

CONNECTED

SPRING 2020

MAGAZINE

CONNECTORS TO COMBAT THE VIRUS

THE URGE TO BREATHE

AT THE HEART OF THE DAKAR RALLY

IN THIS MAGAZINE



I M P R E S S U M

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HARDSHIP MAKES US STRONGER

As we were about to launch the creation of this issue of CONNECTED, the world entered a total war against the COVID-19. I'm thinking about your health, dear customers and partners, about the health of your families and all the staff of the LEMO Group. I hope that you will all get through this pandemic without too much trouble.

Our Group is a preferred partner of medical equipment manufacturers, including respiratory assistance systems which have been at the forefront of this health crisis. In this edition, we cover how we have united to combat this virus and help our customers save lives. We will tell you more about this commitment (see page 04), without any pretension. I am proud of each and everyone's involvement, despite the sometimes-difficult circumstances.

This issue also grants a large space to harsh environments, for which our brand has become a reference. It also includes a leap into the heart of the legendary Dakar rally, in which I have participated for the first time.

Extreme situations and conditions can bring about setbacks, even disasters. It is inevitable. However, they also push us to imagine more efficient and powerful solutions. No matter what, I believe it is always together that we shall succeed in making progress.

Alexandre Pesci
CEO LEMO

TECH-BITS

FROM AROUND



© UVD Robots

N°1

Covid-19 cleaning robot

Just like LEMO, thousands of companies participate in the fight against the COVID-19. The Danish company UVD Robots has been at the heart of the action since the beginning. The demand for its UV sterilisation robots, designed for reducing the risk of infection in hospitals, has skyrocketed. The company has been selling them since 2018, each unit at the cost of 80K US dollars. The high-dose UV treatment damages the DNA and RNA of viruses, microbes or bacteria, preventing them from multiplying. The technique has existed for decades, but UVD Robots has applied it for large-scale automated use. Once the hospital is mapped, the robots move around autonomously, disinfecting a room every 15 minutes and when necessary going for recharge. The process is not perfect (dust or obstacles can block the UV), but it provides a useful additional line of defence for hospitals and the world.



© Isimova

N°2

From snorkelling to hospitals

Developing and getting approval for new medication or new medical equipment takes an enormous amount of time. So, given the dramatic urgency of this pandemic, shortcuts have been taken – there's nothing to lose if the alternative is death. The case of Easybreath snorkelling masks from French sporting goods manufacturer Décathlon is emblematic. Thanks to locally 3D-printed valves, they can be used for temporary respiratory assistance for patients (or simply for protecting healthcare staff). The idea was born at the height of the pandemic in Italy. By now, thousands of CAD files of the adapted valves have been shared and tens of thousands of modified masks have been used in hospitals. Décathlon has even stopped selling them in several countries, so that they can supply them free-of-charge to hospitals in need (for instance in Russia in mid-April). Although this development breaks the rules, it is a nice example of human ingenuity.

THE WORLD

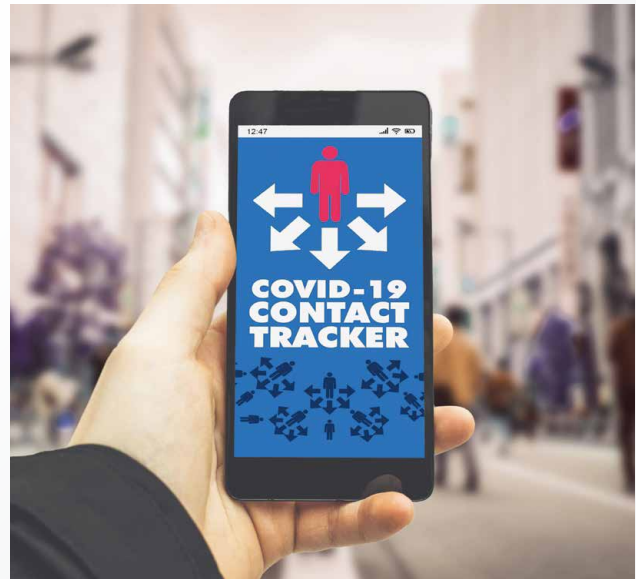


© Spindiag

N°3

The urgent need for rapid diagnosis

Test solutions are necessary for identifying sick people rapidly and, on a wider scale, for having a clearer vision of the pandemic. But they don't exist. Many teams around the world have been working on developing automatic diagnosis devices, such as Roche Diagnostics, Thermo Fisher Scientific, Qiagen or Quest Diagnostics. These solutions being as much a public health as a trade issue, governments have also been investing. In Germany for instance, Hahn-Schickard and Spindiag have received in mid-April 6 million euros from the government to adapt their rapid diagnosis system. The process (using a polymerase chain reaction (PCR), a reference in infectiology) makes it possible to determine in 30-40 minutes a SARS-CoV-2 infection. You simply deposit the used cotton bud in a disposable cartridge and the mobile device takes care of the rest. It should be available by this summer at the latest.



N°4

Smartphones called for help

Digital tracking could help to contain the pandemic or at least to get it under control. The idea is to follow the movement of smartphones to detect whether their users have been in contact with someone infected and if that's the case, to notify them. The process is much faster than interviewing each sick person to learn about where they have been and who they have been in contact with. In Europe, a major project has brought together 130 academic and industrial partners to work on the issue. In USA, Google and Apple have joined for a common project that would use the signals of 3 billion smartphones. There are many technical obstacles – for example, smartphones need to be switched on with Bluetooth activated. It also implies that infected people are correctly identified and that a large proportion of the population accepts participating. The debate is extremely sensitive with regard to the potential threat to privacy that this tracking could create.

COMBATTING THE COVID-19

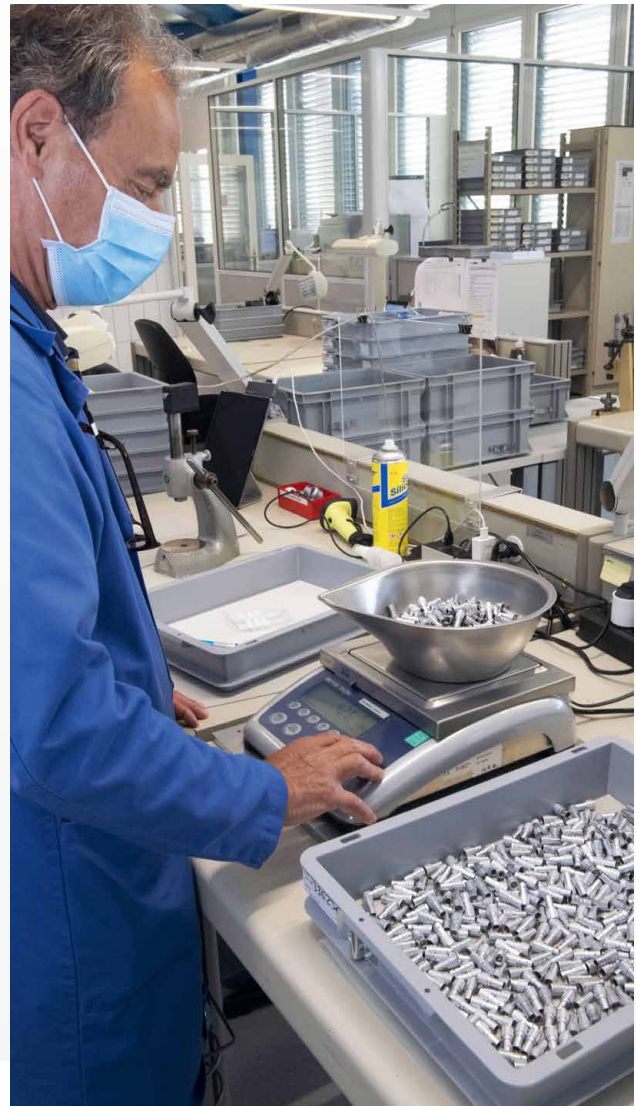
As a key supplier to medical device manufacturers, LEMO has immediately responded to pressing demands from customers, despite the impact of the pandemic on its production forces. The story of an emblematic example of commitment, one out of thousands of other companies in the world.

It was in late December 2019 that LEMO had its first contact with the COVID-19: the Group's Chinese staff had then heard about a virus raging in the province of Wuhan. Vague at first, then growing into a very real threat by mid-January: the media report an epidemic and call for caution. On the 23rd, the first day of the Chinese New Year holidays, Wuhan is completely sealed off and the 150 Chinese LEMO employees start two weeks of lockdown, just like all their fellow-citizens.

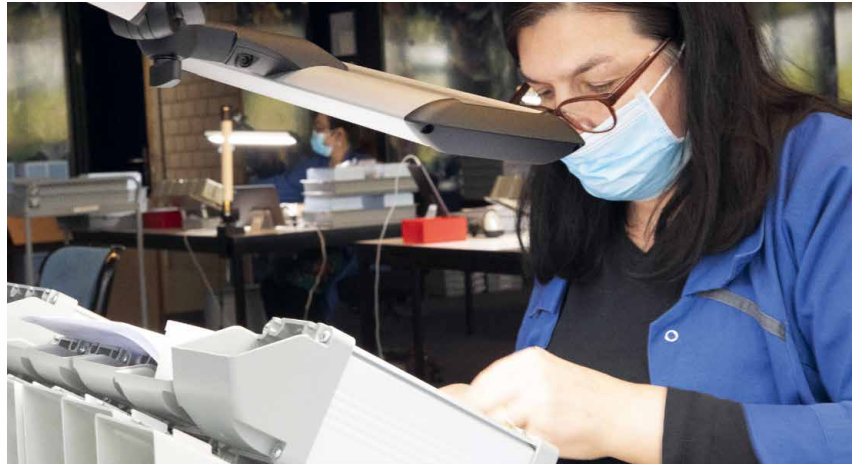
In Ecublens (Switzerland) where the head office of the LEMO Group and the bulk of its production staff are located, a first measure is introduced: management suspends travel to China and recommends hygiene rules. On 31st January, whilst the WHO declares a global health emergency, LEMO asks its subsidiaries to find masks for their Chinese colleagues after local supplies have been exhausted.

