

CONNECTED

AUTUMN 2019

MAGAZINE

THE ART OF THE RACE

ALL HAIL AIR TAXIS!

THE FIREFIGHTING ROBOT
OF NOTRE-DAME



IN THIS MAGAZINE



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THE ART OF MOVING THE WORLD FORWARD

What is the difference between creativity and innovation?

Creators and innovators both explore and push the limits beyond the known. They never stop questioning and searching. They continuously reinterpret techniques and processes and invent new ones. Passionate, sometimes to the point of obsession, they aim for perfection and tend to refuse compromise. Over time, their experience becomes more and more specialised and efficient. Finally, the solutions they offer inspire those who come after them.

Creators and innovators, each in their own way, both make the world move forward.

That is why this issue of CONNECTED has associated the two. We are presenting a creator I've had the great

pleasure to work with, an artist who gives colours and personality to objects (illustrated by our cover page).

We have also interviewed innovators whose projects seemed crazy – flying taxis, firefighter robots – that nonetheless became a reality.

Questions, such as "Why", "Why not?" and "What if?", are at the heart of human evolution. We are instinctively driven by curiosity and identifying problems and solutions.

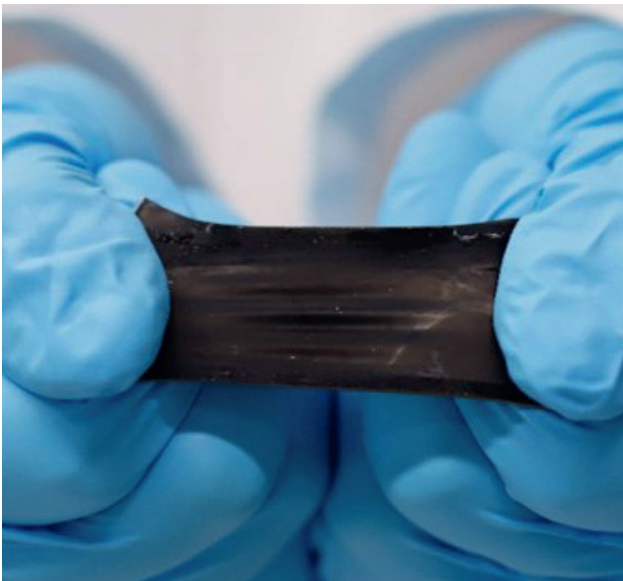
At LEMO, it is this creative force we are so passionate about and that we nurture to make it an art, the art of innovation.

Alexandre Pesci
CEO LEMO

TECH-BITS

FROM AROUND

© Niederberger Group, ETH Zurich

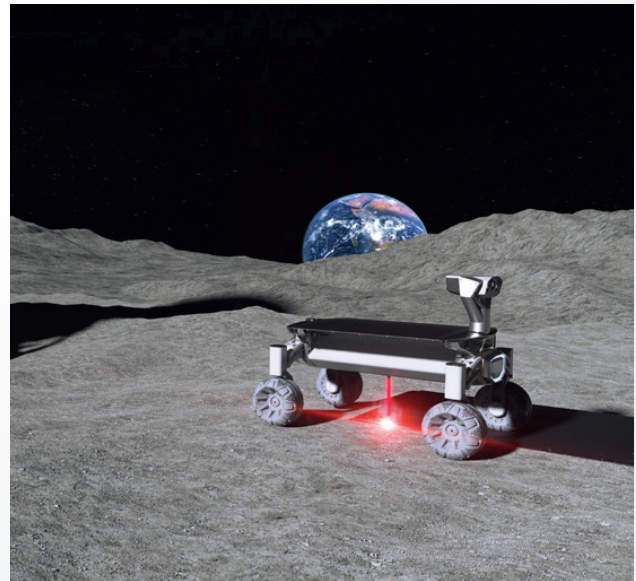


N°1

Twist and charge

Electronic displays that can be folded or rolled are becoming more and more popular. Potential applications include smartphones (hello, new Samsung Fold!), tablets, computers and smart clothing. Unfortunately, they require an energy source which is generally a rigid and heavy lithium-ion battery. A new innovation from an ETH Zurich team could change that: the researchers have developed a prototype for a flexible thin-film battery that can be bent, stretched and even twisted without interrupting the supply of power. This battery uses a new gel electrolyte (discovered by an ETH doctoral student) and is entirely made with flexible components (bendable polymer composite for the current collectors, "roof tiles" overlapping silver flakes for the interior). The new battery is so bendable it could be sewn directly into an item of clothing.

