CONNECTED

MAGAZINE

SPRING 2019

JOYON & THE ROUTE DU RHUM:
A TALE OF TWO LEGENDS

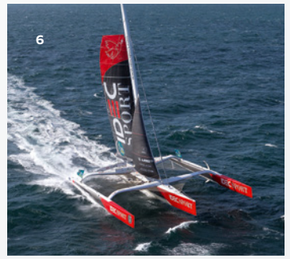
ROBOTIC ANIMAL AGILITY

1969: A GIANT LEAP FOR LEMO

LEMO

12

IN THIS MAGAZINE



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FASTER, HIGHER AND STRONGER

WE ARE DRIVEN BY SPORT

Sport has been a driving force of innovation. For sport's sake, we endeavour relentlessly to invent and develop new materials, new designs, new technologies. Sport is also by definition an extreme application (acceleration, vibration, friction) which presents exciting technical challenges.

It was only natural for LEMO to become a supplier of choice for motor sport and especially for Formula 1 and endurance races.

However, we are more than mere suppliers. How could it be otherwise? Sport and innovation have a lot in common: passion, a quest for perfection and performance and pushing limits. "Faster, higher, stronger" could be the motto of engineers.

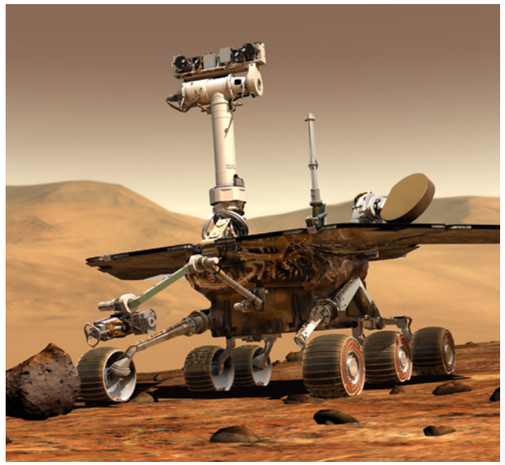
This affinity has led us to sporting partnerships. By coincidence, this CONNECTED is fortunate to tell you about two of them. First of all, our partnership with IDEC SPORT and its skipper Francis Joyon, extraordinary winners of the latest Route du Rhum race (see our special feature on page 6). Then with snowboarder Selina Jörg, who became the world champion in February (see page 33).

Higher, further and more attractive – this is also what guided us in enhancing our magazine. It has donned a new design to share what drives, inspires and motivates us all.

Enjoy!

Alexandre PESCI
CEO LEMO

TECH-BITS FROM AROUND THE WORLD



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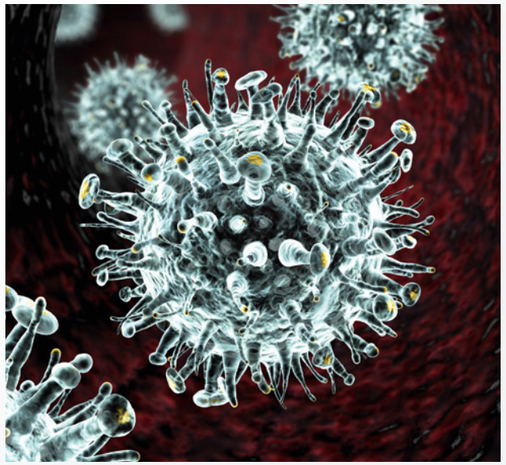

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Nº1

R.I.P, brave Mars geology explorer

In mid-February of this year, Planet Earth said goodbye to its oldest ambassador on Mars. Launched in 2004, for what was originally planned to be a 3-month mission, NASA's Opportunity Mars rover had explored the Red Planet for a record-breaking 15 years. It travelled over 45km, explored several craters, took almost 218,000 photos and shed light on a multitude of clues about the story of the Earth. In particular, it found traces of liquid water dating back to 7 billion years, pH-neutral water that could have sustained microbial life. Yes, Mars used to be a livable planet. NASA had indeed predicted that dust would eventually cover the rover's solar panels, depriving the robot of recharging energy, but martian winds had surprisingly acted like windscreen wipers. However, on 13th February NASA declared its Opportunity Mars rover had finally died, more than 8 months after the solar powered robot had gone silent during a raging dust storm – and a day after the final calls to awaken Opportunity had gone unanswered.

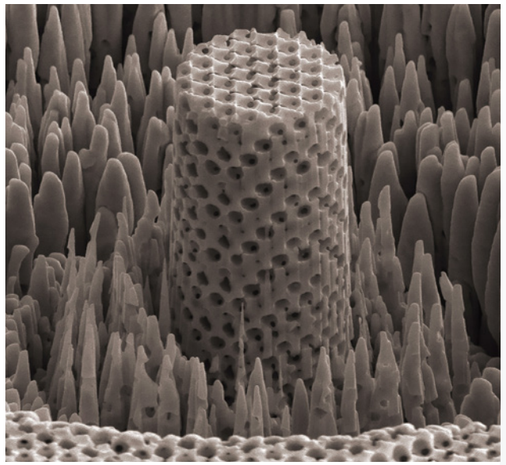
Opportunity's travels: https://go.nasa.gov/2UWM7DW

Nº2

A pill to kill all strains of flu

According to the World Health Organisation, influenza affects up to 1 billion people every year, with 3 to 5 million severe cases and up to 650,000 deaths. Each season vaccines are used to protect us from the strains most likely to occur. Unfortunately, sometimes unexpected strains of flu may spread and vaccines prove to be ineffective. This may well change: scientists have announced that they have developed an experimental oral medicine which protected mice from a broad range of influenza viruses. Their medicine originates from the discovery in 2008 of a class of broadly neutralizing antibodies (bnAbs) in humans. These antibodies attach themselves to a portion of a protein – practically identical to all strains of flu – on the surface of the virus. Without this portion, the virus cannot fuse with the infected cell.

Article published in: https://bit.ly/2UyWjmc



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Nº3

Metallic wood that could also store energy

A sheet of nickel with nanoscale pores that make it as strong as titanium, but four to five times lighter. This is what a group of scientists from several American universities have presented in Nature Scientific Reports. They have built up this structure by piling up spheres of plastic (a few hundred nanometres in diameter) and filling in the voids with nickel. Once the plastic dissolves, there remains only the much more regular nickel structure - much stronger than the material in its natural form. The low density of the structure (roughly 70% of the material is empty space) and its "cellular nature" have inspired its name "metallic wood". This structure offers not only light weight and robustness but could also include material that stores energy. An airplane wing made of metallic wood could also serve as batteries.

More details: https://go.nature.com/2HHvlWK

Nº4

Noise-blocking Objects

A simple ring fitted on the end of a tube, which lets air and light pass through, but blocks sound. Although it sounds virtually impossible, researchers have done it. The mathematically designed 3D-printed ring – called acoustic metamaterial – is shaped to catch certain frequencies passing through the air and to reflect them back toward their source. Researchers have managed to block 94% of sound. It should be possible to mathematically design an object that can block the sound of just about anything – ventilation systems in buildings, drones or even MRI machines. It wouldn't necessarily be limited to round ring-shapes. For a wall for example, it could be stacked up hexagons, making up a honeycomb structure wall, transparent and open, but soundproof. Enough to make our lives considerably quieter.

Press release: https://bit.ly/2uvq63K

HD WEARABLE CAMERA CONNECTOR

In an increasingly interconnected world, there is a constant drive to ensure that connections are made ever simpler. The new M Series Mixed High-Speed Coax combines, in one single connector, everything a camera needs. A great example of simplicity and compactness.

Wearable cameras are among the numerous devices fitted to modern vests worn by security and armed forces. They must be as lightweight, resistant, compact and practical as possible – any confusion in the "heat of battle" being obviously out of the question. The new LEMO connector makes their connection drastically easier.

This connector is the M Series Mixed High-Speed Coax connector. Similar to all the other M Series connectors, it is highly compact and designed to function in the harshest of environments. However, it is also the first to combine coaxial and low voltage signals, which is a real advantage for quite a few applications.

Among the large number of possible configurations, let us focus on the one for wearable cameras. A coaxial M series connector of just 1 cm in diameter can house five contacts: 2 contacts to power the camera, two low voltage contacts to drive the camera's micromotors (zoom, controls) and a single 75-Ohm coaxial contact to transmit images in HDTV quality. In a nutshell, all the connections necessary for the camera are integrated.

2 contacts for power supply, 2 low-voltage contacts to drive the micromotors and a single 75-Ohm coaxial contact to transmit images: everything the camera needs.

At the same time, LEMO engineers have managed to double the maximum operating frequency of their standard coaxial contact, for example. It has been increased to 6 GHz for the new M Series range.* Another special feature: there is no ratchet coupling mechanism, unlike the rest of the M Series. The camera's connection is completely noise-free, which means it is even suited to applications where discretion is vital (think "stealth operation").

The M Series has always been an example of compactness and this new model takes this feature a step further. One single connection – instead of two or three – frees up a lot of space for the equipment and reduces the number of parts required for the design. Simplicity is greatly enhanced for the user as well: one single connection is enough and there are fewer cables to purchase, maintain and carry ...

Wearable cameras are of course not the only possible market for the new connector. All broadcast applications requiring robustness, compact design and simplicity can benefit from the M Series Mixed High-Speed Coax connector. Even so, since as usual, LEMO's new solution is customisable upon request (size, contact configuration, Push-Pull instead of screw coupling) all the customers have to do is define their needs.