On 10th February, as scheduled by the government, LEMO's Chinese offices resume their operations. First, only shipping staff go back, the others have been equipped for teleworking. Onsite personnel are gradually increased. In mid-February, they receive 20,000 masks from their European colleagues. "This has really made our return easier", comments the subsidiary director David Ge. "This quick support was also very moving, as it reminded us that we are part of a family that protects its members. It was a strong sign of encouragement."

At the same time, a tense calm has settled over Europe. Will the COVID-19 come or stay at the gates of Europe as the SARS (Asia, 2002) and MERS (Middle East, 2012) did? There are definitely a few outbreaks, but on 6th February, there are only about 30 confirmed positive cases on the Old Continent. Even in Italy, nothing



▼
Despite the pandemic, production and assembly processes run without interruption.



predicts the storm that would come and hit the country: the first death linked to the COVID-19 is announced on 21st February, when the country has only counted 20 confirmed cases.

In Switzerland, the virus remains absent from statistics. Still, on 28th February, the LEMO Group reinforces its recommendations in terms of hygiene and extends the travel ban to South Korea, Japan, Singapore, Iran and the North of Italy.

Then comes the month of March.

The month during which the epidemic is officially declared a pandemic, with Europe being its epicentre. Italian statistics are a brutal expression of its severity: by 1st March, the virus causes 34 deaths, four weeks later, the death toll has risen to over 10,000.

On 4th March, one day before the first registered death in Switzerland, LEMO decides to implement new quarantine measures, recommends meetings through videoconference, and introduces the WHO hygiene measures. HR and IT prepare teleworking for as many people as possible.

In mid-March, when all the Chinese staff are back at work, Switzerland comes to a standstill. After closing the schools, the government bans all "non-essential" activities and "Stay at home" becomes the watchword. From one day to another, thousands of Swiss companies come to a halt.

For LEMO, this is not an option.

The Swiss company is a key partner to major respiratory assistance system manufacturers, crucial in combatting the COVID-19, the shortage of which has dramatic effects (see our article on Hamilton on page 08). LEMO also supplies most major medical technology manufacturers supplying solutions for operating theatres and intensive care units. They are all engaged in a race against time. They must produce so that a maximum of lives can be saved. They depend on their suppliers to meet the demands.

LEMO gets urging messages from ventilator manufacturers, sometimes supported by just as urging letters from governments. Meeting such exceptional demand is as much an industrial as a moral duty, so on 23rd March, LEMO decides to reorient all its production.

More specifically, explains the CEO Alexandre Pesci in a message to all Swiss factories, *"I requested that all manufacturing orders for systems linked to COVID-19 should be given first priority and all orders for other medical equipment second priority."*

LEMO implements this prioritization instantly. From now on, all orders linked with the battle against the pandemic are processed upon arrival. Even if it means stopping another ongoing production order.

The most wanted solutions are, unsurprisingly, the two connectors that LEMO sells most in the medical sector: the metal LEMO B series and the REDEL P plastic. But there are others as well: *"The range is more varied than we thought"*, says Nicolas Amoudruz,

production manager. *"There's also a demand for M, D, K and S series. These solutions are used for patient life-sustaining equipment, monitoring systems or providing treatment, such as perfusion"* (see insert on page 07).

Redirecting production does not only affect the Ecublens plant, even if the HQ is by far the largest production site, where all the components converge for assembly. It also affects the other Swiss component manufacturing plants in Delémont (LEMO 5 factory) and Sainte-Croix (REDEL factory), and also the Hungarian REDEL Kft factory where P series connectors are assembled.

What about non-priority production? Do customers accept waiting? *"Not all machines are involved, so standard production goes on"*, answers Amoudruz. *"Furthermore, we endeavour to produce their most important orders without incurring a delay."* For other orders, the Group subsidiaries ask customers for their understanding. The obvious severity and urgency of the health crisis are recognised by all.

The subsidiaries acknowledge the efforts and flexibility of production plants – their thank you messages are posted at the headquarters. These encouragements are welcome, since LEMO production – like thousands of other companies around the world – has also been directly impacted by the pandemic and its effects.

A first contamination in Ecublens on 17th March obliges Nicolas Amoudruz to send 80 to 90 people home from manual assembly. Quarantine for them while the workshop is

being decontaminated. Work resumes only five days later, with many people absent.

Additional protections are decided (the Swiss government enforces measures on companies as of 19th March). Temperature checks at the entry, distancing workplaces, setting up partitions... dozens of various measures are taken at the Swiss and Hungarian factories.

It is also decided to set up work shifts that do not overlap, so that, in case of contamination, only one of them is affected. The week after, unfortunately, there's a new positive case in the automation department. *"We didn't have enough time to decontaminate before the arrival of the next shift"* recalls Amoudruz. *"So, as a precaution, we shut off this workspace completely."* Fifteen people are sent home.

Two cases, that is a very small number. However, in the persistent anxiety-inducing context, the psychological effect is felt throughout the company. In Ecublens, like at other companies in Switzerland and around the world, concerns arise. Is it safe to go to work? Do employees risk their lives and that of their families? Shouldn't production be completely shut off? These perfectly legitimate questions are rapidly addressed by LEMO's management.

"We made a great effort in internal communication" explains Nicolas Amoudruz. *"We described in detail LEMO's role in our customers' supply chain, why we had to stay open and why we had to commit to the battle against this global threat."* The message got through even better than expected. *"The atmosphere relaxed very quickly, and I could feel a huge motivation, given the importance and urgency of our mission."* LEMO has been producing medical solutions for decades – it is its largest market. The current dramatic situation has further amplified the sense of this mission. *"People are proud to assemble technologies that contribute to saving lives from the COVID-19. This shared feeling across all of our manufacturing plants, has had a strong federating effect."*

In addition, on 25th March, the CEO Alexandre Pesci joins production and sets to work in the assembly workshop. He returns several times during the following days. All the top management, as well as some other volunteers join in, as a sign of solidarity with the production teams and to show their trust in the protection measures implemented.

As a matter of fact, the measures prove to be efficient: in mid-April, only a dozen confirmed cases have been recorded at the Swiss production plants, none in Hungary. The same positive picture at the large subsidiaries: no confirmed contamination in China, Germany or UK (at the time of going to print).

All the same, during the third week of March, production staff in Ecublens drop to 40% (and even 30% in the manual assembly workshop). The temporary shut-down of the workshop is not the only reason. Some people are in quarantine because they had been in contact with a sick friend or parent, some were sent home

because they are at risk or have symptoms. Applying the sanitary protection measures (distancing, rotation) has also reduced working hours. *"It wasn't easy to manage!"* says Amoudruz. *"Luckily, the workforce increased afterwards."*

The manager also gets some help from outside. *"About a dozen of people from engineering and industrialisation were redirected to production."* Their hours add up to those worked by top management and the volunteers.

The increased efforts to meet the demand from medical companies will have involved all the factories and all hierarchy levels. The positive effect of such crises is that they contribute to uniting people.

At last, the terrible month of March comes to an end.

In Europe, confinement measures and employee protection seem to have worked. Gradually, Switzerland, France and even Italy weather the storm and come out of it, still somewhat bewildered and very cautious. Governments schedule lifting the measures progressively.

The epicentre of the pandemic has now moved to the United States, where it is hitting hard. Africa and South America have also started to be heavily impacted. Many thousands of lives are still to be saved, perhaps even more. The LEMO Group's production continues in "COVID-19 prioritisation". ■



LEMO'S ROLE, VITAL AND ACKNOWLEDGED

An active player for decades in the medical sector, LEMO has become a preferred partner thanks to the ruggedness, reliability and ease of use of its solutions. Today, the Swiss group supplies most major medical technology companies, including ventilators.

Like other key suppliers of the sector, not to mention healthcare staff, LEMO committed to the global battle against the COVID-19. Its role has been acknowledged by the government of the Swiss Canton of Vaud (where LEMO is established) and received the authorisation to continue working even throughout the peak of the pandemic.

The applications of its solutions in respiratory assistance equipment are varied. For Chinese, English, Swiss and US devices, the LEMO Group's products connect sensor systems to measure and regulate CO₂, temperature, or humidity. For a Canadian manufacturer they are for sensors monitoring the patient's vital signs. For Swiss manufacturers they are for floating rotor systems or screen systems.

Other medical technologies – central to the functioning of hospital emergency or intensive care units – also use LEMO connectors. More specifically, in patient monitoring (sensors measuring the level of O₂), infusion administration, blood testing and cardiac resuscitation. There are also LEMO connectors in the automatic body temperature measuring systems in public spaces. ■

▼
Distancing, masks and protecting walls have been some of the implemented measures.



▲
LEMO B Series (left) and REDEL P Series, two of the most requested connectors during the pandemic.

INTELLIGENT VENTILATORS

Hamilton Medical's respiratory assistance equipment optimises ventilation and saves time for medical staff. Two qualities of critical importance for intensive care units overloaded by the COVID-19 pandemic.

There is only one available ventilator. Which patient should it be given to, knowing that the others will die?

This is the worst-case scenario which was experienced much too often in Italy during their peak infection period earlier this year and that all countries have been trying to avoid at all costs. The demand for ventilators has skyrocketed. France aims at tripling, the USA at quadrupling its fleet. Manufacturers have boosted their efforts to meet the demands. Among them, Hamilton, a leader with 20% of the market for ventilators used in intensive care units.

Since early 2020, the Swiss company began to work in 2 shifts, seven days a week. By the end of April, they have already tripled their usual annual production, delivering thousands of machines worldwide and continuing to increase the pace.

As the pandemic continued to spread, it was discovered that the SARS-CoV-2 (COVID-19) attacks almost all body organs, with the lungs being its primary victim. In the most severe cases, the virus can completely stop their dual function – providing oxygen and withdrawing carbon dioxide from the bloodstream. When this happens, the patient needs to be intubated.

Such intervention is never simple or harmless, points out Kathrin Elsner from Hamilton Medical.

"Mechanical ventilation is a very unnatural process for the lungs. Inappropriately applied, it can do a lot of sometimes irreversible damage to the lung tissue. Damaged alveoli will not recover. And if too many alveoli are damaged, consequences can be fatal."

