made it to the SpaceX competition this summer. There, each group had to undergo an extensive list of tests to prove confidence in their pods design, and to then work through any issues that might be observed during this testing. Swissloop quickly recognized safety was at the center of SpaceX's evaluations; they also realized it was beneficial to work in cooperation with the other teams.

"It was a great environment and there wasn't too much rivalry," says Friess. "In fact, all the teams collaborated and even borrowed tools from each other."

After all of the tests were completed, only five teams made it to the final round – including Swissloop. Using a cold gas propulsion system proved to be beneficial, as no one else had used this innovative method before. It was one of the first decisions the team had taken based on trade-

©Swissloop

©Saft

Saft's lithium-ion battery pack for Swissloop

offs between design complexity, time, and speed – and it differentiated them from the rest of the competition. The SpaceX team were so impressed they said they hoped other teams would look at using cold gas propulsion in the future.

"That was also one of the reasons I think we got into the top three," says Timperio. SpaceX chose the top three based on a few different criteria, however mainly it was focused on design diversity. *"We think they wanted to see really different designs in the finals, yet at the same time, each design had to show feasibility of these systems working in the Hyperloop,"* says Timperio. *"Which is why we think our design was chosen – because we basically designed a small rocket for the Hyperloop, and it worked!"*

Moving ahead

Back in Zurich, the team have reflected on their experiences and are already working on ideas for their new prototype for the 2018 competition next year.

"We definitely learned where to simplify as much as possible and where to look to add complexity," says Friess. *"For example, some parts of our system were over-engineered or too complicated."*

For the students, the chance to receive feedback from engineers working in a cutting-edge field was invaluable. *"Having veteran, 12-year SpaceX team members commenting on how cool our pod was, was really a nice confidence boost,"* says Timperio.

Swissloop's goals for its next design are to ensure safety, simplify the model and increase speed. The team will also be working with Saft to increase the battery's capacity so the prototype will be able to run for longer. As suggested by the SpaceX team, they would also like to add a temperature sensor to the battery pack.

Swissloop and Saft have both benefited from the partnership – and enjoyed it.

"You gave us a huge edge," says Friess. *"It was really great to have Saft go the extra mile and have Ryan build a battery in a day – that's just crazy. We couldn't be luckier to have such a great sponsor."*

ryan.bunge@saftamerica.com

Blazing a trail: How Saft's female leaders are breaking down the gender barriers

The statistics are clear – more women are needed in the STEM (Science, Technology, Engineering and Maths) workforce across Europe. Here, three of Saft's top female leaders describe how they've carved out careers in science and suggest how more girls can be encouraged to join them.

Having studied civil engineering and industrial business management and been a site and program manager for Electrolux, Mari Kadowaki was undaunted when she became Saft's first female general manager in 2007, taking over the factory in Oskarshamn, Sweden.

But it was a step that broke down gender barriers at the company and that reality was brought home to her one day when she welcomed a group of retired former employees to the factory for a tour and lunch. Over coffee one elderly gentleman made a point of telling her: *"When we heard a woman was coming in to lead we thought it would be the end of Oskarshamn factory."*

Luckily Mari, who is also the managing director of Saft Sweden, hasn't felt such prejudices in the workplace. On the contrary she says she's found being a woman in the industry is a positive experience: *"You always get attention and people are very respectful. So I think it's a real privilege to be a woman in this world."*

Mari Kadowaki, General Manager of Saft's factory in Sweden

©Saft

Redressing the gender balance

Along with other women, however, Mari is keen to make it less of a privilege and more of a routine situation to have women in science jobs. Within the EU-28 countries women scientists and engineers make up 2.8 per cent of the total labor force, while men make up 4.1 per cent, according to the European Commission's SHE Figures 2015 report. In France (where Saft has its headquarters and three factories) the overall number of engineers is progressing (4 per cent increase on average per year) as well as the percentage of female engineers that represents 20.5 per cent according to the French Association of Engineers and Scientists 2016 study (IESF).

At Saft, some 23 per cent of the company's engineers and top managers are women. While the overall workforce is 32 per cent female. At the company's plant in South Shields in the UK there is a 50/50 male/female split among the 120 employees and in the past it was even predominantly female. Tessa Collinson, South Shields' general manager and purchasing director for the civil electronics division, says she's never noticed a problem of a gender divide even though the majority of the factory's senior managers are male.