The M Series Mixed High-Speed Coax connector (coaxial + low voltage) is the latest design from an iconic product family. The M Series was created in 2009 specifically for motorsport, where reliability, compactness, light weight and ruggedness are a must. Thanks to these qualities, combined with a very wide range of operating temperatures (-55°C / +200°C), it is not only the "product of choice" in the uncompromising world of Formula 1, but also for aerospace and defence applications. The series has been regularly enhanced, offering a number of variants (multiple low voltage, hybrid, fibre optic). A High-Power model (see Connected 10) is currently in the testing phase, whilst others are currently being developed. ■

* *6 GHz frequency and <1.2, measurements tested and verified on an RG 179 DT cable.*

FRANCIS JOYON & THE ROUTE DU RHUM

During the last edition of the Route du Rhum race, 62-year-old Francis Joyon and his 12-year-old maxi-trimaran beat all of the next-generation navigators and boats. But how did he achieve this? Climb aboard for a spectacular journey combining the excitement of motor sports, the inspiration of great discoveries and the drama of man versus nature.

A TALE OF TWO LEGENDS

Fantastic, thrilling and historic. The last edition of the Route du Rhum, the transatlantic solo race from France to Guadeloupe, made yet another addition to its already legendary story. After sailing 6,560 kilometres across the often merciless sea and more than 7 days and 14 hours of the gruelling race, victory was not decided until the final sprint. Just over 7 minutes separated the winner from the runner-up, which is the smallest difference recorded since the 98 seconds of the very first edition of the Rhum in 1978.

Even more so than its sporting suspense, this race will be remembered for its symbolic aspect. It was the scene of an extraordinary battle of generations.

In the main multihull category of maxi-trimarans (32m-long, 23m-wide sea monsters) the latest-generation "flying" boats, capable of skimming over the sea to fly at tremendous speed, lined up for the first time. Among the pilots, the 62-year-old Francis Joyon engaged in a classic duel against 36-year-old François Gabart – the oldest skipper against the youngest.

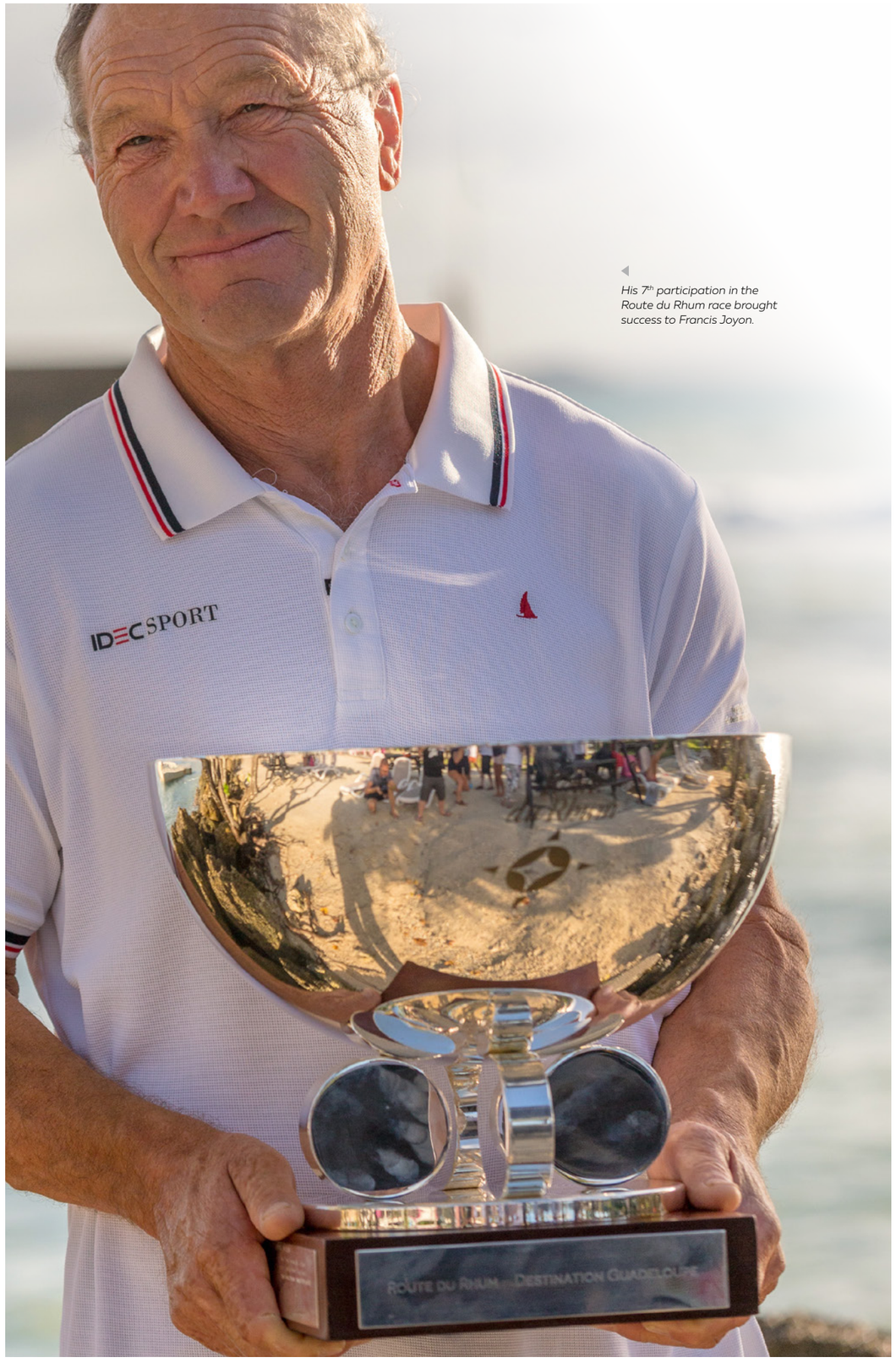
Against all the odds, the elders won. Joyon with his 12-year-old boat – an eternity in technological terms – beat Gabart and his trimaran transformed only a few months earlier. It was an ending worthy of the best adventure stories.

"I deserve no special credit, it's the boat that wins every time!" said Joyon briefly, once he crossed the finish line. IDEC SPORT (navigating under different names for other sponsors) had indeed already won the two previous editions of the Rhum. True to himself, Joyon is too modest (see his exceptional career on page 18). However, the story of his maxi-trimaran evokes the epic tale of Homer's Odyssey.

IDEC SPORT, was created in 2006 by the French naval architectural firm VPLP (Van Peteghem-Lauriot-Prévost) for crewed ocean racing. Its mission: to set new records. Their ambition was well founded, since VPLP boats have won all the Rhum races since 1990, as well as an America's Cup, an English Transatlantic race, 6 Jacques-Vabre transatlantic races and 5 Jules Verne Trophies !

In 2010, the maxi-trimaran, called Groupama 3 at the time, underwent modifications so that it could be manoeuvred single-handedly. It brought success: Frank Cammas won the Rhum that year. In 2013 it was purchased by Banque Populaire and became Maxi Solo Banque Populaire VII. Loïck Peyron won the Rhum in 2014, setting, at the same time, a new record (7 days, 15 hours and 8 minutes). The runner-up was Francis Joyon (which was his best result after finishing 6th in 2010).

At that time, Patrice Lafargue, IDEC Group's CEO, had just started thinking about a new objective: how to help Joyon become the very first skipper to beat the round-the-world solo AND crewed records. The solo record had been done (Joyon beat it in 2004 and 2008), but he had to win the Jules Verne Trophy for the crewed record. What if the boat that had just come to win the Rhum, originally designed for crewed racing, was THE ideal boat ? *(Contd. on page 10)*



His 7th participation in the Route du Rhum race brought success to Francis Joyon.

© JM LIOT / ALEA / IDEC SPORT

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IDEC GROUP, IDEC SPORT... AND LEMO

In 2002 the IDEC Group, a global player in the real-estate market, was one of a group of companies sponsoring Francis Joyon in his 4th Route du Rhum race. The navigator's boat, like many other competitors', had run into problems and unfortunately capsized only 48 hours after the start of the race (only 3 out of the 18 competitors in the same category have crossed the finish line). He was left stranded for five days before being rescued.

© JM LIOT / ALEA / IDEC SPORT

Television cameras were filming the helpless sailor and his stricken craft, which predominantly displayed the IDEC Group logo placed on the inner bows of the 60-ft trimaran. This caught the eye of IDEC's CEO (and racing driver) Patrice Lafargue. Soon after, the two men met in person for the first time and there was an instant connection between them. It wasn't long before the Group launched a lead sponsorship deal with Francis Joyon in his new record-breaking projects across the world.

In 2015 Patrice Lafargue bought the car racing team he had previously driven for, four years earlier at the legendary 24 Hours of Le Mans race. IDEC SPORT now includes both Sailing and Racing.

Since 2017, the hull and sails of IDEC SPORT have born the logo of another group passionate about technological and sporting performance – LEMO. The start of a successful journey. ■

For sure, the trimaran had been built more than 8 years earlier, which is a considerable age in the technological world of ocean racing. However, there were also many strong arguments in its favour. *"This is a well-built boat"* explains Fabrice Thomazeau, Marketing & Communications Director of the IDEC Group, who has always been passionate about sailing. *"She is very well designed and has achieved outstanding results. For us, it still had great potential."*

Buying a boat costs less than building a new boat from scratch (the IDEC Group has already bought two and built one in 2006). *"This way, we could have it immediately, whereas we'd have had to wait for 2 years to build a new one"*, explains Thomazeau.

The decision to purchase the boat was made. Ahoy Jules Verne Trophy 2015 !

The boat was renamed IDEC SPORT and spent several weeks in the shipyard in autumn 2015. As usual, Joyon stripped it down to the essentials, making it lighter and more simple. There was a forest of ropes on the deck and he had half of it taken away. The rigging (used for manoeuvring the sails) was also made less complex. Out of the two masts that came with the boat, Joyon kept the "small" one (no less than 33.5m long) that Frank Cammas had chosen for his solo race.