During intubation (1 or 2 weeks, if all goes well), the patient's condition and needs vary all the time. With traditional ventilation systems, the settings need to be constantly monitored and fine-tuned. This requires time and personnel, two resources limited in intensive care, especially in the middle of a pandemic. Hamilton Medical has a solution to address this issue.

The company was created in 1983 with a clear vision: to produce automated ventilation modes and intelligent systems that can instantly adapt to the patient's needs. On the one hand, it could improve care. On the other hand, it could save time for medical staff, who could then do other important jobs.

Hamilton took a first decisive step in 1998: they launched the first "intelligent ventilation mode" (filed under the trademark ASV standing for "adaptive support ventilation").

"ASV simplifies ventilator settings down to three parameters the clinician has to adjust", explains Kathrin Elsner. "Minute volume (the volume of gas per minute), PEEP (the pressure in the lungs above atmospheric pressure) and FiO2 (the percentage of oxygen in the gas mixture)." ASV has been adopted by many hospitals around the world, becoming a standard for artificial ventilation.

In 2010, a further major step with the INTELLiVENT-ASV that Hamilton Medical presented as the world's first ventilation autopilot. Hi-Tech and algorithms *"make the ASV settings fully automated using two additional sensors."* The first sensor (equipped with LEMO's REDEL P connectors) measures carbon dioxide, the second oxygen saturation. In short: INTELLiVENT-ASV can do everything on its own, *"constantly adapting to the patients' condition and needs and keeping them within lung-protective parameters."*

INTELLiVENT-ASV includes a feature helping to wean the patient, as soon as possible, off the ventilator. *"Quick Wean assesses the readiness to wean criteria for the patient, as set by the clinician. It can perform so-called "spontaneous breathing trials" where the*

The flagship products are the HAMILTON-G5/S1 and the HAMILTON-C6. The highly compact HAMILTON-T1 (equipped with LEMO B connectors) has become a reference in patient transport.

The HAMILTON-C1 and HAMILTON-T1 models are the most demanded in the current crises. *"With their integrated turbine, they are independent of compressed air. They are easy to use and, despite their small size, offer all the features of a full-sized ICU ventilator. All this makes them very well suited for pandemics."*

Hamilton Medical employs a staff of 400 in Bonaduz, a village nestled in south-east Switzerland. Plus 100 more around the world. The company attributes its success to its innovations and the ease of use of its solutions. *"But a big part of it is that we live for ventilation technology, the whole company revolves around it", concludes Kathrin Elsner. "This focus makes us unique among the other big players on the market."* ■



© Hamilton Medical

patient is encouraged to breathe spontaneously and without support. If those trials are successful, the clinician can consider extubating the patient."

Hamilton Medical proposes ten models of mechanical ventilators (with a whole range of accessories and consumables). They meet various needs of many users. *"Our ventilators can ventilate all kinds of patients from neonates to adults, active or passive, either intubated or via mask or nasal prongs. They all offer traditional and state-of-the-art ventilation modes and therapies."*

▲
Compact and autonomous, the C1 is one of the most wanted Hamilton ventilators in the current pandemic situation.

CHALLENGING THE BOUNDARIES OF THE POSSIBLE

By definition, all progress is made by pushing back the limits of what is possible. To innovate and discover, you need to push boundaries and explore the unknown, conquering conditions never before controlled. For this to be successful, you need to rely on flawless equipment and technology.

PAGE 12

PAGE 14 **SOLUTIONS DESIGNED
FOR HARSH ENVIRONMENTS**

PAGE 16 **"THE FIRST STEP TOWARDS SUCCESS:
BOLDNESS."**

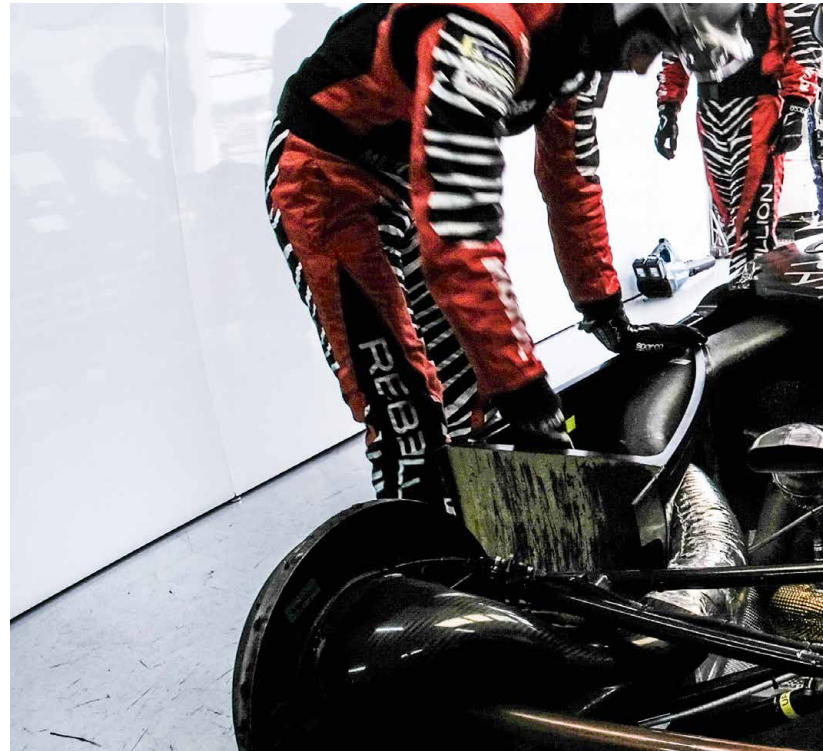
AN INTERVIEW WITH ALEXANDRE PESCI
AT THE HEART OF THE DAKAR RALLY





►
LEMO has been equipping
endurance and Formula One racing cars for decades

© AutoWebb - Eric Fabre



The LEMO Group has become a leader in interconnection solutions for the most demanding applications operating in harsh environments. It is a relatively small niche within the global connector market estimated at a total of 60 billion USD. However, it is a profitable one and excellent in terms of image.

Being positioned in the high-performance market is also very motivating for the staff. After all, the solutions which they develop and work on, support the continual exploration and therefore human understanding of environmental extremes. From the depths of space to the depths of the ocean. From polar regions to burning deserts. From immobile and sterilised operating theatres to roaring, chaotic motorsport circuits. The Swiss brand is a reference when it comes to ensuring reliable connections, even in the harshest conditions.

Yet, when the company was launched in 1946, conquering harsh environments wasn't among its goals. Its founder Léon Mouttet designed his first products for the Swiss post and telecommunications, a more benign world than that of harsh outdoor environments. However, from the outset, Léon Mouttet's relentless pursuit for perfection naturally propelled the business towards the world of harsh environments.

It was the quest for the ultimate in quality that brought about the conquest of extreme conditions.

Quality and reliability have been the driving force of innovation, the backbone of LEMO's success story.

Very early on, important investments were not only made in research, but also in integrating manufacturing know-how. With patience and

resolution, the Group has gradually verticalised its competence. It has acquired equipment, production plants and even some companies (including the US factory Northwire in 2014). Today, the LEMO Group has internalised the entire value chain. From Research & Development to the production of complete solutions, through manufacturing parts, surface plating or even cable design and assembly. This structure has enabled the group to reduce its dependence on external suppliers. And most of all, the perfect control of its quality through the whole process from idea to delivery of the final interconnect solution.

Being positioned as a leader in innovation and high performance can be constraining.

It is a position from which one can easily and quickly plummet. Luckily, the quest for excellence has been rigorously pursued by the directors (Marcello Pesci, then Alexandre Pesci, son-in-law and grandson of Léon Mouttet) as well as their staff.

"We have never considered it sufficient to simply meet the requirements", says Noman Hashemi, VP Technology & Engineering. "We have always set the bar very high and strived to exceed our customers' expectations".

The same self-discipline applies in testing. For decades, the LEMO Group has possessed very well-equipped laboratories (at LEMO for materials and connectors, at LEMO FOUR for fibre optics and at NORTHWIRE for cables). 80% of electrical, mechanical and environmental tests are carried out in-house. In this field as well, LEMO maintains very high standards. *"Unlike others, we have a very conservative approach to results",* says Roger Vonlanthen, test



laboratory manager at the Group's HQ. *"The performance limits specified in our catalogues are always considerably lower than the results we obtain in our laboratory."* Noman Hashemi confirms with a smile: *"Between marketing and technical, LEMO is clearly on the technical side! We always keep a good safety margin."*

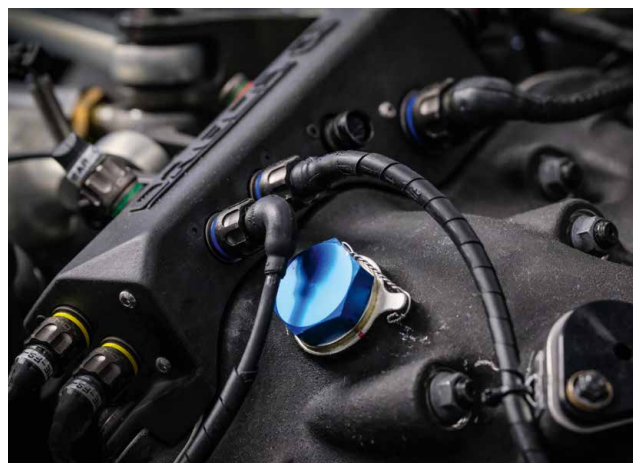
This margin is a guarantee for the customers, who know how large it is. *"Our customers use it regularly!"* explains Noman Hashemi. *"At times, they even push our solutions above the limits that we have set."* Sometimes, to the great surprise and pride of their designers. This was the case of the watertight O3 Series, the smallest screw-coupling connectors of the Group. LEMO guarantees it up to a depth of 300m, a customer has used it without any reliability problems at 4000m!

In fact, when the bar is raised very high, the standard product is often enough for conquering extreme environments. It is for example the standard solutions of the S series that equip the fantastic extra-terrestrial ISS laboratory. A space station is the ultimate example of an extreme environment.