© Laser Zentrum Hannover



N°2

Lunar home sweet home

With its reduced gravity, the Moon could be an ideal departure base for further space exploration. The problem is that transporting 1 kilo of material into space costs about 700,000€. How to send building equipment and materials for a "reasonable" price? A German scientist group from The Laser Zentrum Hannover and the Institute of Space Systems at the Technical University of Braunschweig have found a solution: send a lightweight laser system, which could melt Moon dust and use it to create versatile structures via additive manufacturing. The project called "Moonrise" is well under way, the first tests should take place on the Moon as soon as 2021. The process could then be scaled up to produce larger structures – foundations, paths, and landing surfaces. 3D printing of lunar homes is also planned by the ESA and the NASA.

THE WORLD

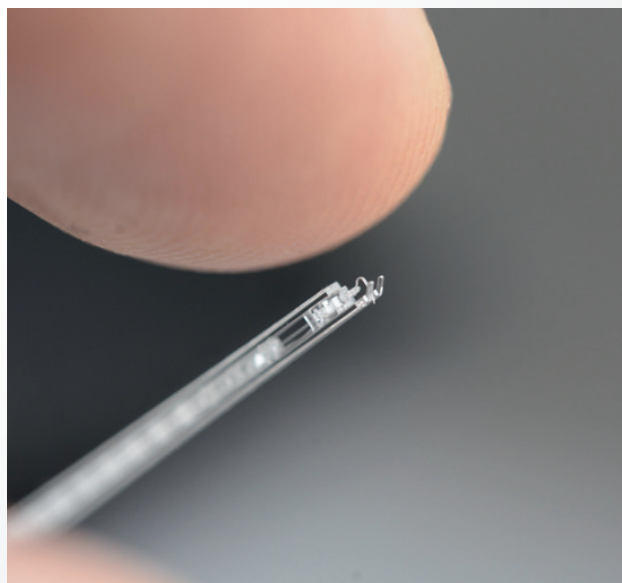


© Ocean Cleanup

N°3

Victory for the cleaning Dutchman

This time, it works: Ocean Cleanup's floating device has managed to autonomously collect floating plastic debris (from scraps just a few millimetres in size to discarded fishing nets) from the ocean. 25-year-old Dutch Boyan Slat's startup has announced this positive result in early October. A first attempt, with the previous prototype, failed, because it moved at a speed different from the debris. The new device, a free-floating, 600m-long boom, has been reinforced and equipped with a parachute anchor that slows it down. Launched in June, it drifted along with the wind and the currents, to the Great Pacific Garbage Patch, an accumulation zone of plastic, as large as three times the size of France. The next step will be to scale up the device and to make it more resistant, so that it can function for a whole year before collection is necessary.



SPOT-RVC © Instant-Lab

N°4

An eye-needle to cure your sight

When the retinal vein is blocked by a blood clot, it reduces the amount of oxygen carried to the retina and can trigger sudden vision loss. This is what we call a "retinal vein occlusion" (RVO) and over 16 million people worldwide, especially the elderly, suffer from it. Until now, RVOs have been impossible to cure, because of the small dimensions of these veins and their walls. This could very well change thanks to SPOT-RV, a revolutionary high-precision microscopic medical device developed and manufactured in Switzerland. The 6cm long and 1mm thick device, made of a single piece of glass, contains a hair-thin fluidic channel and sophisticated flexible blades. It allows a doctor to inject a blood-clot-dissolving compound directly into the retinal vein. The prototype still needs to pass preclinical trials to obtain accreditations before it can go into full production.

LEMO BENELUX'S UNSTOPPABLE GROWTH

To support the unprecedented growth of its Benelux business, LEMO has invested in a new, purpose-built, hi-tech and eco-friendly facility near Amsterdam.