The skipper also went for another option that Frank Cammas had introduced, which is so unique that it became the emblem of the boat: a bicycle. Yes, a real bicycle, complete with its wheels, saddle, handlebars and gears. It was taken off after the Route du Rhum 2010, but Joyon reinstalled it for the 2018 race. Fixed onto

© JM LIOT / ALEA / IDEC SPORT

With the bike, it is possible to hoist the sails using leg power, rather than only your arms.

the aft deck, the bike is linked to the winches, usually operated with hand pedals that the sailors turn full speed to hoist or take down the sails. Such "pedalling" can take ages, explains Joyon. *"Sometimes as long as 45 minutes for a gennaker, from the moment it is in the bag to being installed. It takes enormous amounts of energy. We are very happy to be able to finish the winching with the bike, by leg power, when our arms simply can't go on! Not to mention the significant time-saving."*

These transformations make IDEC SPORT less versatile than some "full size" maxi-trimarans, for instance for light winds. At the same time, they make it lighter and more ergonomic, similar to boats intended for single-handed racing. *(Contd. on page 12)*

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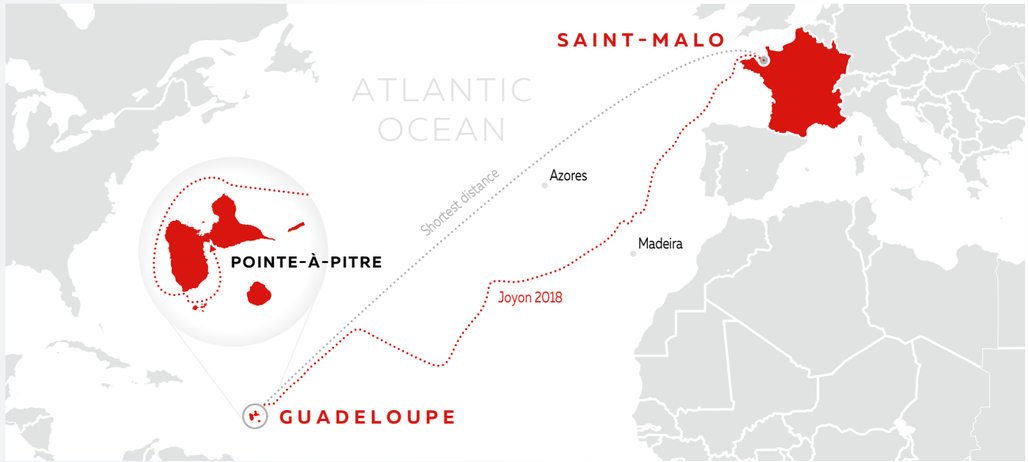
ROUTE DU RHUM, A LEGENDARY TRANSATLANTIC RACE



DISTANCE
3542 MILES (6560 KM)

RECORD
7 D 14 H 21 MIN 47 S (JOYON, 2018)

For Francis Joyon, solo or crewed round-the-world tours present the greatest human and sporting challenges a sailor could ever encounter. However, the Route du Rhum is a legendary race, a temptation which this ocean lover cannot resist.

"There is a kind of magic that surrounds the start in Saint-Malo and the arrival glowing in the light of the Caribbean islands, which lures you into the race", explains Joyon *"and to return in spite of the terrible moments we also experience."*

The Route du Rhum was created in 1978 and has been held every four years since, always along the same route. The Canadian Mike Birch won the first race in 23 days, by a narrow margin of only 98 seconds.

When it was created, the Route du Rhum proved the supremacy of multi-hulls over mono-hulls. Forty years later, the 2018 race marked the beginning of a new era, that of "flying giants". One record was broken even before departure, with 123 competitors from 11 different countries lined up to take part across the 6 categories.

Competitors face an immense challenge.

Although the Rhum reaches its climax in the mild, sunny Caribbean climate, it departs during the European winter. Early November is probably the worst time to set sail through the English Channel. Past the southern tip of Brittany, you need to cross the Bay of Biscay, which can be particularly treacherous during this season. The 2018 competitors know all about the challenges they will face.

Then comes THE decisive moment in the race, when you set your course towards the west on the "highway of trade winds". If you take this direction early on, the distance will be shorter, but the strong winds make the journey more dangerous. If you travel further south, to ride the southwestern winds of the Azores, the route is less risky, but slower and longer.

Then follows the diagonal crossing of the Atlantic. Trade winds vary, sometimes they make one trajectory better, then another. The sailor, helped by his navigators (see page 20), has to decide which one to choose to benefit most from the wind direction.

As they approach Guadeloupe, the different routes chosen by competitors start to converge. Then comes the ultimate challenge: competitors have to sail around the island from the north and then from the west to cross the finish line in Pointe-à-Pitre.

In the 40 years' history of the Route du Rhum, only one edition (2002) didn't break the previous record. This winter, the journey took Francis Joyon one third of the time set by Mike Birch in 1978, proving the extraordinary technical development that boats have gone through in the past 40 years. ■

It wasn't only the boat's equipment that was limited to the essentials. The crew was reduced to 6 instead of the usual 10, which is a lot lighter and easier to manage, following a decision taken by the skipper.

Test sailing in the Southern seas in late 2015, with several records in view, confirmed that the choices taken were the right ones. On 22nd November IDEC SPORT set sail in an attempt to win the Jules Verne Trophy and to beat the record set by Loïc Peyron of 45 days, 13 hours and 42 minutes. Sadly, Joyon failed: it took him two days longer.

The following year, after some more successful navigating in the Southern seas, he gave it another try. After a bad start (damaged daggerboard), IDEC SPORT set sail again on 16th December. This time, the round-the-world tour was successfully completed on 26th January 2017: Joyon's "mini-crew" beat the Jules Verne Trophy record by 5 days, in a time of 40 days, 23 hours and 30 minutes. The skipper has indeed become the first sailor to beat both the solo and crewed world records, which was a tremendous accomplishment.

The IDEC SPORT team then thought it was time to focus on their next target: a legendary single-handed transatlantic race Joyon had participated in six times already, without success.

Three years had passed since the last Route du Rhum. In a year's time, wouldn't the boat be too old to win a third Rhum in a row? Wouldn't Joyon himself be too old to win his first one?

Both of them seemed to show signs of age with the arrival of the flying maxi-trimarans, which hadn't participated in the 2014 race. Designed by naval architectural firms (among them the key player VPLP), this new generation has kept the same dimensions. On the other hand, their performance has skyrocketed with the addition of foils, these "skis" that hoist their 10 tons plus out of the water. As a consequence, water drag is drastically reduced, which enables unprecedented speed: up to 46 knots (85 km/h).

These flying machines have become the new Lords of the sea. The Route du Rhum 2018 was supposed to be the beginning of their reign.

However, they did not weaken Joyon's resolve in any way.

During winter 2017-2018, IDEC SPORT underwent its most extensive transformation since its launch. Still in accordance with its ascetic skipper's mantra: *"do a lot with little"*.

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The platform that had enabled the vessel's outstanding achievements was left untouched. Major changes were made to the rigging (the superstructures). Mainsail carriages and guideways were changed and lightened. The number of sails was limited to five – half of what boats competing in the Vendée Globe (famous solo mono-hull round-the-world race) use. It makes the boat much lighter and you spend *"much less time changing them"*, highlights Joyon.

There was also a lot of *"time-consuming finetuning"*, adds the skipper. The diameter of the ropes was reduced for example, in order to lessen friction on halyards and lines as well as weight. This may seem insignificant for a boat that still weighs 15 tons at the start line (which is more than the latest maxis), but every detail counts.

The inside of the main hull is hardly used during a solo race, the skipper's living quarters are limited to the helm and a small cabin protected by a simple plastic sheet.

Unsurprisingly, the IDEC SPORT team focused on the foils that make the new boats "fly".

Must they copy the latest maxis to be able to compete on equal terms with their rivals? *"Of course not"* was the immediate decision taken by Joyon and his team. It seemed way too costly and risky. At high speed, the forces (the boat's weight, wind, water) acting on the delicate foils are gigantic. All of this had not been sufficiently tested and measured. The data were still too recent and the limits too unclear.

Therefore, the team kept the original smaller foils. However, their edges and curves were improved, increasing their load-bearing capacity by 30%.

Joyon added a tail unit on the rear of the floats, horizontal to the rudders (it now looks like an upside down "T"). This way, the foils hoist the bow and the rear "sits back" on the rudders. The main hull doesn't completely lift out of the water, unlike the "flying" maxis, but it is greatly lightened.

© JM LIOT / ALEA / IDEC SPORT

In a nutshell, IDEC SPORT does not fly, it *"flutters"* – says Joyon. Calculations, drawings, production, installation, tests and adjustments: the IDEC SPORT team spent months working on the rudders. The end result was nothing grand or revolutionary, as Joyon fully accepts : *"Our foils and rudders do not present any major technological breakthrough, but rather an interesting compromise that brought about substantial improvement to the boat."*

The team had too little time to collect the data necessary to fully understand the changes. However, test sailing during the summer of 2018 was encouraging: *"Clearly, the boat sails faster in all points of sail."*

"What I like most is that we managed to keep it simple. The boat hasn't become like a labyrinth. With a few small tricks, we can easily adjust the incidence of foils single-handedly and adapt very quickly to the changes in the sailing conditions."

Through this simplicity, IDEC SPORT can challenge the flying boats, although they are inherently faster. Another advantage: the "reasonable" alterations that Joyon himself conducted did not compromise his thorough knowledge of the boat. He steered it on all the seas, including two round-the-world races. He can interpret every vibration, every whisper. All this can be of crucial importance.

Most importantly, a compromise on performance was made for the benefit of ruggedness. Joyon knew that the flying trimarans were more fragile. Prior to the race, he sounded like a warning to his rivals (reported by "Le Monde"): *"I have the most powerful boat in the fleet, designed to sail through the roaring forties and furious fifties!"*

At last, the big day arrived. The 11th Route du Rhum, 40 years after its first edition, set sail on 4th November 2018, in front of a crowd of tens of thousands of people in Saint-Malo (France). The weather and the sea were to be rough as usual during this period in the North Atlantic.