Demanding applications have progressively become a strategic objective. Whenever the standard is not enough, the Group's engineers set to work. *"Customers want to further enlarge the temperature range? Push the limits of our solutions? Add a functionality?"* asks Noman Hashemi. *"The answer we give them is always the same: we will manage!"* This constant appetite for innovation and excellence is rewarded by the pride felt at having succeeded where others have failed.

The M Series, created together with and for Formula One (see article on page 30) is an emblematic example of a custom development. Compact, powerful and robust, it has become the uncontested standard for extreme environments. ■

▼
The rugged M Series, a standard for harsh environments.



© AutoWebb - Eric Fabre

SOLUTIONS DESIGNED FOR HARSH ENVIRONMENTS

Component design, materials and surface treatment are combined to ensure unparalleled reliability even in the worst conditions. Here is an overview of some performances that have made LEMO a reference for harsh applications.

10⁷ Gy Radiations

N Series connectors have been developed in cooperation with the nuclear industry. Using specifically approved material and designed to be handled by robots, they function steadfastly in highly radioactive environments.

10⁷ Gy

>200 cycles

-55°C/+200°C

Temperature variations

Day after day, for years on end, aircraft take off into ice-cold skies and land on burning hot tarmacs. Day after day and for years on end, industries expose their equipment to large fluctuations in operating or storage temperatures. Not the slightest problem for B or F Series connectors.

-55°C/+200°C

>200 cycles Resistance to sterilisation

In a medical environment, sterilisation is as vital for patients as it is aggressive for the equipment. LEMO can provide high durability solutions for any sterilisation method chosen by the customer, such as the P series, with a robust design made of extremely resistant materials.

30G

70 kV DC**High voltage**

Ensuring reliability and safety in high voltage environments requires several adaptations. The design as well as the materials, with high dielectric properties, of dedicated connectors (such as the Y series selected by the CERN) makes sure to keep apart components with different electric potential (contacts and earthing).

>5000 cycles

>60 bars**Hydrostatic pressure**

Underwater, in the sea or the ocean, connectors are subject to great pressure variations which also depend on their size. W or V series are perfectly reliable up to 300m depth. High-performance O3 connectors are designed for up to 600m. They are ready to explore the North Sea.

70 kV DC

>1000h**Resistance to salt spray**

Salt is a powerful corrosion agent, especially on the long run. Specially selected materials combined with special surface treatment, such as chromium, black chromium and NiCorAl™ plating, makes LEMO's solutions perfectly adapted to fit large vessels or the equipment of troops stationed by the sea. The choice of materials and surface treatment of our connectors ensure resistance to all types of hostile and corrosive environment.

>5000 cycles**Guaranteed durability**

After a high number of operating cycles, the connector's contact mating force diminishes through normal wear, which can lead to signal discontinuity issues in certain harsh environments. So, LEMO guarantees not only 5000 mating cycles (more than 13,5 years if you count 1 cycle per day!), but also states that contacts will retain 75% of their original retention force.

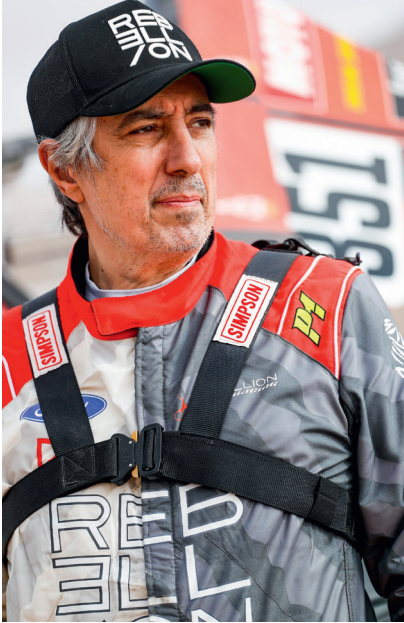
>60 bars

30G**Vibrations**

How can you secure reliable and uninterrupted connections withstanding the shock and vibrations that military equipment, a Formula One engine or a fighter jet are subject to? By designing particularly compact and robust solutions fitted with LEMO's standard high reliability crimp contacts, such as M Series connectors.

>1000h

"THE FIRST STEP TOWARDS SUCCESS: BOLDNESS."



© DPPI

AN INTERVIEW WITH ALEXANDRE PESCI AT THE HEART OF THE DAKAR RALLY

It was back in January, just before the COVID-19 became a global crisis: the legendary Dakar Rally raced through the harsh desert lands of Saudi Arabia. Among the competitors, there was the LEMO Group's CEO, Alexandre Pesci. The story of a childhood dream come true, a breath of fresh air welcome in the current climate.

Alexandre Pesci, why did you wait until the age of 53 before taking part in such an extreme endurance race as the Dakar Rally?

Alexandre Pesci: I've been passionate about cars, from as early as I can remember and from a very early age I dreamt of competing in the Dakar Rally, as it is the ultimate test in motorsport. I had promised myself that I'd participate before the age of 30, but I didn't. Then I turned 40, then 50. Now it was really the last chance – you'd better not be too old before tempting such a challenge – so, I embarked on the adventure.

What goals have you set yourself?

To go there. To experience it. The Dakar Rally is the hardest of all endurance races – typically, one third of the cars do not cross the finish line. I hadn't really put any pressure on myself, I just wanted to try and finish the race. In this context, each successful leg was a personal victory.

You have accomplished your goal, by ranking 43rd in the car category (out of 83 participants and 58 arrivals) and 3rd Rookie...

The result is nothing extraordinary – I drove 22 hours longer than the winner Carlos Sainz, which is a lot! But it is not bad at all for novices like myself and my co-driver Stephan Kühni. They say that a first Dakar does not usually go well. So, the other competitors were very surprised when we crossed the finish line. Especially when they realised that it was my very first car race. It's as if I had started mountaineering by climbing Mount Everest and succeeded (laughing).

Dakar is very intense: 11 legs in 12 days. How does a typical day go?

We get up around 6:30–7 a.m. The connecting stage starts an hour later: you have to drive your car to the departure of the "special stage", a few kilometres away. Then it's the "special" (between 319 and 546km this year). Then another connecting stage on road – the longest one was 370km – to join the camp from where we leave the



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The 2020 Dakar Rally ran across Saudi Arabia's spectacular scenery.

next day. Then shower, physical recovery, a meal, debriefing with the mechanics. Around 8 p.m. everyone gets together for the briefing about the next leg. We go to bed around 10:30 – 11:30 p.m. With earplugs, because there is noise all night – reconditioning the vehicles, late arrivals...

How exactly was your buggy reconditioned every night? Romain Dumas told me that his truck contained just about all the parts to reassemble a car...

Yes, his crew did a tremendous job. As soon as we got back from a leg, one of the six mechanics would go off with the buggy to "listen" whether there is a problem. Then, they would rebuild it almost completely – even the smallest broken fragments of the car body were mended. Finally, they would go off once more to test that everything was perfect. All this work would keep them busy regularly until 4 a.m. Sometimes, upon waking up two hours later, I would see nobody: the crew and their trailer would be already gone to join the next stage. Getting out of our camping car, I would only find our buggy in front of me, refurbished and ready to leave.

What were the specials like in the Saudi deserts?

There was sand, a lot of sand. Red, white and yellow sand... it was magnificent, and I love driving across the dunes, but sometimes we got really tired of it. By the way, Stephan my co-driver told me that in any case, he would not spend this year's summer holidays on a beach (laughter)! There was also a lot of dust and stones – much less comfortable than sand. It is quite amazing the extreme level of constant shock a car can withstand rolling on stones: the buggy was



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Driving in the dunes can be very challenging.

shaking all over, we thought it would fall apart. We have also had some rather horrible passages on rocky terrain.

What part did navigation play? Veteran Stéphane Peterhansel had warned that it would be particularly difficult and interesting this year...

Navigation is an integral part of a Dakar race. You need to search and find your way. You get the roadbook the evening before, sometimes even on the morning of departure, with only 15 minutes left for analysing before leaving. This is adventure.

No navigational instruments on board?

No smartphones, no nothing. The two GPS on board, supplied by the organiser, do not indicate your position on the map, only the signposts that you have to drive past within 50 metres to collect the points.

How precise is the roadbook?

It is rather vague: it gives a direction and a distance, that's all. Even the best get lost sometimes – Al-Attiyah and Baumel have lost 14 minutes driving 7km in the wrong direction before realising that they had made a mistake. As for us, we lost our way once or twice and missed a few signposts, but we did quite well. Some competitors get lost for hours.

It is nothing like a carefully prepared rally, where the co-driver announces every bend and obstacle to the second!

Nothing at all. At the Dakar rally, we navigate only by sight. The roadbook does not help to know whether there are right angle bends ahead. It indicates major dangers, but the organisers don't necessarily have the same perception as you do. At times, important danger is

▼
The co-driver Stephan Kühni



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announced ahead and you drive on without even taking notice of anything. Then, at other times, it says "subsidence to the left" when in fact, you discover that it is the edge of a cliff! So, you have to stay extremely vigilant. You have to see the bends, obstacles, dangers for yourself. I think this is what makes the Dakar race so superb: navigating by sight pushes you to your limits.

It is rather physical. How can you hold on?

Yes, it is very tiring. You drive relatively fast, you have to keep concentrating and you spend 8, 10 or even 12 hours a day in your car, which is an awful lot. You hold on, because you love it and you are supported by a solid team. Also, fuelled by energy bars and drinks prepared by our physiotherapist.

Are there breaks during the race?

Only a 15-minute break during legs of more than 350km. It is neutralisation: you must stop and must not do anything on the car – not even repair. Just relax. A countdown shows when you are allowed to start again.

You have mentioned speed: how fast were you driving without any major obstacles?

I'm a beginner and I wanted to limit risks, so not very fast! On track, we would drive at around 120kmph, with peaks at 165kmph. Otherwise, between 90 and 100kmph. Across the dunes, it was more around 60-70kmph.

Is it difficult to drive among the dunes?