Tessa Collinson, General Manager of Saft's factory in England

©Saft

> *"I don't ever think of myself as a woman in technology because for me it doesn't matter what sex you are, it depends on you as an individual. I started out in life in human resources which is seen as a more female field but I wanted to work for a technology company as I found it inspiring."*
>
> Tessa Collinson, General Manager of Saft's factory in England


Linh Nguyen, Operator at Saft's factory in Oskarshamn, Sweden

©Saft

Making women's voices heard

By contrast, when research engineer Catherine Lepiller arrived at Saft's plant in Poitiers, western France, five years ago, she says she found a particularly male culture where it was sometimes difficult for women to make themselves heard. Things have been improving and now around a third of the 45 people in her technical department, including the chemical lab, are women.

Catherine has a PhD in electrochemistry and has worked at the CEA, France's Alternative Energies and Atomic Energy Commission, along with companies in Canada and the U.S. She holds two patents and has written and contributed to multiple science papers. Now she is bringing her scientific expertise to her role as technical manager for Saft's primary lithium battery range. She is in charge of the development of new products as well as supporting Saft's three specialized factories in China, the UK and France on quality, production, supplier and customer issues.

"When I was young all of the sciences were interesting to me," she says, *"but chemistry attracted more women than men as women tended to want to become technicians in labs. Men tended to do maths and physics."*

"I think the situation is better now than when I was a student. If a young woman wants to go into science today there is no question about it."


Catherine Lepiller, Technical Manager, primary lithium batteries, Poitiers, France

Encouraging girls... and boys

The opportunities are certainly there for girls to study science but it seems they still need encouraging. Through the Association of Swedish Engineering Industries, Teknikföretagen, Saft has been supporting a campaign by Youtube star – and qualified software developer – Therese Lindgren, to attract more girls to science. Therese Lindgren's message is that too many young people still think that if you study technology you become an electrician, when in fact it leads to so much more.

And while girls are the priority, Mari Kadowaki, who is the mother of two teenage boys, sees the need to attract both boys and girls into science.

"I think young people are getting more and more distanced from technical activities," she says. *"Everything is digital so they have things in simulation but few young people spend time repairing things like their motorbikes these days. They are living in a different world compared to industry."*

Europe as a whole is not keeping pace with demand for STEM skills, according to a 2016 report from the EU STEM Coalition, which is working to spark children's interest in maths and science at school, equip science students with a broader range of skills, and build alliances between educators, employers and governments.

Mari is aware of the scale of the changes that are needed to attract new talent, not least in making industrial workplaces more inviting: *"I think industry has not managed this very well. We are stuck in boring, ugly buildings. First of all they didn't attract females and nowadays they are not attracting men as well."*

> *"Science companies need to think how we will fit into the future. Young people will have a lot of companies and organizations to choose from and they will look for more than just salaries and bonuses. They will look at a company's culture, buildings, management style, history, purpose... all these things will matter in the future."*
>
> Mari Kadowaki, General Manager of Saft's factory in Sweden

10 batteries with extraordinary stories

Many Saft batteries are designed to operate in extreme environments or to meet unusual needs. Here are the stories of 10 of our most extreme batteries.

1. The world's largest battery

The city of Fairbanks, Alaska, is remote and cold. With no electrical connection to the rest of America, a power failure could be a disaster for the city. To prevent this, in 2003, Saft supplied the world's largest battery. At 2,000 m2 and weighing 1,300 tons, the battery will provide 40 megawatts of power for up to seven minutes. That's enough time to start the backup diesel generators that will restore power to the city. This nickel-based battery must work first time, when needed, despite temperatures that can fall as low as -51°C.

2. The deep space battery

Philae, the robotic European Space Agency lander, touched down on a comet 720 million km from Earth in November 2014, ending a voyage of almost 11 years. Its landing position meant its solar panels were not illuminated by the Sun. It was able to carry out its mission only because of its Saft primary battery, which provided power for 64 hours in freezing temperatures. No battery has travelled further from the Earth.