Soon enough, it became obvious: Joyon and his team were perfectly right.

The Bay of Biscay – exactly where Joyon discovered and learnt sailing – was swept by a depression. Then by a second and a third. Winds gusting up to 100km/h, raising 5m-high waves. The young flying maxi-trimarans didn't make it through without damage.

After an impressive start, Sébastien Josse's maxi-trimaran the Edmond de Rothschild, launched in 2017, lost 8m of its starboard float that broke off after only 24 hours of racing. A break in the structure forced Thomas Coville and his boat the Sodebo Ultim to reroute and head towards the north of Spain. Armel Le Cléac'h dropped out in the Azores, his Maxi Banque Populaire IX having capsized because of a damaged float.

François Gabart's Macif and Francis Joyon's IDEC SPORT, have made it through the Bay of Biscay and were racing way ahead of the other 121 competitors. That's how the Atlantic crossing started.

36-year-old Gabart took off. He managed to amass a 200 nautical miles (370km) lead over the older Joyon. However, the Macif team had been hiding a secret (that was going to be revealed only shortly before arrival): his boat was also severely damaged during the depressions in the Bay of Biscay. The maxi had lost its starboard float and part of its rudder. He was like an injured cheetah, with his condition steadily worsening.

Being alone at the helm of a 30-metre racer means a sea of happiness to Joyon.

At the age of 62, Joyon shows the perseverance of an extreme sportsman during the 7,5-day race.

Image © JM LIOT / ALEA / IDEC SPORT

On the other hand, IDEC SPORT was in good health. It kept up the pace, with regular peaks of over 30 knots (56km/h). Dazzling his team, Joyon steered his maxi-trimaran faster and stronger than he had done with his crew.

Irresistibly, little by little, IDEC SPORT caught up with Macif. Mile after mile, day after day, hour after hour. With rising tension, the observers were exulting.

Whatever happened was absolutely incredible: in the route around Guadeloupe – with the finish line practically in view – Francis Joyon overtook François Gabart! His hard-won victory elicited an abundance of superlatives in the press and with fans.

For professionals, there are lessons learned.

On their website VLPL welcomed yet another victory for the boat they had designed twelve years earlier. Vincent Lauriot-Prévost also mentioned that one shouldn't come to early conclusions about the new generation of maxi-trimarans (among them "their" Macif, Banque Populaire and Edmond de Rothschild) and their reliability. *"Apart from minor exceptions, these boats have very little experience in navigating and they had never experienced such conditions during training. These machines are still in the learning phase".*

After crossing the finish line, an exhausted but happy Joyon made waves in the press.

© JM LIOT / ALEA / IDEC SPORT

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The unfortunate François Gabart, who lost at the very end of the race, was complimented by his older rival.

Interviewed by the journal "Ouest France", Michel Desjoyeaux, a solo racing star and the only skipper having won the Vendée Globe twice, comes to a similar conclusion: *"This class of vessels has progressed way too fast, in one or two years these boats have accelerated by 20 to 30 per cent"* says the skipper who's nicknamed "Professor". "It's as if you had a Formula 1 car, added a turbo and then drove it over the same speed bumps. The car, of course, can break."

Such setbacks are inevitable, says Desjoyeaux: *"We are in a world of competition pushed to the extreme in a hostile environment that we do not control. We do not have a crash test, or a test car. So, we have to go through regression phases to move forward."* Clearly, the delicate balance between performance and reliability, lightness and robustness should be improved. *"It is very difficult to gauge and it's up to the sailors – who know what really happens at sea – to help the engineers and designers with this task."* Joyon succeeded in doing this before the others.

The Route du Rhum 2022 will obviously be a completely different story.

In 4 years, flying maxi-trimarans will have matured, collected and analysed tons of data, improved their initial weaknesses. For sure, one of them will win the 12th Route du Rhum.

In the meantime, Francis Joyon and the maxi IDEC SPORT – with 45 years of ocean racing between the two of them – remain the extraordinary record-holders of the Route du Rhum race. ■

STEERING A STEADY COURSE TOWARDS 6 NEW RECORDS

© JM LIOT / ALEA / IDEC SPORT

The IDEC Group extends over the Asian continent. The group decided to illustrate this adventure, as well as the trading relationships between Europe and Asia, by a grand tour completed with Francis Joyon at the helm of his prestigious maxi-trimaran. The IDEC SPORT Asian Tour programme includes no fewer than six records, 5 of which along new routes.

This intense record-breaking programme will come to a spectacular end via the Route du Thé, having travelled from Hong Kong to London in 2020. Launched in 1990, this route was inspired by the famous 19th-century clippers like the Cutty Sark, who used to race back to London with the new crop of the season in order to gain the highest prices.

The tour also promotes two causes supported by the IDEC Group and their skipper-ambassador. First, the French Brain and Spinal Institute, with 500 experts involved in research on diseases such as Alzheimer's, Parkinson's or multiple sclerosis. Second, "Ocean as common" an initiative for the protection of the oceans fostered by many great skippers. ■

You can follow the tour live on: www.idecsport.com

October 2019

LA MAURICIENNE
Port-Louis (France) – Port-Louis (Mauritius)
Joyon will attempt to beat his own solo record set 10 years ago.

November-December 2019

MAURITIUS –SINGAPORE; SINGAPORE–VIETNAM; VIETNAM–SHANGHAI; SHANGHAI-HONG KONG
Creation of four oceanic routes to set the first reference time for crewed races

January-February 2020

THE ROUTE DU THÉ
Hong-Kong – London
The first reference time on board of a modern trimaran (Phippe Monnet in 1990) was 67 days. The current record that Francis Joyon and his crew will attempt to beat is of 36 days, 2 hours and 37 minutes (Giovanni Soldini on Maserati, 2018).

PORTRAIT OF A RECORD HUNTER

A weather-beaten face with clear blue eyes which narrow to a squint when facing the sun. Calm on land, stoic at sea. The quiet 62-year-old man is very much in the image of a great navigator.

Yet Francis Joyon was born far away from the sea. He comes from a small rural village located about a hundred kilometres south west of Paris. He grew up in the middle of a huge patchwork of farm fields and before him, no one in his family had been a sailor.

By the time he was a teenager, Joyon had developed a great love for nature, large open spaces and fresh air. Maybe this is why he used to go off on cycling trips to explore France with his brother. At 17, a cycling tour took him to the archipelago of Glénan – a group of islands off the Brittany coast that stretch out into the Atlantic. The young man was staying overnight at a youth hostel when he heard about the famous Glénans sailing school. He convinced his mother to pay for him to take part in a two-week course. Joyon loved the experience so much he stayed on as a volunteer for several months. He helped with boat preparation during the day, navigated in the evening and slept in a tent at night.

From that moment, nature, large open spaces and wind have always carried the smell of the sea. The landlubber became a sailor.

HIS RECORDS

2018 ROUTE DU RHUM
(Saint-Malo – Guadeloupe)

2017 TROPHÉE JULES-VERNE,
crewed round-the-world race

2017 NORTH ATLANTIC

2015 INDIAN OCEAN

2014 ROUTE DE L'AMITIÉ
(Bordeaux - Rio de Janeiro)

2013 SOLO NORTH ATLANTIC CROSSING

2013 ROUTE DE LA DÉCOUVERTE
(Cadix - San Domingo)

2012 24-HOUR SOLO RECORD COVERING 666.2 MILES

2009 FRANCE TO MAURITIUS
(set the reference time)

2008 SOLO WORLD TOUR ABSOLUTE RECORD

2007 SOLO CHANNEL CROSSING

2005 SOLO NORTH ATLANTIC CROSSING

2004 SOLO WORLD TOUR ABSOLUTE RECORD

▲ *Joyon : his face marked by past endeavours, his eyes fixed on future records.*

Young Joyon didn't feel at ease as a sailing instructor. He preferred sailing by himself. He left the Glénans to join others navigating on the ocean. He obviously enjoyed adjusting sails to go faster, but he didn't think about racing yet. He'd always been a handyman, so at this point, he decided to train as a ship's carpenter. It was only at the age of thirty that he finally started racing.

Joyon then became a fearsome competitor and dedicated himself to record hunting. In 2004 he beat the solo round-the-world race record by 50 days (!) and last winter he won the Route du Rhum race.

In between there were many, many more (see his track record). He was the first navigator to beat the all-time record of the solo round-the-world non-stop on a multihull. A career that makes him one of the greatest skippers in history.

His nickname "Menhir" does not not only mean that he's a man of few words. During the races, whether they last 7 or 60 days, he's as solid as a rock. He never hesitates to push his limits in terms of sleep or food, provided he can gain some minutes in the race. Still, for his Route de Rhum victory, he swears that this is something that he didn't do. His perseverance, akin to an extreme sportsman, surprises even his wife.

Among his sailing heroes, Joyon mentions Mike Birch (first winner of the Route du Rhum), Philippe Poupon and Yves Pajot. But if he had to name just one, as he says, it would be Bernard Moitessier. Moitessier, the diehard navigator and writer, (whose book he read many times "Vagabond des mers du sud", translated into English as Sailing to the Reefs), is intensity incarnate.

Just like a farmer or a mountain-dweller, Joyon combines his energy and perseverance with a great economy of means. His work philosophy corresponds perfectly with that of his life: make a lot out of a little.

Accordingly, his team is small and his budget is tight. Even when he attempted the crewed round-the-world record (Trophée Jules Verne in 2017), he embarked only 5 men with him, which is half of the usual number. Impossible, the observers had said. Joyon proved the contrary.

Similarly, Joyon prefers recycling to investing in something new. For his first Route du Rhum, for example, he made up a boat with two floats from another boat. He's been navigating on the same boat IDEC SPORT for the past four years, a 12-year-old maxi-trimaran and he controls all its modifications himself.