It is fantastic, but also rather tricky. If you bump off a dune and you find yourself facing another one, you're sunk at the bottom of a bowl. Even if it's large, you have no way to gather speed to climb up again. It happened to us once. I had to back off meter by meter, until I got high enough to pass over the edge. So, you always have to look further ahead, towards the next dune. There are also much flatter dunes on which you can drive fast... however, they may lead to a sudden downhill of several dozens of meters! You have to be really careful.

In case you get stuck in the sand, can you get help?

Competitors get on really well and they mutually and spontaneously help each other. Once we were blocked in a dune and tied a cord to the front of the buggy – soon enough, a truck stopped to pull us out.

The deserts of Saudi Arabia offer a spectacular natural scenery, have you actually enjoyed it?

No, not during the race: I was much too focused on my wheels and, on the road, the dust stirred up by the other drivers hides everything. Fernando Alonso got into trouble once by following another driver when, hidden by the dust cloud, he didn't see a large stone and got his wheel torn off. Sometimes, I had to stop and wait until the dust cloud would dissipate – to realise that we had left the trail. I discovered some of the scenery we had driven through only in the evening on the campsite, while looking at the images of the race.

SHORT, TARGETED PREPARATION

Being the CEO of an industrial group with a family doesn't leave you much free time. How did you prepare your first Dakar Rally?

I had a few 1 to 3-day driving courses, in order to test various types of terrain and to get used to a sequential gearbox. In the south of France and, to experience dunes, in Morocco and in Qatar. All in all, about ten days, which is very little, so I chose very good coaches: Nasser Al-Attiyah and Matthieu Baumel (editor's note: winners at Dakar 2019 and second in 2020). Driving was a pleasure, physical training was much less so! Six months' muscle strengthening (abdominals, neck, back) to better support the repeated shock in the car and cardiovascular

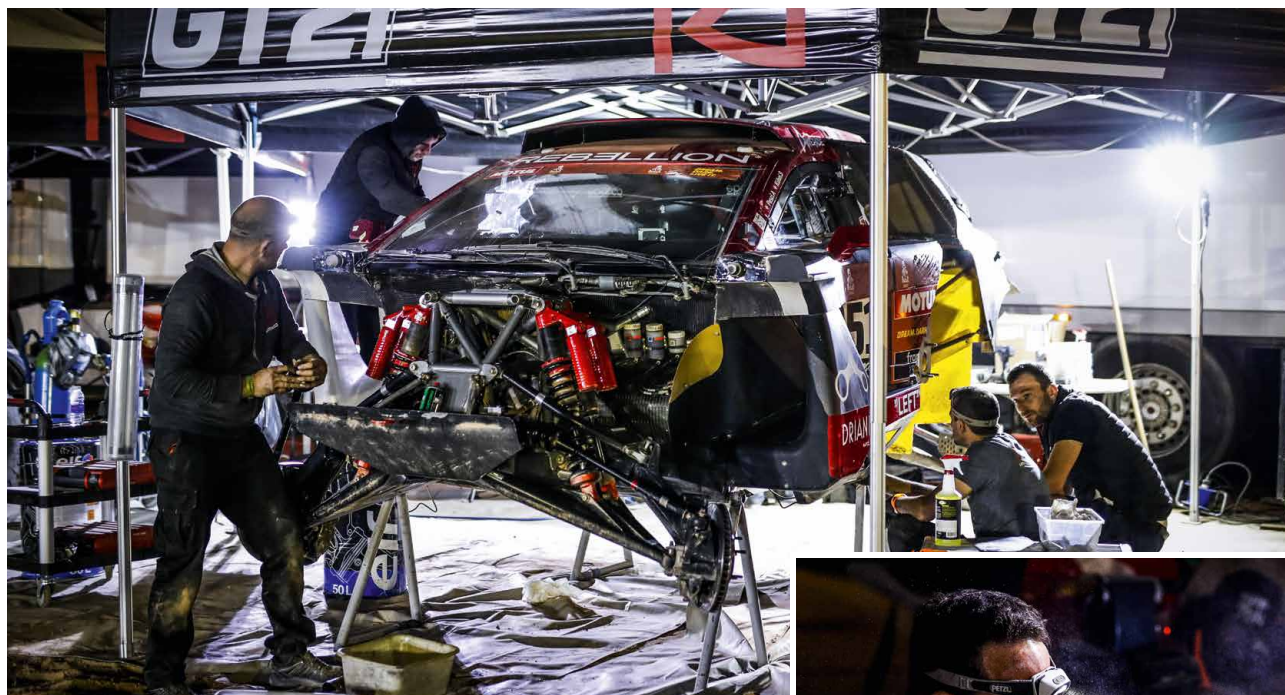
training to improve my endurance. We had also exercised reading the roadbook, which is crucial to running the Dakar rally.

No mechanics?

Not for me, since it's not the driver's job. It's Stephan Kühni, my co-driver, who had to do an important technical training, to be able to change parts such as the clutch. He was well prepared and made himself technical sheets. Whenever we had a problem, I simply followed his orders.

For the development of the car, you chose RD Limited, Romain Dumas' company. Why?

I reviewed several quotes and Romain's was the best. He's an experienced driver – he ran three Dakar rallies, once finishing 9th. Also, his car manufacturing is serious, inventive, and economical. He gave me some good ideas – simplifying the car to a maximum, to avoid reliability problems, use tried and tested components, change the engine (see page 22). I've seen him for years at endurance races and we get on well. Moreover, he has a whole technical team with him, excellent engineers who work for Indycar or BMW. Reliable people who have a thorough knowledge of their job. ■



▲
Romain Dumas' mechanics often worked till 4 a.m.

Did you have any breakdowns?

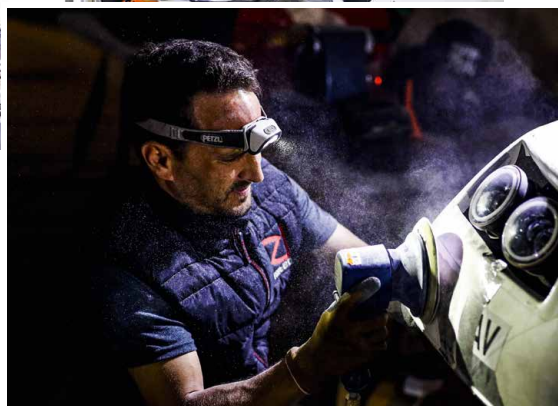
Luckily, very few. We had flat tires twice. We broke the clutch in the dunes and lost an hour replacing it and getting free from the sand. Another time, our accelerator broke down. It took only five minutes for Stephan to repair it, while three competitors stopped to make sure that everything was OK. So, it worked out fine for us, the buggy was excellent.

In case of a problem, how do you ask for assistance?

There are two buttons in the car. A red button to notify a serious problem, an injury – the organisers send a rescue team immediately. A green button for technical problems. In this case, you repair it yourself or wait for your maintenance crew. When we broke our clutch, we forgot to notify, so it was the organisers – the cars have a tracker, so they know when a competitor has stopped – who called us. We explained them and they just said, "OK, good luck!"

Romain Dumas was less fortunate: after only 65km in the first leg, he had to jump out of his car, together with his co-driver, before it went up in flames. Your car was identical...

They had a problem with their tank which got over-pressurised and swelled until it exploded. It's quite unbelievable. There was a system for degassing the tank every time you stop, maybe it was defective on their car. We didn't have any problems with this – even in Morocco, where it was much hotter. Romain was really unlucky. He designed our cars to win and he, the experienced driver had a chance to aim for victory. In his first 65km, he had already overtaken 15 competitors...



▲
Repairing and rebuilding the buggy to the smallest detail.

When did you realise that you would finish this Dakar race?

No one can be sure! We lived from one day to the other. I drove at my own pace, I did push myself, but at the same time I tried to stay realistic, without taking too many risks, without exceeding my limits. It didn't stop us from experiencing a disastrous leg. It seems that you need to have lived at least one nightmarish day to have "done your Dakar". For us, it was the fourth day.

It was the 453km leg between Neom and Al-'Ula, in the North... what happened?

It was a stony path – we drove over stones and rocks over hundreds of kilometres. It was backbreaking. Moreover, a truck ran into us. My door got smashed, we fixed it with adhesive tape so that it didn't fall off. Further on, we got stuck. Stephan was placing the plaques under the wheels to free the car from the sand, when another competitor drove too close: I heard a muffled thud and Stephan crying "Ouch, ouch, ouch!" I thought he broke his leg and that our Dakar would be over. Luckily, it was much less serious – he got hurt in the ribs, with some cracked cartilage. He managed to get back into the car and we could go on. To crown it all, we finished the leg in the night.

Driving through the desert by night is a hellish experience. The headlights were not very efficient, I couldn't see much. We had a LED bar on the roof, but it makes the shadows and contrasts even worse than in daylight. We finished that special around 8 p.m., completely washed out. I thought "Now, I've had my Dakar experience"! We didn't really have any more problems after that.

Two bikers got fatally injured this year, your teammate Romain Dumas and his co-driver could have burnt in their car. Does one think about danger and death when entering a Dakar race?

It is impossible to ignore this aspect: there is a whole chapter in the regulations about accidents, repatriation of the bodies... not to mention the disclaimers to be signed. However, running the race by car is much less risky than by motorbike, accidents rarely happen. So, I was fairly positive before departure. A little adrenalin during the first few kilometres and then concentration took over. All the same, we did have a few frights...

How come?

I went into a spin once. Another time, driving at 80-90kmph, I got caught in camel grass – one side of the car lifted up and we stayed on two wheels over a good thirty metres before falling back, luckily on the good side. Driving by sight is both dangerous and beautiful: there are obstacles all the time. You must stay focused and need a little bit of luck as well.

What will you remember from this experience?

The magic of Dakar lies in a combination of sport, friendship, solidarity, discovery and scenery. It is this unique cocktail that I will remember... and that I feel like tasting again. Tim and Tom Coronel, the twin

brothers who participate every year, had already warned me: "It will take you ten days to recover and then you will want to return!"

Do you think you will go for another Dakar?