3. The battery at the bottom of the ocean

The deep sea has some similarities with deep space, so it makes sense that Marum – the University of Bremen's center for marine environmental research – would turn to Saft to power its deep-sea exploration vehicle, CMOVE. Operating at depths of several thousand meters, the unmanned vehicle is a mobile platform for various scientific instruments and experiments. Its battery had to be light, space-efficient and capable of powering the vehicle on missions of up to nine months.

4. The battery that crossed the Andes

Cobija, in Bolivia's Amazon rainforest, is the home of the world's largest photovoltaic-diesel hybrid microgrid with an energy storage system (ESS) that combines solar panels and diesel generators. Energy from the solar panels is stored in a battery, reducing the community's reliance on diesel. The extreme nature of this project is the challenge of getting it to the site. Without a suitable airport to fly into, shipping containers were floated across rivers and then transported over the Andes by truck.

5. The batteries that survived a rocket fireball

The first test flight of the Ariane 5 launcher failed spectacularly when a malfunction in the control software triggered its self-destruction. The safety circuit, powered by six Saft batteries, triggered explosive charges and the unmanned rocket exploded 37 seconds after launch. Nobody was injured by the debris, which was scattered over the rainforest in French Guiana. More than six months later, four Saft batteries were recovered and shipped home for testing. Despite the fireball and the 5,000-meter plummet, they were still in full working order.

6. The satellite battery that lasted 18 years

Launched in 1984, the MARECS B2 maritime communications satellite revolutionized sea-to-land communications and played a role in countless search and rescue operations. Designed to operate for seven years, the satellite was not boosted into a high 'retirement' orbit until 2002. Its Saft nickel-based battery was still fully functioning after 11 extra years.

7. The battery that can cope with a rocket launch

Batteries carried on rockets must withstand very high impact and vibration levels during launch. Saft's M62 cell was designed to do just that and is the largest battery of its kind. First used in 2008 on the Automated Transfer Vehicle that was launched on an Ariane 5 rocket and used to carry material to the International Space Station, it is currently being tested by space agencies in the United States and Japan.

8. The battery in the frozen North

Saft's first ESS north of the Arctic Circle is in Colville Lake, northern Canada. Like the one in Cobija, it features a combination of solar panels and a new diesel plant, to replace the ageing diesel generators that the community of 150 people had relied on before. The battery had to be delivered down ice roads that are open for only a few weeks each year.

9. The battery that works in explosive atmospheres

In potentially explosive atmospheres, a battery short-circuit could cause an explosion. Therefore, batteries for these environments, such as gas metering or tracking dangerous goods, need to undergo a hard short-circuit test. Saft's M20 EX was designed to pass this test at ambient temperatures of up to +70°C and is the only battery of its kind that is certified for use in explosive atmospheres.

10. The first Saft battery on the moon

The Smart1 satellite was designed to answer questions about the Moon's origin, look for signs of ice at the Moon's south pole and test solar-electric propulsion and other new technologies. It orbited the Moon for three years and then, in a planned maneuver, crashed into the surface. Whenever the satellite's trajectory took it out of view of the solar rays that powered it, it relied on a Saft lithium-ion battery.

We've got it covered

HEAD OFFICE

France

Saft Levallois
26 Quai Charles Pasqua
92300 Levallois
Tel.: +33 1 58 63 16 00
Fax: +33 1 58 63 16 18

Saft production sites

Saft sales networks

Australia

Saft Batteries Pty Ltd.
saft.sydney@saftbatteries.com
Tel.: +61 2 9674 0701
Fax: +61 2 9620 9990

Brazil

Saft do Brasil Ltda.
info.brasil@saftbatteries.com
Tel.: +55 11 4082 3292
Fax: +55 11 4082 3297

China

Saft (Zhuhai FTZ) Batteries Co Ltd. (Shanghai Branch)
lucy.shen@saftbatteries.com
Tel.: +86 21 5866 6405
Fax: +86 21 5866 6403

Saft (Zhuhai FTZ) Batteries Co Ltd.
Tel.: +86 756 6290 288
Fax: +86 756 6290 289

Saft Hong Kong Ltd.
joan.wong@saftbatteries.com
Tel.: +852 3756 6399
Fax: +852 3756 6300