Economy of means goes with a deep sensibility towards the planet : *"Our carbon footprint isn't too heavy, since we are using something that already exists. We make it live and last, which aligns fairly well with my philosophy. I am more at peace with myself, than by building a new boat from scratch."* The common sense of the sailor and the landlubber. ■

A BOAT LIKE NO OTHER

As with all racing machines, maxi-trimarans are constructed from high-tech materials that are both lightweight and robust. IDEC SPORT's massive hull structure is built from carbon-Nonnex and its sails are made of a seamless, lightweight, highly resistant 3D thermomoulded composite material (North Sails' 3Di).

As for the rest of the craft, the use of technology has been kept to a strict minimum, for both weight saving and regulatory reasons.

The Route du Rhum for example has banned motorised winches, meaning that sails must be human-powered. The only engine on board is a small **fossil-fuelled generator**, which together with **solar panels** and a **wind turbine** powers all of the electrical equipment. What little technology there is on board is fairly basic: an **autopilot** which keeps the boat on course while the skipper is manoeuvring (often) or sleeping (rarely); an **anti-capsizing system** which releases the sheets, if the boat heels too much (the forces involved are similar to those acting on a car speeding at over 200 km/h, everything happens in a matter of seconds); and a **computer** with a dedicated messaging system to communicate with the shore team.

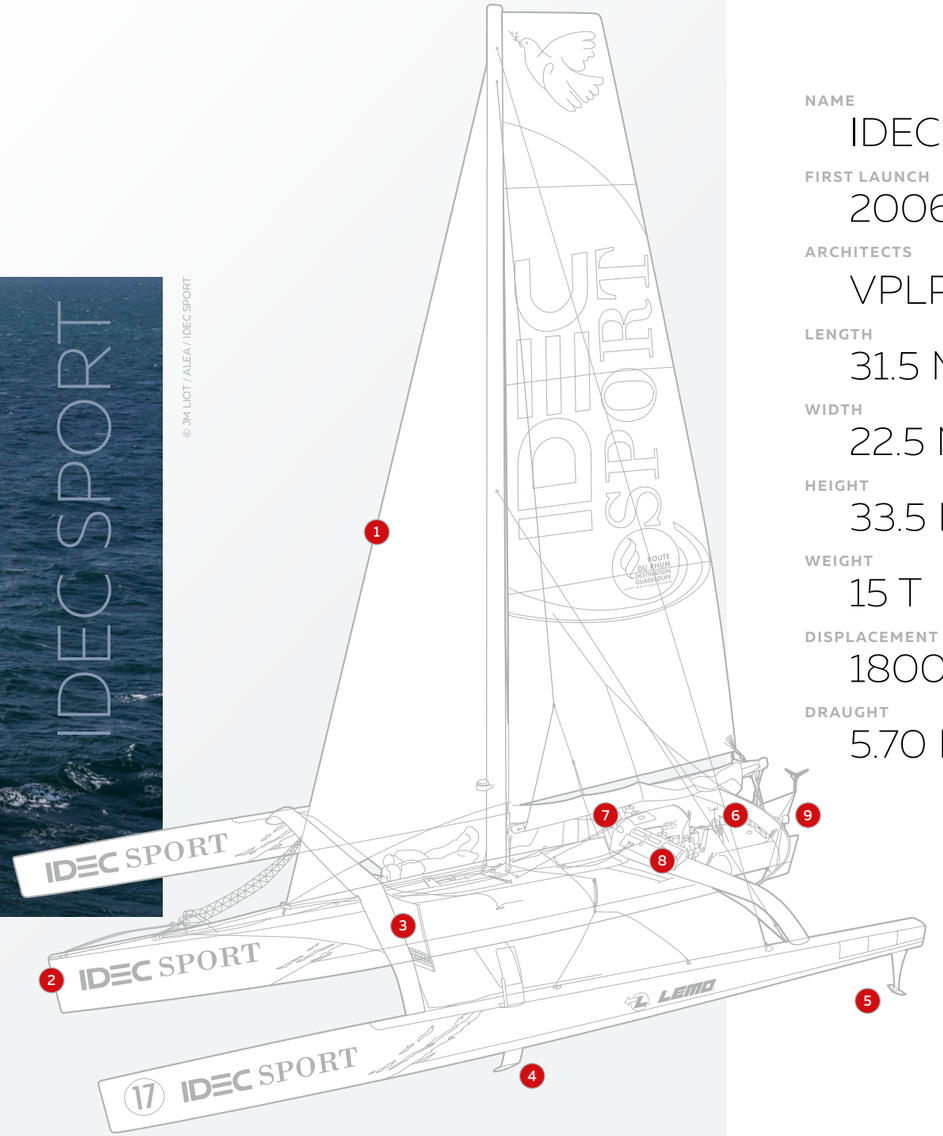
© JM LIOT / ALEA / IDEC SPORT

This legendary maxi-trimaran has inspired the new generation most.

During a competition such as the Route du Rhum, this shore team comprises two navigators (the only assistance allowed which is limited to maxi-trimarans). The navigators analyse and transmit course recommendations based on data retrieved from previous races. In any case, Joyon himself makes all the decisions.

The skipper's quarters are limited to a few square meters, on a tiny surface compared to the size of the boat. Outside, the cockpit with the **helm**, the **navigation instruments** (including those measuring wind speed and direction, given that the boat sails too fast for the skipper to be able to "feel" them). We must not forget the famous IDEC SPORT **bicycle** either, which works the winches using leg power.

In front of the bicycle fixed on the main hull are the spartan living quarters, with no heating and protected only by a simple plastic sheet. It includes a **sleeping berth** (40 cm wide placed on a bedstead), a tiny **"office corner"** and a kitchenette with a small gas **stove** (nothing fancy there; the skipper embarks mostly freeze-dried food). ■



NAME
IDEC SPORT

FIRST LAUNCH
2006

ARCHITECTS
VPLP

LENGTH
31.5 M

WIDTH
22.5 M

HEIGHT
33.5 M

WEIGHT
15 T

DISPLACEMENT
18000 KG

DRAUGHT
5.70 M

1. **SAILS**
For the Rhum, only 5 sails were kept on board.
Upwind sail surface: 411 m2
Downwind sail surface: 678 m2

2. **MAIN HULL**
The crew's living quarters are inside (very rarely used during a solo race).

3. **SOLAR PANELS**
Power on board electronics

4. **FOILS**
Enhanced for the Rhum 2018. They can hoist the boat out of the water.

5. **RUDDERS**
With their new horizontal rear foils, they make the rear of the boat «sit back» on the water. sheet, this is where the skipper eats, sleeps, reads his messages and wind charts.

6. **BICYCLE**
A speciality of IDEC SPORT: it enables winching by leg power.

7. **LIVING QUARTERS**
Tiny, protected by a plastic sheet, this is where the skipper eats, sleeps, reads his messages and wind charts.

8. **COCKPIT**
Outside, at the helm where the skipper spends most of his time.

9. **WIND TURBINE**
Powers on board electronics

A GAME OF THRONES

If you are a bulldozer or tractor operator, a well-designed seat can make all the difference between working and suffering. Companies like KAB specialised in making sure you are sitting comfortably, so that you can work both safely and efficiently.

Working with a construction or a farm vehicle can be very physically demanding. You spend 8 to 10 hours in a small cabin, have to adapt to all weather conditions, on pothole-ridden roads, slippery slopes and potentially dangerous terrain. Above all, you need to stay focused and efficient, in spite of being shaken around like a martini! Very much like astronaut training.

Fortunately, there has been a lot of progress in this field. The wheels or tracks, the structure, the material and vehicle design have all been improved in order to dampen the effect of shock and vibration associated with operating vehicles in harsh environments. The seats are at the very heart of this evolution.

"What's the next thing we can do to make the vehicle more comfortable? That's the question we ask ourselves every day" says Gary Hamberg, CVG Product Line Manager for Off-Road Seating. *"We invest the most in R&D, in terms of both time and money, to answer this question."*

The latest product, SCIOX, is a perfect example of seat evolution, combining many new technologies and great modularity. ©KAB Seating

CONNECTED | #12 | SPRING 2019 |

Occupant comfort has been an area of focus for KAB seating since 1968. The UK company, acquired by the CVG group in 2001, specialises in the design and manufacturing of seats for industrial vehicles. It has earned a prominent position in the field of construction vehicles, from light to heavy duty (in particular in hydraulic excavators). Volvo, Caterpillar and practically all major players in the sector have become its customers. Seats are also sold to small OEMs and for the aftermarket industry.

In a nutshell, the evolution of comfort solutions aims to isolate the operator from the shock and vibration of the vehicle, which are not only exhausting, but also potentially harmful.

Today, KAB and the other seat brands of the CVG group (Bostrom, National, Stratos) have a great asset, a reputation for high performing, durable seats, which has been built up over 50 years. *"Mention our brands,"* says Hamberg, *"and people will tell you about our suspension systems!"*

Positioned underneath the seat, systems developed by KAB now comprise of up to 6 shock absorber axes. *"They not only protect the operator from forward and backward motion, but also up and down and side to side."* Air suspension systems (more efficient, precise and adjustable than traditional mechanical suspensions) initially high-end, have gradually become the standard. Considerable means have also been invested by CVG in the development of integrated, adjustable dampers.