For sure I will. I thought I would try the race only once, but here we go... I was surprised by my own endurance; I didn't think I would keep it up for so long. It was amazing to see how it is possible to manage without making too many mistakes. It makes you want to come back. One of the drivers – Jean-Pierre Strugo – was participating in his 26th Dakar race. He's 73 and he's done a good job, so it seems that Dakar keeps you young! As for myself, I would be happy to participate once or twice more.

Fulfilling a childhood dream means one dream less...

Childhood dreams are sometimes forgotten, sometimes postponed. You may be afraid of being disappointed, even with yourself. However, if you dare to go ahead, you may discover that it is never too late. I am happy to have done so. It's a great feeling. Even if, shortly after the race, I had to embark on a much more difficult and important drive – my Group's combat against the COVID-19. ■

© DPPI

▼
With eyes fixed on the difficult terrain,
the drivers did not have much occasion to enjoy the scenery...



REBELLION DXX: PERFORMANCE & RELIABILITY

A blank sheet of paper, vast experience and a year's work. This is what it took Team RD Limited, led by three-time Le Mans winner Romain Dumas, to design the two DXX buggies. Romain himself drove the 329, whilst Alexandre Pesci took charge of the 351.

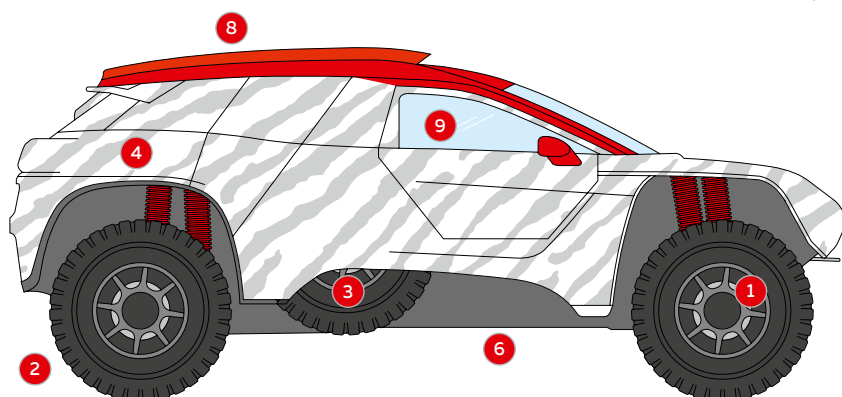
The costly equipment made by large manufacturers are unaffordable for independent drivers.

"To limit the damage and reduce the costs, reliability was at the heart of the concept", explains Romain Dumas. "We have maximised the use of tried and tested parts." Among them, the solid 5L naturally aspirated V8 Ford Cosworth engine "since turbos are less reliable" and "the best-known sequential gearbox in the market."

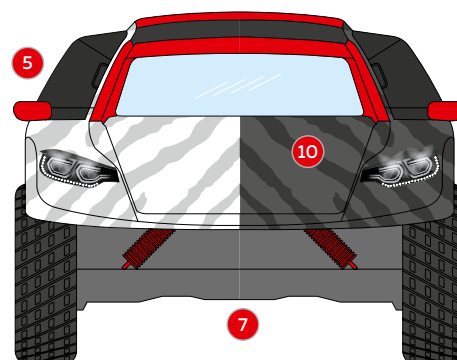
Optimising the choice of materials used throughout the vehicles made it possible to keep to the minimum weight imposed by the regulations (1580kg) and so maximise performance: carbon (chassis), Kevlar (chassis protection), aluminium (suspensions), magnesium (engine parts, spare wheel support) and polyester fibre. ■



© DPPI



- 1 Wheels**
42kg each. The powerful braking system is provided by 8-piston caliper disc brakes, suspension by two 23kg dampers on each wheel (with 1,25m articulation).
- 2 Tyres**
Thanks to a compressor, their inflation can be modified while in motion. Softer, to increase traction on loose surfaces and harder for more speed without puncturing on stony terrain.
- 3 Spare wheels**
One on each side. In case of a puncture, hydraulic actuators (controlled from inside) activate a lever that lifts the side of the vehicle. Faster than a manual process.

**CONSTRUCTOR**

RD Limited

CATEGORY

2-wheel drive, petrol

MAXIMUM SPEED ON HARD GROUND

200 kmph

MAXIMUM SPEED ON SOFT GROUND

180 kmph

LENGTH / WIDTH / HEIGHT

4m80 / 2m20 / 2m60

WEIGHT

1580kg

ENGINEV8 naturally aspirated
Ford Cosworth, 5l**POWER**

380CV

IN-RACE FUEL CONSUMPTION

40l/100km

GEARBOX

Six-speed sequential

- 4 Fuel tank**
385-litre capacity. In order to avoid rupture or explosion, the tank is not rigid: it is a rubber container.
- 5 Air inlets**
To avoid the engine overheating, they are large and plentiful, so, among the first elements to be considered for the design.
- 6 Tubular chassis**
For a maximum of solidity and rigidity, this is the only important element of the vehicle that is still made of (heavy) steel.
- 7 Ventral protection**
In order to resist the countless shocks, the chassis is protected by Kevlar plates, a lightweight material which, unlike carbon, doesn't break.
- 8 Vehicle body**
Made of carbon fibre, lightweight and resistant, to optimise the weight of the vehicle.
- 9 Side windows**
They are made of Makrolon, a transparent plastic offering high resistance to shock and fire. However, the windshield is made of glass.
- 10 Cable harness**
Custom-developed to connect the elements of various origins that constitute the buggy. The interconnection was an obvious solution: the robust LEMO M series, already used in F1 and endurance.



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SAUDI ARABIA HOSTS THE 42ND EDITION OF A LEGENDARY RACE

The legendary Dakar Rally is known as the “world’s toughest motor race”. In January of this year, the 42nd edition was held for the first time in Saudi Arabia. The event started in Jeddah on 5th January and finished in Al-Qiddiya on 17th January, after 12 stages of competition. The course sped across a large portion of the country’s spectacular scenery. Sand rules over the landscape and the drivers had more than enough of it along three quarters of this gruelling course.

The drivers and co-drivers covered a total of 5000km during the 12 special stages (the race itself). All in all, they covered more than 7800km if the transfers between stages were also included (each with a time limit itself). Each leg included distances between 393 and 886km. Every one of them requiring several hours of extreme concentration while being violently shaken around.

In the car category, Spaniard Carlos Sainz won the rally in less than 23 hours. Ahead of Qatari Nasser Al-Attiyah (last year’s champion) and Frenchman Stéphane Peterhansel (13 times Dakar winner). The last arrivals (among those who have managed to cross the finish line) had to struggle more than 242 hours...

Trucks, motorbikes and quads were the other race categories. 557 competitors covering 53 nationalities ran with 351 vehicles. The eldest was 73 years old, the youngest 18. Only 13 women have participated.

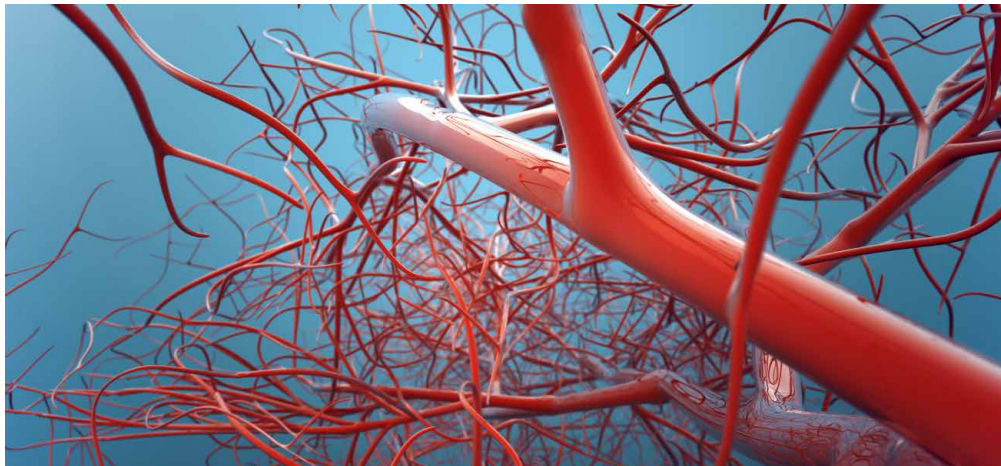
This 42nd edition was the first one held in Saudi Arabia, where the next four editions should also be taking place. The previous eleven editions were organised in South America. Before that, the rally-raïd stretched between Europe and Africa. The first race held in 1978 has given it the name under which it became famous: “The Paris-Dakar”.

With its important infrastructure and vehicles racing at 200kmph through extreme environments, the race has not been spared from tragedies. Some local people have been run over. In a 1986 helicopter accident, the organiser Thierry Sabine was killed together with four other people, including singer Daniel Balavoine. Several journalists have also died. All in all, more than thirty drivers, mainly motorcyclists, which is the most exposed category, have been killed. The 2020 Dakar Rally had its own share of tragedies: two motorcyclists died after falling. ■

ULTRASOUND EXPLORATION

For over 70 years, the company UJRC has been exploring and pushing ultrasound technology to its limits. A journey that started in the heart of Japan and has taken UJRC to the inner recesses of the human body.

Ueda, located in Japan's Nagano province, is the city UJRC calls home, enjoying a mild climate, divided into two parts by the country's longest and largest river. It was here that Japan Radio Co opened a factory in 1942. It specialised in ultrasound technology and became a separate company 7 years later, adopting the name of its town. Hence Ueda Japan Radio Co (UJRC) was born.



The company, that has celebrated its 70th anniversary, now employs 600 people. Its steadily increasing sales should reach 15.3 billion yen in 2020. Within the large JRC group dedicated to communication technologies (5700 employees), Ueda Japan Radio has remained focused on its historic know-how. It creates and manufactures high-value-added technologies for various applications using ultrasounds: industries, radio communications & medical. It also offers solutions for submarine applications, a historic activity, as sonar systems were developed in the early twentieth century for detecting submarines!

Medicine has become by far the most important sector for UJRC (its Medical Business Unit has generated a turnover of almost 8 billion yen in 2019). Its ultrasound and other medical solutions are commercialised in Japan as well as on an international level. These solutions enable us to explore the human body in its smallest recesses: the insides of blood vessels, the digestive system, internal organs, muscles, tendons, bone density and last, but not least, fetuses.