With improved logistical flow, expanded inventory and expedited delivery services: LEMO's new Dutch site, inaugurated in September, offers a great many advantages to employees, customers and the environment alike.

LEMO opened its Dutch subsidiary in 2005 with the initial purpose of covering the Benelux market. Thanks to its ideal position, close to the Amsterdam hub, the company has since been entrusted with additional missions. Currently, it has a cable assembly department and is home to the LEMO European Distribution Center, supplying several European companies (for example Scandinavian customers). It also hosts the European stock of LEMO's Northwire Cable.

Meanwhile, its staff grew from 2 to over 50 people.

To keep up with its evolution, the company had to move first in 2007 and then again in 2012. All the same, LEMO Benelux's site in Heemskerk became less ideal as it tried to accommodate organic growth.

With office space split across several buildings, storage facilities spread over three floors (far from the assembly area), and with no loading dock or freight elevator (the buildings were designed for offices), it was neither efficient, nor easy to work in.

The new building provides a solution to all such problems.

With its three floors coloured black & metal grey, its large windows and pure contemporary design, the site (an investment of 6.2 million euros including the land) is simply superb. It is much more than that, adds Niels Zonneveld, LEMO Benelux's Managing Director: "A big, big step in every aspect!"



This time, LEMO opted for the town of Haarlem, bigger and closer to the enormous port of Amsterdam as well as Schiphol airport and its main freight carriers. This close proximity should further improve distribution (shipping on the same day for orders placed before 3 p.m.).

▼
The new 2500m² building near
Amsterdam opened in September.



The building itself was designed for efficiency. "Expert support was provided to the architects in order to optimise the flow of goods and people. We will no longer need to run from one building to another!" Which is more than welcome on rainy days (which are quite frequent in Holland!).

The teams are now close to the parts and equipment they require. And yes, there is a loading station to improve logistics which dramatically reduces the manual labour element.

The change is particularly spectacular for the stock. With the installation of the 12-meter high Modula inventory system, the surface area (600m²) could be greatly reduced, whilst still increasing the overall volume four times. The thousands of components and finished products are now stored, found and distributed much faster. Northwire cables have their own "Paternoster" system, both customers and subsidiary companies benefitting directly from it.

Every new building is an opportunity to confirm company values. This is also the case for environmental protection: the site (equipped with heat pumps and solar panels) got an excellent GPR score - the Dutch index for evaluating the energy consumption, materials and the potential reuse of the building.



▲
Inside, a bright start-up atmosphere.

The GPR score also includes employee comfort and health, highlighting yet another LEMO value, seeking to be acknowledged as a global "employer of choice".

Plenty of light, large spaces, pleasant meeting areas and a roof terrace... a fairly futuristic working environment, which contributes to improving the working life of employees "as well as to attract new ones, which is just as important for us", adds Niels. The location of the new site, closer to big cities, makes it even more attractive.

Last but not least, the design of the building - to which LEMO's CEO Alexandre Pesci has also contributed - perfectly embodies the brand's high-end positioning. The site invites visitors, customers or partners for a pleasant experience.

No more moving, promises Niels. With 2,500m² (doubled in size), "we have plenty of growing room to triple assembly and double office staff". There is enough space for new equipment (overmoulding and pressure testing have already been planned) to meet new challenges.

The company's message to customers is very clear: LEMO will serve them better than ever and for a long time to come. ■

ALL HAIL AIR TAXIS!

Dozens of start-ups and companies have been in competition to launch their electric vertical take-off and landing (eVTOL) aircraft. The challenge is to conquer the skies over megacities and provide short hops and commuting services on demand. Let's take off for the immediate future with Volocopter, a pioneer of this new urban air mobility.

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© EHang



Bruce Willis flew one of them in "The Fifth Element", the 1997 blockbuster film set in the 23rd century. Today, air taxis are about to take off in the real world, and without any special effects. Their most likely form? Drones, like those that have become commonplace in our skies in these last years, but large enough to carry passengers.

Categorised as non-helicopter electric vertical take-off and landing aircraft, or simply eVTOLs, the continued technological development of multirotors, batteries and stabiliser systems has contributed to their emergence.