Other parts of the seat are also important comfort-wise. For instance, its form (seat back height, armrest type, etc.) can be optimised for each specific vehicle application. Or its air conditioning (heating, cooling, ventilation) can be integrated in the seat in order to ensure the best possible conditions for the operator's body. *(Contd. on page 24)*

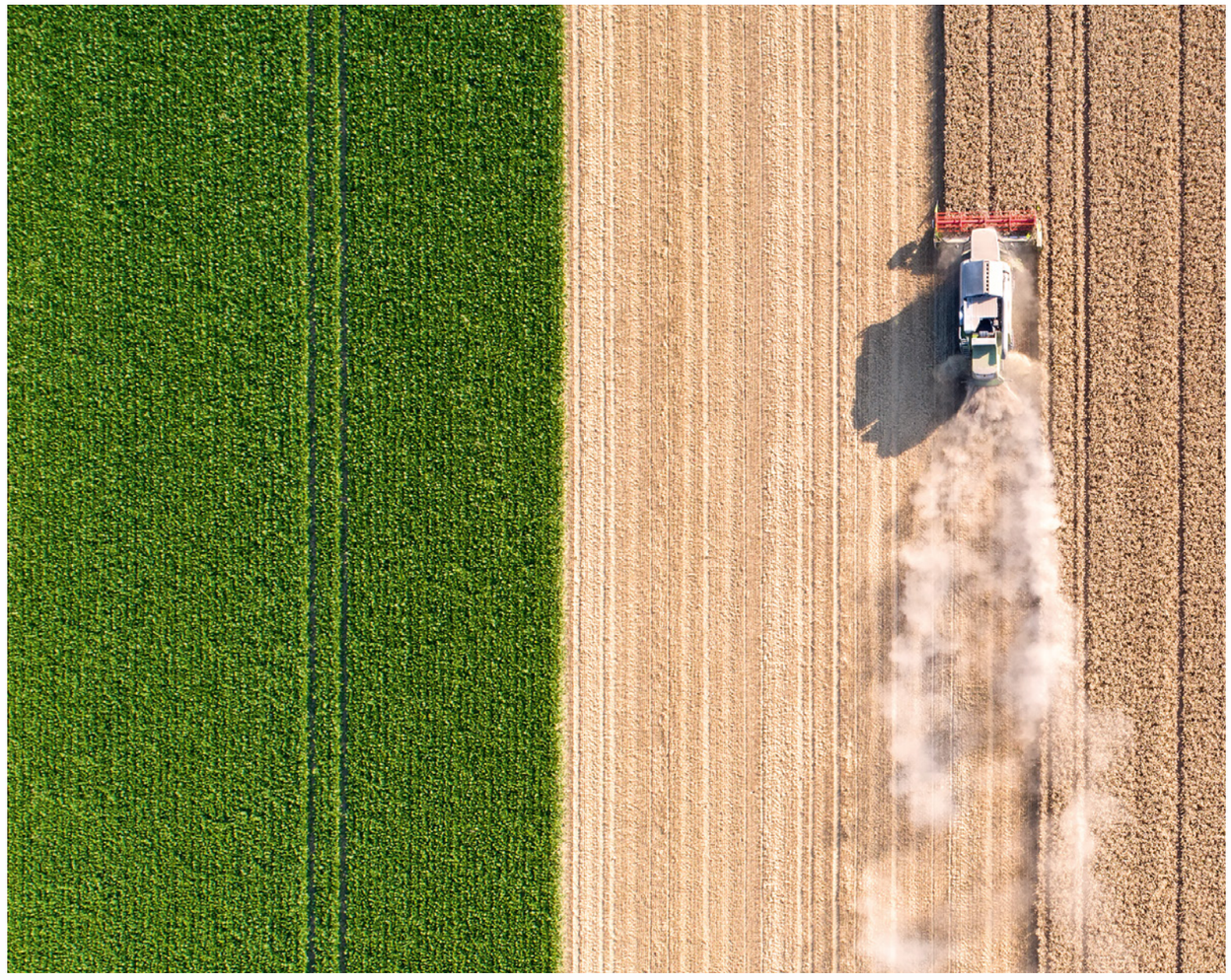
Working with a construction or a farm vehicle can be very physically demanding.

Other integrated functionalities are more to do with health than with comfort, for example lumbar support. Or even more so, active back massage, stimulating blood flow and counterbalancing the operator's long periods of immobility. These technologies are in addition to safety measures, such as OPS, sensors which are capable of detecting the presence or absence of an operator, and in the latter case, shutting down the operation of the vehicle.

All in all, a high-end seat is a true concentration of technology. *"People often don't realize how much is integrated in there."*

For sure, evolution of technology will not stop in the future. Seats will certainly follow the global trend of "always more electronics": automatic adjustment to the operator and his/her working position, personalised seat position and inclination, dampers adjusted according to conditions (roads, construction sites, fields), connection to mobile apps… KAB and the CVG group cater to every requirement. All ideas are weighted according to two criteria.

The first criterion is reliability. Industrial vehicles are expected to last a long time, often several decades and electronics do not withstand dusty and dirty off-road environment for long. The second criterion is price. *"This market is very very cost conscious"* notes Mr Hamberg. Unlike in the automobile industry, there is no place for gadgets or luxury.



© iStock - ollo

In short, it is out of the question to cut back on the benefits of comfort (less fatigue, better productivity) and provide lower reliability or durability. On a construction site, all downtime has a very high cost.

To be able to propose competitive prices and to meet the extremely varied requirements of its customers, KAB Seating has been focusing on providing modular solutions. *"Our range of products relies on a common base model. Customers can select the standard model or go all the way up to the Premium. They do not pay for unnecessary options."* This applies to the choice of materials (from black cloth to leather with coloured twin stitching) or functionalities (seat height, armrests, massage system, etc.)

In case, after having read this article, you feel like sitting in a KAB seat, the good news is that you do not necessarily need to climb into a bulldozer or a tractor. The brand sells office chairs as well. These chairs occupy a niche market suitable for up to 24-hour use for high usage environments, whether users work on a construction site in Rio or in the Corn Belt, a call centre in Mumbai or an office in the City of London. Across both industrial and office, the user needs are satisfied in the same way, offering the best possible comfort to those who have to remain seated for long periods of time. ■

NORTHWIRE & CVG TEAM UP WITH HEAVY EQUIPMENT MANUFACTURERS

Through KAB and its other specialised brands, Commercial Vehicle Group (CVG) manufactures hundreds of thousands of seats and other component systems every year. The vast majority are intended for intensive use like trucks and school buses, or heavy-duty applications, such as construction vehicles, tractors, military land vehicles.

These extreme conditions put a great strain on various systems. Therefore, CVG requires particularly robust and reliable interconnection solutions. They have found in Northwire, LEMO's US cable manufacturer, a solution provider specialised in such environments, combining expertise, innovation and responsiveness.

"CVG's commitment to provide the best possible engineering service has truly become a group effort with Northwire", says Jason Cornwall, a lead application engineer for CVG. *"Northwire's willingness to collaborate and educate CVG engineers about cable design has greatly improved CVG's ability to provide our customers with value engineering in cost reduction projects and with new product development."*

Projects they have successfully partnered on for global off-road heavy equipment manufacturers include retractile cables for joysticks in construction equipment, diesel, fuel and chemical resistant wire and cable for camera harnesses and numerous other extreme environment applications where superior performance is required. ■

A NEW DIMENSION OF METROLOGY

Verifying a component's physical accuracy is a process carried out by dimensional measurement in production, an application of metrology. It is also the primary field of expertise of TESA, a global leader founded in 1941. Interview with a micron hunter.

You will often find a TESA logo in production plants and quality control workshops. The Swiss brand is synonymous with high quality measuring instruments – from micrometers and calipers to inductive probes and the iconic height gauges. It has helped manufacturers for almost 80 years to verify lengths, widths, diameters and inter-axles, angles and curves as well as the surface quality of their parts.

TESA has never stopped innovating, launching devices that have remained unsurpassed. This is especially the case with IMICRO (a hand tool measuring the diameter of through-holes): launched in 1950, it has never been matched by the competition and is still a TESA bestseller - a clear sign of know-how in micromechanics and machining, but also of a certain trend in the sector. *"It is true that part of our field is rather conservative"* confirms Blaise Vuille, Technical & Business Development Director. *"Some analogue products are based on processes that we designed over 50 years ago. It is quite common for our instruments – hand instruments to start with – to be used for several decades ! This is excellent for TESA's reputation, but less so for our turnover."* Given that a micron stays a micron, who needs a new instrument to measure it? *"Industrial metrology had to be rethought in order to find new business models."*

The role of metrology had to be redefined, says the expert. *"20 years ago, our instruments were mostly used for checking product quality at the end of the production chain. Today, quality management is progressively integrated into every production phase and we help companies to do so."*

This new extension of services is exactly what Hexagon specialises in. The Swedish group (with a global staff of 18,000 employees) acquired TESA in 2001. *"Through its applications,*

The latest generation of MICRO-HITE, TESA's iconic height gauges. © TESA

Hexagon is capable of simulating the entire production and control chain in order to validate, at each production phase, that the reference quality is met."

It can contribute to the design of parts by defining the relevant quality levels (overstated quality requirements are unproductive!), in order to identify the machines best suited to perform a task to the required standard and carry out the appropriate measurements, etc. With every optimisation, the process becomes smoother and the production time shorter, with fewer errors and less material wasted.

"This is the mission of today's metrology", concludes Vuille,: *"to offer custom solutions that enhance product quality, but also and above all, that improve the efficiency of companies."*

Global quality integration is primarily based on data collection. The time is long gone when an operator performed a measurement and jotted down the results in a notebook. *"An increasing number of our instruments are designed to be connected."* explains Vuille. *"Data can be automatically transferred to an acquisition centre, which ensures better traceability of measurements and so improved management of quality control workshops. It also helps to detect any irregularities and utilises statistical process control to anticipate errors and provide the means of feeding back machine adjustments via a closed-loop production system. Services, data, software, industry 4.0. This is the part of metrology offering the most opportunities for innovation."*

Integration into the Hexagon group has allowed TESA to diversify and has enabled it to contribute to innovative technologies, extending its traditional portfolio. For example, the probe heads and non-contact sensors used on the Hexagon coordinate measuring machine, multisensory and optical CMMs. These "in-house" (the TESA brand does not appear) activities have grown in importance. *"Today 50% of our production is dedicated to sensors that equip measurement machines from the Hexagon group."*

However, TESA has not given up its own historic share in the market sector (still 60% of its turnover). It continues developing its instruments, but not just by making them connectable. The greatest effort is being made to simplify their use, for an obvious reason: *"There are fewer and fewer metrology professionals in workshops and the responsibility for taking measurements is being taken over by production operators. Therefore, we have to make it as simple as possible to limit errors to a maximum extent."*

The last generation of MICRO-HITE, a range of vertical measurement devices launched initially in 1981 is a good example. TESA fitted it with several technologies (positioning aids, touch-screen, interface clarification) which makes it easier for the operator to handle and read the results.