The greatest asset of the Japanese company is its cross control of ultrasound technologies. Everything is designed and manufactured in Ueda. From piezoelectric materials to image processing units, transducers and sensors (emitters and receptors of ultrasonic signals).

UJRC produces and customises components that medical equipment manufacturers integrate into their solutions. It can also develop complete technologies, such as automated blood dispensers and X-ray equipment.

VISICUBE, launched in 2016, is one of the complete solutions made by Ueda Japan Radio Co. This intravascular ultrasound system is a concentration of all the know-how of the company, marking a new step in its quest for technologies that are more and more miniaturised, reliable and powerful. Moreover, VISICUBE incarnates Japan's legendary attention to aesthetics: it received the Good Design Award in 2017.

What is VISICUBE used for? For visualising diseased blood vessels from inside the arteries. Placed in the catheter, the ultrasound sensor emits sound waves which are reflected by the blood vessel walls. Since the intensity of the return signal depends on the tissue type, the algorithms of the electronic system are capable of transforming the data into images. Doctors can thus examine with precision the size of blood vessels, the lumen, the plaque surface and volume causing the occlusion (blockage) or stenosis (narrowing) of blood vessels.

Apart from the catheter, all components of VISICUBE are designed and manufactured by Ueda Japan Radio.

Guided by its 70 years' expertise in ultrasound technology, the company has managed to further optimise high frequency. It has also improved the fluidity and quality of images for high speed pullback of catheters. Hence, VISICUBE delivers particularly clear and detailed high definition live images.

UJRC has even managed to neutralise the effects of an inevitable disruptive force that keeps blurring intravascular ultrasounds: the human heart and its powerful beats. ■



▲
Visicube's control unit with a miniaturised ultrasound device.

►
From transducers to sensors and image processing,
all the components of Visicube
are designed and manufactured by UJRC.



ON SOLID GROUND

© Pagani Geotechnical



The TG63-150 is, according to Pagani, the top-selling compact penetrometer in the world.

Throughout the world, buildings have become safer and safer. Pagani Geotechnical has been contributing to this continuous improvement for almost 50 years, by developing compact, automated geotechnical equipment and tests.

The Tower of Pisa is indeed a famous monument. Yet, it is also a monumental error of civil engineering. Built in 1173 with no foundations on a flood plain, the white marble tower started tipping on its southern side even before it was completed. Its peculiar inclination is like a spectacular warning to all builders around the world.

Yet, people have studied the ground under their feet, way before the 12th century. They have done so ever since they started extracting rock, building houses and bridges and digging irrigation systems. At first purely empirical, soil investigation has been rationalised since the 17th century and has given rise to geotechnics, a technoscience combining geology and geomechanics.

Today, the most frequently used measurement instrument in geotechnics is the penetrometer. "Imagine it as a giant hydraulic press that digs a measurement cone in the ground..." explains Paolo Bruzzi, Pagani Geotechnical's sales manager. The Italian company, whose factory is based in Piacenza, near Milan, has become a global leader in the field of geotechnical equipment.

Penetrometers render high-fidelity images: "Our equipment detects layers - sand, clay or other - as thin as 10-15 cm." Enough to make reliable estimates on soil behaviour when building a road or a bridge, digging foundations or simply setting up the pillar of a ski lift.

As for all measurement instruments, the quality of penetrometers depends on their reliability. "The system verifies itself its accuracy after every measurement", explains Paolo Bruzzi. "Incoherent data would immediately signal that the cone had been damaged. So, we can be sure that our measurements are always absolutely precise."

Furthermore, the cones require mandatory calibration every year, a further warranty of correct measurement. Material and processes are standardised de facto on an international level. The cone sizes, the forces applied, the penetration speed... everything is defined to enable traceability, repeatability and data sharing.

Penetrometer tests can be used for other types of measurements as well. In particular, for seismic measurements. *"In such cases, we stop penetrating after every meter and create a seismic wave from the surface"* explains Bruzzi. *"Its amplitude and propagation speed is measured by a sensor on the cone, which makes it possible to evaluate the soil's behaviour in case of earthquakes."*

Anecdotally, the "elastic" soil, isolating the structure from earthquakes, which provoked the tipping of the Tower of Pisa, also protected it from several earthquakes.

The instant results obtained by the penetrometers have greatly contributed to the popularity of these instruments. Carried out in situ, the tests do not require any soil sampling, nor waiting for laboratory analysis results. *"They disturb the soil much less than core drilling, so they are less likely to influence the results"*, says Paolo Bruzzi.

Whether disturbed or not, ground is not easy to deal with. The equipment must possess huge power to drive in a cone. *"In the past, the only solution was using heavy duty trucks, up to 20 tons"* recalls Bruzzi. *"Such trucks are still used in certain cases and they usually cost in excess of 400,000 euros, require a heavy vehicle driver, an entire team and, since the measurements need to be carried out vertically, a flat, large enough piece of land..."*



In a nutshell, a costly and constraining solution. The idea of developing an alternative is how the story of Pagani Geotechnical began.

It all started back in the seventies in Italy. As building requirements were being strengthened, Ermanno Pagani created his geotechnical consulting company. Tests became widely used and the entrepreneur realised that engineers were increasingly using heavy trucks for projects that were much smaller than building bridges or blocks of flats, such as family homes. He wanted to carry out tests with equipment that would be much less disproportionate. Wouldn't it be possible to have a penetrometer capable of analysing with precision the first 20-25m of soil (deep enough for a large number of projects), but that would be more compact, easy to use and much less costly than geotechnical trucks? Since he couldn't find anything to meet such needs, he developed his own equipment. As it attracted his

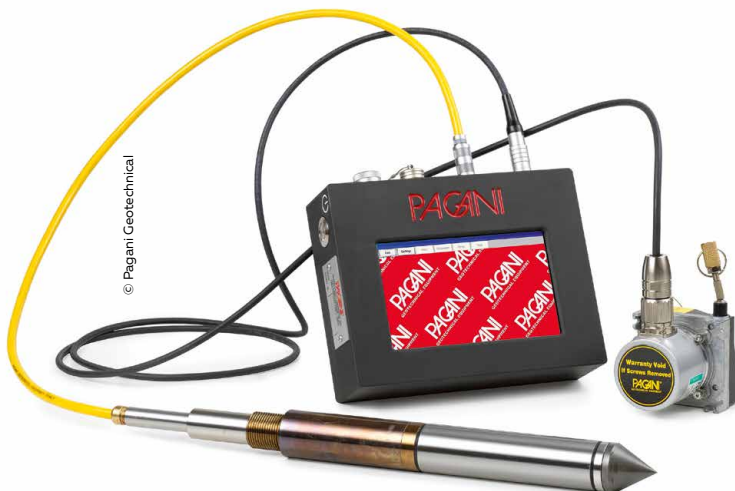
customers' attention, he could foresee the potential market and launched his business. Since then, Pagani Geotechnical stopped being a consultant, and became a manufacturer. His first penetrometers were sold in 1983.

A year later, the company launched its TG 73-200 model, a modular and mobile device. Its mast can be tilted forward and backward enabling measurement even on sloping terrain. It anchors automatically into the ground so that it can exert the necessary thrust, in spite of its modest 3 tons. Handling, anchoring and measurements are automated to such an extent that only a single operator is needed to carry out the tests.

Pagani has put a particular accent on the robustness of the product. *"The TG 73-200 was built to be indestructible"* laughs Bruzzi. *"It withstands all types of 'abuse' - very difficult terrain or heavy-handed, clumsy operators!"*



▲
Pagani Geotechnical customers have used their penetrometers on all types of terrain: rainforests, glaciers... even on the canals of Venice.



▲
The new CPT-AS data logger connected to the cone penetrometer packed with sensors.

Thanks to these "over the top" characteristics, the 73-200 remained Pagani's high-end model, selling five of them a year. *"Its customers are large companies that require no-compromise performance for some highly demanding applications."* As for other applications, Pagani Geotechnical has taken another step forward.

The TG 63-150, even easier to use, was launched in 1989. It is slightly bigger than 1m by 2m and weighs only a ton. The engineer can transport it himself in a van (no longer a need for a truck and a truck driver) and carry out the measurement on his own. It is a first in its field which simplified the tests and cut the costs considerably. The price (44,000 euros, which is half the price of a 73-200 and close to one tenth of a truck) contributes to broadening the client base – medium-sized companies, consultancy firms, universities, laboratories...

"The 63-150 was the first of its kind", says Paolo Bruzzi. *"It had immediate success. With 800 units sold in over 70 countries, it has even become the best-selling compact penetrometer in the world."* It is still Pagani's best-seller, who sell over sixty of them every year.

The TG 30-20 and 63-100 completed Pagani's range of penetrometers. The Italian company, still managed by its founder, employs 25 people. Its factory produces between 70 and 80 machines a year and its 800 customers come from almost 90 countries.

Apart from the engines and hydraulic systems, everything is developed and produced in-house: accessories, electronic cones, seismic modules, power units... Even its data acquisition systems, including the new CPT AS, launched this spring, fully fitted with LEMO connectors. *"This watertight system needs to operate on all terrain, from snow-covered northern countries to the Amazonian rainforest"* explains Bruzzi. *"We have chosen IP65 certified LEMO connectors for their resistance and compactness, as well as for aesthetic reasons – the excellence of our solutions also derives from design!"*

Pagani's material is robust (its penetrometers are used for "an average of more than 20 years"). Technical components remain stable (*"there hasn't been found anything better for exploring the soil!"*). Improvements are made essentially in the electronics system and the accessories. Two or three annual upgrades optimise measurement precision and ease of use. Safety is reinforced to follow the continuous evolution of regulations. Applications have become mobile.

"Many innovations arise from our partnerships with universities and research centres in Italy, Brazil, England or other countries, and, obviously, from feedback from our 800 customers from almost 90 countries, who use our technologies regularly in all possible conditions: in jungles, frozen soil, deserts..."