Czech Republic

Saft Ferak® AS Praha
praha@saftbatteries.com
Tel.: +420 257 013 260
Fax: +420 257 013 261

Saft Ferak® AS Raskovice
raskovice@saftbatteries.com
Tel.: +420 558 426 111
Fax: +420 558 692 226

France

Saft Bordeaux
Tel.: +33 5 57 10 64 00
Fax: +33 5 57 10 66 70

Saft Nersac
Tel.: +33 5 45 90 50 26
Fax: +33 5 45 90 50 71

Saft Poitiers
Tel.: +33 5 49 55 48 48
Fax: +33 5 49 55 48 50

Germany

Saft Batterien GmbH Nürnberg
info.de@saftbatteries.com
Tel.: +49 911 941 740
Fax: +49 911 941 7425

Friemann and Wolf Batterietechnik GmbH Büdingen
Tel.: +49 6042 954 150
Fax: +49 6042 954 490

India

AMCO-Saft India Ltd. Bangalore
contact@amcosaft.com
Tel.: +91 80 2728 7947
Fax: +91 80 2728 7716

AMCO-Saft India Ltd. Delhi
delhi@amcosaft.com
Tel.: +91 11 4063 8644
Fax: +91 11 4063 8644

AMCO-Saft India Ltd. Mumbai
mumbai@amcosaft.com
Tel.: +91 22 2780 2568
Fax: +91 22 2780 2568

Italy

Saft Batterie Italia Srl
saftitalia.milano@saftbatteries.com
Tel.: +39 039 8947 361
Fax: +39 039 8965 854

Japan

Saft Japan KK
hiroyo.ogawa@saftbatteries.com
Tel.: +81 3 6206 6269
Fax: +81 3 6206 6279

Middle East

Saft Nife® ME Ltd.
panos.naziris@saftbatteries.com
Tel.: +357 258 200 40
Fax: +357 257 484 92

Norway

Saft AS
bente.solum@saftbatteries.com
Tel.: +47 6716 4160
Fax: +47 6716 4170

Russia

Saft LLC
contact.RUS@saftbatteries.com
Tel.: +7 495 966 16 73
Fax: +7 495 966 16 73

Singapore

Saft Batteries Pte Ltd.
kimchoo.lim@saftbatteries.com
Tel.: +65 6512 1500
Fax: +65 6746 6772

Spain

Saft Baterias SL
contacto@saftbatteries.com
Tel.: +34 916 593 480
Fax: +34 916 593 490

Sweden

Saft AB Oskarshamn
reception.oskarshamn@saftbatteries.com
Tel.: +46 491 680 00

United Kingdom

Saft Ltd. Harlow
sarah.carter@saftbatteries.com
Tel.: +44 1279 772 550
Fax: +44 1279 420 909

Saft Ltd. South Shields
Tel.: +44 191 4561451
Fax: +44 191 4566383

United States

Saft America Inc. Cockeysville
Tel.: +1 410 771 3200
Fax: +1 410 771 1144

Saft America Inc. Jacksonville
Tel.: +1 904 861 1501
Fax: +1 904 772 1463

Saft America Inc. Valdese
Tel.: +1 828 874 4111
Fax: +1 828 874 2431

Saft America Inc. Valdosta
valdosta@saftamerica.com
Tel.: +1 229 247 2331
Fax: +1 229 247 8486

Saft America Inc. North Haven
nancy.keinz@saftamerica.com
Tel.: +1 203 985 2700
Fax: +1 203 985 2539

Saft Lake Success
Tel.: +1 516 621 4980
Fax: +1 516 621 4517

Come and meet us at:

Metro China 2017

November 21 – 23, 2017
Shanghai, China

Mass-Trans Innovation Japan

November 29 – December 1, 2017
Chiba, Japan

IoT TechExpo

November 29 – 30, 2017
Santa Clara, California, U.S.

TowerXchange Meetup Asia

December 12 – 13, 2017
Marina Bay Sands, Singapore

InnoTrans 2018

September 18 – 21, 2018
Berlin, Germany

Saft batteries, meeting the railway challenges of today and tomorrow




www.saftbatteries.com

SAFT