A micron will always stay a micron, but in this world of infinite precision, the human factor remains intolerably uncertain. ■

Launched in 1950, the internal micrometer IMICRO is still a bestseller. © TESA

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TESA IN 15 DATES

1941 Creation of the **TESA** brand and of the company Téléphonie SA, in the Lausanne area (Switzerland)

1941 **TESA Minmetal**: The first measurement instrument associating the newly created brand with metrology, this micrometer has been a true commercial success

1945 The company is renamed **TESA SA**

1950 Creation of **IMICRO**, the iconic diatest

1957 Creation of **TESAMASTER**, a micrometer equipped with a unique reading system

1967 Acquisition by the US **Brown & Sharpe**

1970 First application of electronics in sensors detecting differences of a few hundredths of microns

1977 **TESA DIGIT-CAL**, the first electronic caliper with digital display

1981 **TESA MICRO-HITE**, the first computer aided measurement column, equipped with a control panel

1989 Creation of the **first laser interferometer** commercialised in the UK

2001 **Brown & Sharpe** acquired by the **Hexagon group**

2002 **TESASTAR**: TESA launches its first sensor for 3D machines

2006 First motorised probe heads integrated into Hexagon machines

2012 Launch of a range of **inductive wireless sensors**

Today **TESA** commercialises over **3000 measurement instruments and systems**

ROBOTIC ANIMAL AGILITY

Packed with sensory systems and equipped with revolutionary joints, the ANYmal robot is perfectly at ease on even the roughest terrain. It will soon be ready to inspect industrial sites, sewage systems and minefields with complete autonomy.

An off-shore wind power platform, somewhere in the North Sea, on a freezing cold night, with howling winds and waves crashing against the impressive structure. An imperturbable ANYmal is quietly conducting its inspection.

ANYmal, a medium sized dog-like quadruped robot, walks down the stairs, lifts a "paw" to open doors or to call the elevator and trots along corridors. Darkness is no problem: it knows the place perfectly, having 3D-mapped it. Its laser sensors keep it informed about its precise path, location and potential obstacles. It conducts its inspection across several rooms. Its cameras zoom in on counters, recording the measurements displayed. Its thermal sensors record the temperature of machines and equipment and its ultrasound microphone checks for potential gas leaks. The robot also inspects lever positions as well as the correct positioning of regulatory fire extinguishers. As the electronic buzz of its engines resumes, it carries on working tirelessly.

After a little over two hours of inspection, the robot returns to its docking station for recharging. It will soon head back out to conduct its next solitary patrol.

ANYmal played alongside Mulder and Scully in the "X-Files" TV series*, but it is in no way a Hollywood robot. It genuinely exists and surveillance missions are part of its very near future.

** « X-Files », season 11, episode 7, aired in February 2018.*

ANYmal can check whether everything is in its place, read counters, check for gas leaks or abnormal temperatures.
© ANYbotics

CONNECTED | #12 | SPRING 2019 |

This quadruped robot was designed by ANYbotics, a spinoff of the Swiss Federal Institute of Technology in Zurich (ETH Zurich). Made of carbon fibre and aluminium, it weighs about thirty kilos. It is fully ruggedised, water- and dust-proof (IP-67). A kevlar belly protects its main body, carrying its powerful brain, batteries, network device, power management system and navigational systems.

ANYmal was designed for all types of terrain, including rubble, sand or snow. It has been field tested on industrial sites and is at ease with new obstacles to overcome (and it can even get up after a fall). Depending on its mission, its batteries last 2 to 4 hours.

On its jointed legs, protected by rubber pads, it can walk (at the speed of human steps), trot, climb, curl upon itself to crawl, carry a load or even jump and dance.

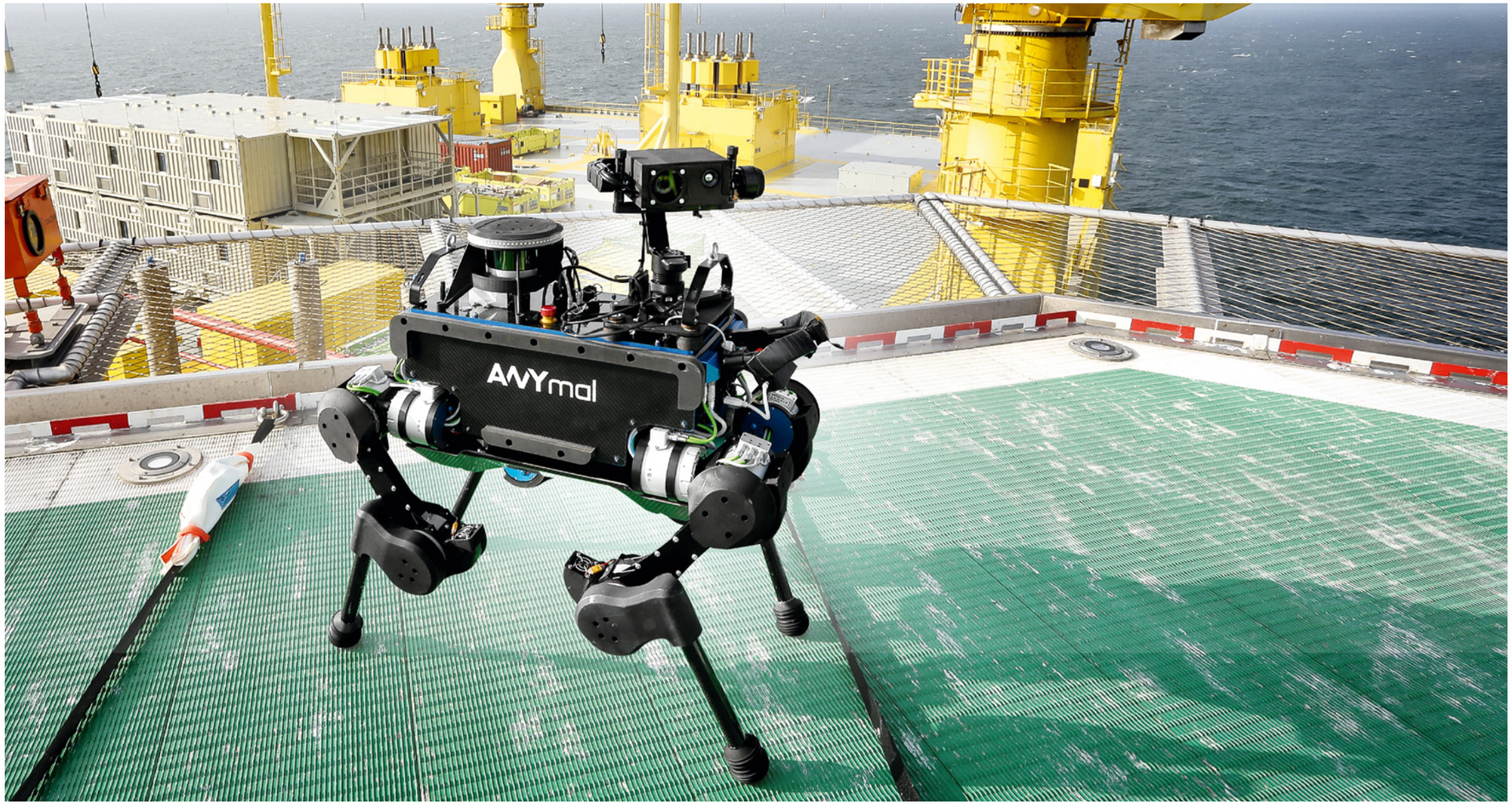
It is the need to move on all surfaces that has driven its designers to choose a quadruped. *"Biped robots are not easy to stabilise, especially on irregular terrain"* explains Dr Péter Fankhauser, co-founder and chief business development officer of ANYbotics. *"Wheeled or tracked robots can carry heavy loads, but they are bulky and less agile. Flying drones are highly mobile, but cannot carry load, handle objects or operate in bad weather conditions. We believe that quadrupeds combine the optimal characteristics, both in terms of mobility and versatility."*

What served as a source of inspiration for the team behind the project, the Robotic Systems Lab of the ETH Zurich, is a champion of agility on rugged terrain: the mountain goat. *"We are of course still a long way"* says Fankhauser. *"However, it remains our objective on the longer term."* *(Contd. on page 30)*

© ANYbotics

LEMO OUTDOORS

Designed to move around autonomously on all types of terrain, ANYmal requires ruggedised, sealed and extremely reliable interconnection solutions, which do not limit the robot's mobility. *"LEMO was an obvious choice"*, says Fankhauser. ANYbotics selected several connector models for all external connections (legs, sensors, power and communication). ■



The first prototype, ALoF, was designed already back in 2009. It was still rather slow, very rigid and clumsy – more of a proof of concept than a robot ready for application. In 2012, StarlETH, fitted with spring joints, could hop, jump and climb. It was with this robot that the team started participating in 2014 in ARGOS, a full-scale challenge, launched by the Total oil group. The idea was to present a robot capable of inspecting an off-shore drilling station autonomously.