Pagani, proudly claiming "Made in Italy", is happy to be associated with high quality. The durability of its machines hasn't hindered regular sales progress for the last few years. For what reason? There's been a growing demand for geotechnical tests. *"The quality of infrastructures has been improving, requirements have become stricter and additional countries, in particular in emerging economies, have started performing tests."* In short, everything is done to ensure that the Tower of Pisa stays unrivalled. ■

LEMO'S UK AMBITIONS UNHINDERED BY BREXIT

Exactly 10 years ago, LEMO UK moved into its spacious new building. It was a logical move for the company, which has been one of the driving forces for market development within the LEMO Group.

In the early 1970's, LEMO's UK subsidiary, located in Worthing on the south coast of England, was a modest small office dedicated to prospecting the local markets. As the business gained momentum and the team started growing, they moved into a 700 sq. m purpose-built building on North Street in 1979. Local distribution intensified, with the steadily growing reputation of LEMO solutions in the UK market, promoted by the Swiss Made label. In 2006, there was another move, a temporary one, while the old building was being demolished and the new one built.



▲
The 3900 sq. m building was inaugurated in 2010 in Worthing.

The new building, inaugurated in 2010, offers a surface area of 3,900 sq. m, which is almost six times larger than before. This evolution is a perfect illustration of the UK subsidiary's role. *"Over the years, we have continuously evolved and can now offer much more than simple distribution services"*, says Peter Dent. With his engineering background and over 30 years' experience in the connector industry, the Englishman was appointed managing director in 2015. LEMO's UK activities also include connector and cable assembly, as well as R&D: the subsidiary company has been actively contributing to the development of several iconic solutions.

It was from the UK that LEMO led the development of the F Series, for example. In the late nineties, Formula One was looking for new next-generation quick-connect, lightweight, compact connectors capable of withstanding the extreme conditions of car racing. Since several major racing teams are UK-based, LEMO launched an inquiry to identify needs, before setting to work. The solution developed in less than 6 months was rapidly adopted by Formula One. The F Series were then further developed into the M Series, also in cooperation with racing teams. Many Formula One cars are still fitted with M and F Series connectors and LEMO, via its UK subsidiary, has continued its close cooperation with these racing teams.



In the UK, LEMO also has cable assembly operations.

R&D for fibre optic solutions has also been influenced by the UK team, where a dedicated structure (LEMO FOUR, meaning Fibre Optic Unit of Research) was created in 1998. This is where the 3K.93C was developed, which has become an HD TV global standard. *"We have played an important role in helping the early adopters like the Premier League"*, recalls Peter Dent. *"LEMO supplied the interconnect technology to equip their stadiums with permanent fibre optic infrastructure."* This decisive asset for the high-quality broadcast of all football matches within the league *"has helped the Premier League become the global brand it is today."*

Fibre optic know-how has also resulted in the development of a portfolio of media converters that LEMO has been marketing for over fifteen years. These hi-tech solutions, designed in the UK, are still assembled and tested here for the whole of the LEMO Group. Training for users of fibre optic solutions has also been offered for many years by LEMO FOUR.

Today, over 50 people work for LEMO in Worthing.

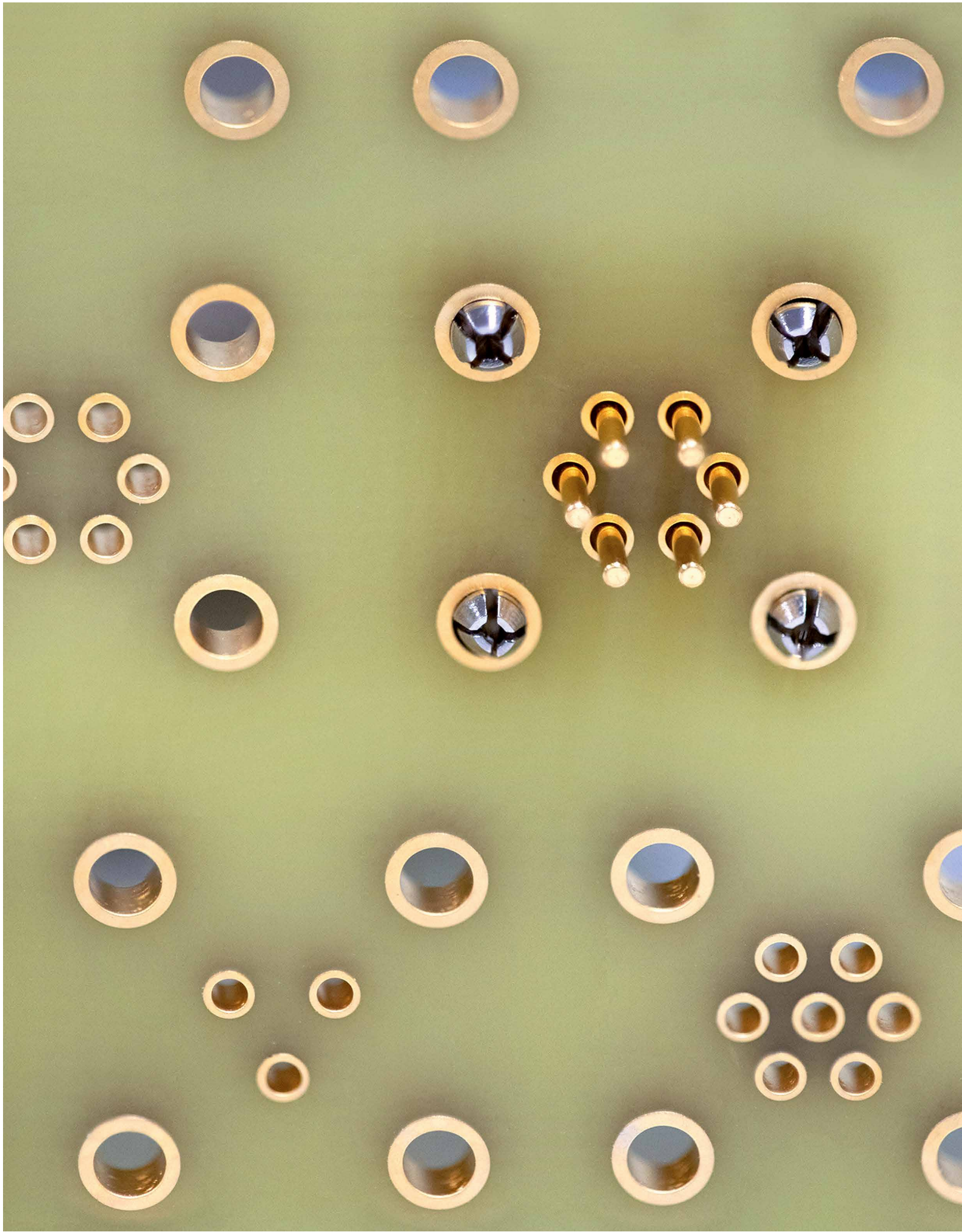
Automotive and broadcast were not the only applications that were added to the historical Test & Measurement market. *"Defence and security have become an important market for us"*, explains Peter Dent. *"Recent global events have increased the demand for equipment to fight terrorism, with intelligence gathering, surveillance and communication tools. These are rapidly changing technologies, as emerging new threats need to be continuously countered. Our support in the development of this emerging market has established LEMO as one of the de facto standards by default and a supplier of choice."* Another global phenomenon – the aging population – has boosted the development of medical equipment, which has also become an important market for the UK company. *"We have been contributing to the next generation diagnostic equipment and surgical machines"* says the proud director, mentioning Spectrum Medical and their cardiovascular perfusion equipment, as an example.

Providing companies – even entire industries – with concrete support for innovation and development gives the greatest satisfaction to Peter Dent. He is also very pleased about the increasing value-added custom solutions. *"Today we are developing complete plug&play subsystems"* he adds. *"We are much more than a supplier: we are strategic partners for our top customers. As a matter of fact, they often consider us as part of their team!"* The UK subsidiary has played a pioneering role in this repositioning strategy applied throughout the LEMO Group.

Last but not least, THE British topic of the last three years: Brexit. What are its impacts on LEMO's services in the UK? *"There are uncertainties, just like for everyone else, but it is mostly an opportunity for us"* thinks the director. *"LEMO chose a long time ago to invest locally in production and customer services. Brexit has confirmed and accelerated this strategy. The preference to source and partner locally has grown, and our capabilities and customer intimacy differentiate and enable us to do so."*

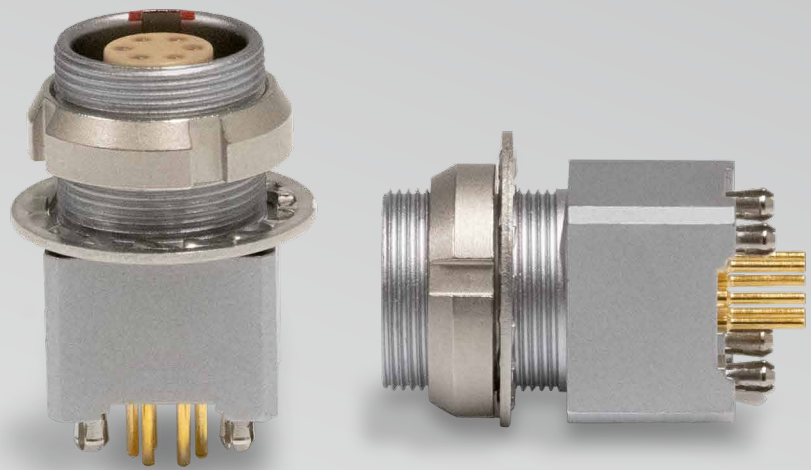
To endorse this investment strategy, the UK subsidiary is proud to announce it has been nominated as a 2020 finalist for the "Sussex Super Growth Awards". These prestigious awards are given to companies within the county who have the best growth rates measured over the prior four years of trading. This year's awards are particularly important, as the period under analysis effectively measures how companies have adapted since the Brexit vote in 2016.

With Brexit effective since 31st January, LEMO has entered a new era in England. Peter Dent points out, with a touch of irony, that the subsidiary was created in 1973, the year the United Kingdom joined the European Community. ■



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