Up against dozens of competitors, the ETH Zurich team was the only team to enter the competition with such a quadrupedal robot. They didn't win, but the multiple field tests were growing evermore convincing. Especially because, during the challenge, the team designed new joints with elastic actuators made in-house. These joints, inspired by tendons and muscles, are compact, sealed and include their own custom control electronics. They can regulate joint torque, position and impedance directly. Thanks to this innovation, the team could enter the same competition with a new version of its robot, ANYmal, fitted with three joints on each leg.

The ARGOS experience confirms the relevance of the selected means of locomotion. *"Our robot is lighter, takes up less space on site and it is less noisy"* says Fankhauser. *"It also overcomes bigger obstacles than larger wheeled or tracked robots!"* As ANYmal generated public interest and its transformation into a genuine product seemed more than possible, the startup ANYbotics was launched in 2016. It sold not only its robot, but also its revolutionary joints, called ANYdrive.

Today, ANYmal is not yet ready for sale to companies. However, ANYbotics has a growing number of partnerships with several industries, testing the robot for a few days or several weeks, for all types of tasks. Last October, for example, ANYmal navigated its way through the dark sewage system of the city of Zurich in order to test its capacity to help workers in similar difficult, repetitive and even dangerous tasks. Soon it will be tested in one of Poland's copper mines.

Why such an early interest among companies? *"Because many companies want to integrate robots into their maintenance tasks"* answers Fankhauser. *"With ANYmal, they can actually evaluate its feasibility and plan their strategy. Eventually, both the architecture and the equipment of buildings could be rethought to be adapted to these maintenance robots".*

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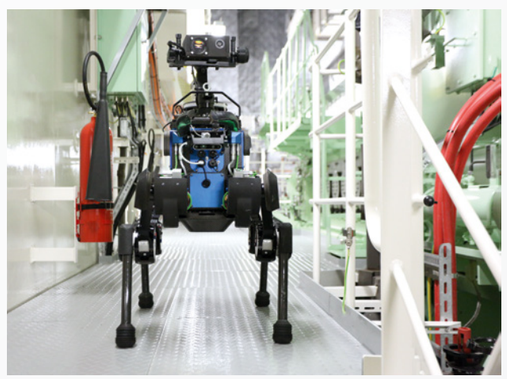
Off-shore oil platforms, the first test fields and probably the first actual application of ANYmal.

Through field demonstrations and testing, ANYbotics can gather masses of information (up to 50,000 measurements are recorded every second during each test!) *"It helps us to shape the product."* In due time, the startup will be ready to deliver a commercial product which really caters for companies' needs.

Inspection and surveillance tasks on industrial sites are not the only applications considered. The startup is also thinking of agricultural inspections – with its onboard sensors, ANYmal is capable of mapping its environment, measuring bio mass and even taking soil samples. In the longer term, it could also be used for search and rescue operations. By the way, the robot can already be switched to "remote control" mode at any time and can be easily tele-operated. It is also capable of live audio and video transmission.

The transition from the prototype to the marketed product stage will involve a number of further developments. These include increasing ANYmal's agility and speed, extending its capacity to map large-scale environments, improving safety, security, user handling and integrating the system with the customer's data management software. It will also be necessary to enhance the robot's reliability *"so that it can work for days, weeks, or even months without human supervision."* All required certifications will have to be obtained. The locomotion system, which had triggered the whole business, is only one of a number of considerations of ANYbotics. *(Contd. on page 32)*

Small in size, ANYmal can make it through anywhere a human can, such as stairs.



Designed for extreme environments, for ANYmal smoke is not a problem and it can walk in the snow, through rubble or in water.
© ANYbotics

The startup is not all alone. In fact, it has sold ANYmal robots to a dozen major universities who use them to develop their know-how in robotics. The startup has also founded ANYmal Research, a community including members such as Toyota Research Institute, the German Aerospace Center and the computer company Nvidia. Members have full access to ANYmal's control software, simulations and documentation. Sharing has boosted both software and hardware ideas and developments (built on ROS, the open-source Robot Operating System). In particular, payload variations, providing for expandability and scalability. For instance, one of the universities uses a robotic arm which enables ANYmal to grasp or handle objects and open doors.

Among possible applications, ANYbotics mentions entertainment. It is not only about playing in more films or TV series, but rather about participating in various attractions (trade shows, museums, etc.). *"ANYmal is so novel that it attracts a great amount of interest"* confirms Fankhauser with a smile. *"Whenever we present it somewhere, people gather around."*

Videos of these events show a fascinated and sometimes slightly fearful audience, when ANYmal gets too close to them. Is it fear of the "bad robot"? *"This fear exists indeed and we are happy to be able to use ANYmal also to promote public awareness towards robotics and robots."* Reminiscent of a young dog, ANYmal is truly adapted for the purpose.

However, Péter Fankhauser softens the image of humans and sophisticated robots living together. *"These coming years, robots will continue to work in the background, like they have for a long time in factories. Then, they will be used in public places in a selective and targeted way, for instance for dangerous missions. We will need to wait another ten years before animal-like robots, such as ANYmal will share our everyday lives!"*

At the Consumer Electronics Show (CES) in Las Vegas in January, Continental, the German automotive manufacturing company, used robots to demonstrate a last-mile delivery. It showed ANYmal getting out of an autonomous car with a parcel, climbing onto the front porch, lifting a paw to ring the doorbell, depositing the parcel before getting back into the car. This futuristic image seems very close indeed. ■

CONGRATULATIONS, WORLD CHAMPION!

To become a leader takes talent, determination and hard work. To remain at the top level requires twice as much effort. We know it, snowboarder SELINA JOERG knows it too. She has already participated in 3 Olympic Games, winning a silver medal in Pyeongchang last year. This February in Park City (USA), she became World Champion in parallel giant slalom. We are very proud to have her as our ambassador.

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1969 – A GIANT LEAP FOR LEMO

50 years ago, Neil Armstrong wasn't the only one taking some important steps. In early December of that year, LEMO first set foot in Germany and this new subsidiary was to become one of the largest in the Group.

It's 1969: the world is in the midst of the Cold War and Germany is at the very heart of the political turbulence. The country is geographically divided in two and so is its old capital city Berlin. However, Western Germany remains a promising market. This is why LEMO decides to join forces with its distributor Megatron to create LEMOSA GmbH in Munich.

Among the first customers there were a number of big names, such as Krautkrämer, a global leader in industrial ultrasonic inspection and General Electric (who would go on to acquire Krautkrämer in 2004).

During the seventies, LEMO started to supply the growing German civil nuclear industry with radiation resistant S series connectors. Since the late eighties, LEMO has entered the most iconic German market: the automobile industry. *"We are not inside the cars, but everywhere around them!"* says Wilfried Mathemeier, director of LEMO Germany and LEMO Austria. "Around" meaning, for instance, prototype test or manufacturing equipment.

The current headquarters were inaugurated in 2001.

The automotive industry has remained the company's biggest market. However, there are now many more. *"Every year LEMO launches new connectors, which opens up new applications and markets and addresses new competitors."* LEMO can count on 5,000 regular customers (buying every year) in Germany and Austria, from a wide range of industries.

The German subsidiary, with its vast inventory, is also serving Austria. Both markets are experiencing solid growth. Germany is one of the two biggest markets for LEMO, in equal position with the USA. Despite its small size, Austria generates a relatively significant turnover, with an annual increase of 6-8% during these last few years.

As a major subsidiary, LEMO Germany is a full-service provider, supplying LEMO, REDEL and COELVER connectors. *"We have a vast inventory of components and we ship 60% of our connectors unassembled"*, says Mr Mathemeier. *"Our customers often prefer to assemble the connectors themselves."*

What really distinguishes the German subsidiary is the importance of its cable business. It is the only LEMO subsidiary acting as a cable distributor – buying and reselling them, many years before the Group acquired US cable manufacturer Northwire in 2014.

"We have kept our own cable inventory since the early eighties", confirms Mr Mathemeier. *"We sell them by the metre to our customers as well as to LEMO subsidiaries."*

They are obviously not just ordinary cables, but high quality and specially selected to perfectly fit all the LEMO connector range and to comply with the specifications of applications they are meant for.

These cables come from a dozen suppliers, most of them German, selected for their expertise in a given material – PTFE, FEP, FPM, etc. The extensive range – about a thousand cables figuring in the catalogue – meets all the demanding requirements: water resistance, oil resistance, high temperature, high voltage, etc. These carefully selected high quality cables attract quite a number of companies, even those that do not look to buy any connectors!

The German subsidiary also has the biggest cable assembly business in the LEMO Group. These activities, initiated as early as the mid-seventies, keep 85 people busy and represent 40% of the turnover. The assemblies include cables from the catalogue, those from Northwire as well as those requested by customers. They also serve other LEMO subsidiaries, such as high-pressure solutions used in pipelines for LEMO Canada or assemblies for antennae shipped to LEMO Italy.

SMPTE connector-cable assemblies (a type that was originally created by LEMO for Sony and that has become a global standard for broadcasting) are a particularly iconic example. LEMO Germany has assembled them for 3 FIFA World Cups as well as several Olympic Games including Rio in 2016, where 1,400 drums were shipped, to support the broadcasting of images from all sporting disciplines all over the world.

Through its 50 years of operations, LEMO has earned an excellent reputation in Germany and Austria, as Mr Mathemeier proudly says: *"Whenever customers and engineers think of a new connector or new equipment, we know that the LEMO brand comes immediately into mind."* This solid reputation is also supported by the fact that customers do not hesitate to add LEMO connectors and cables to their catalogues – which is a further proof of the brand's influence.

This solid growth has had a secondary effect: the current building, which dates back to 2001, when the staff numbered only 85 people, has now become too small. An extra 2,000 m2 will be added to the current 4,000 m2, with the opening of a nearby second building next year. The great adventure of LEMO Germany can therefore continue. ■

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