Much quieter than current helicopters and producing zero emissions, this new class of aircraft seems to be a transport solution ideally suited for countering the exponential population growth in megacities and the increasingly saturated (highly polluting) traffic that goes with it.

Taking an air taxi is a very appealing idea. But what will it cost? The main players in the sector are optimistic and are targeting transport costs that are competitive with ground taxis. This means designing aircraft at reasonable production, operational and maintenance costs, which would be unprecedented in the world of air transportation.

Many other challenges remain to be tackled.

In order to be welcomed in urban skies at low-altitudes, the new aircraft should not be noisy – electric engines can be practically imperceptible from the ground. EVTOLs must be at least as safe as commercial aircraft and licensed by aviation authorities. Things are moving forward for this aspect as well. The European Union Aviation Safety Agency for instance has presented this summer its regulations on VTOLs, even covering autonomous navigation. Airspace will also have to be adapted to handle this new form of traffic – several cities are already working on it.

It is a beautiful dream, the technical challenges are fascinating and the market is promising. Consequently, a large number of players have entered the race. According to "Aviation Today", over 150 companies have been developing flying taxi models and practically all major aviation players (Boeing, Airbus, Bell, Sikorsky, Embraer, Rolls Royce, Nasa, Thalès...) have invested in designing models, infrastructures or components.

EVTOLs have their own dedicated newsletters, magazines and even international fairs. Dozens of start-ups are competing in innovation and fundraising.

The German company Volocopter (that we will cover in detail in this special feature) has been flying its prototypes since 2016. It has completed autonomous test flights in Dubai and is currently testing its services in Singapore. Kitty Hawk and Zee.Aero are supported by Larry Page, co-founder of Google. Jaunt Air Mobility has been working on its device which looks like a cross between a propeller plane and a helicopter.

The discrete Joby Aviation announced in early 2018 that they benefited from an investment of 100 million dollars and completed a test flight. Since then, they have been apparently working in great secrecy on a new eVTOL equipped with tilt-rotors. In China, EHang has announced in early September that it had performed the first passenger carrying autonomous aerial vehicle (AAV) demonstration flight. There are many others as well.

And there is Uber.

The Silicon Valley giant has decided to add air transport to its conquest of urban transportation. In October 2016, it published "Uber Elevate", a white paper presenting its vision for flying taxis (in the meantime, it launched a classic helicopter service last June). It organises an annual symposium, the most recent one having taken place in Washington in June.



A few examples: EHang (top left), Jaunt Air Mobility (top right), Airbus' CityAirbus (bottom left) and Bell's Nexus (bottom right).



© Jaunt Air Mobility



© Airbus



© Bell

Uber doesn't want to be a manufacturer of eVTOLs, but rather a catalyst for aircraft development which could be used to provide its services. Unlike Volocopter, concentrating on inner-city traffic, Uber is targeting mega commuters with more powerful eVTOLs, capable of transporting at least 4 passengers (to increase profitability), at over 200kmph over a distance of 80km, return. They should be able to navigate autonomously (initially, a pilot would be on board).

These eVTOLs are being developed by its "vehicle partners": Jaunt, Bell, EmbraerX, Pipistrel Vertical Solutions, Karem Aircraft and Boeing's Aurora Flight Sciences. Uber is planning to use them as of 2023.

Which projects will never take off? Which start-ups will disappear? Which eVTOLs will remain as "sport and leisure" aircraft, reserved for the most exclusive rich clientele, subject to limited safety criteria? Which ones will actually be used by commercial air taxi services?

It is quite impossible to tell, but 2020 will be rich in news: with the 7th Annual Electric VTOL Symposium in California; the test flights by Volocopter and other companies; and the opening of Uber's test vertiports in Los Angeles, Dallas and Melbourne.

The air taxi race has been launched. Skyport, the English start-up targeting the creation and operation of vertiports in cities, expects that 100,000 passenger drones will be operational by 2050. It is for the authorities and regulators to ensure that urban space mobility will not lead to additional traffic jams in the skies! ■



THE SKY LIMIT

AN INTERVIEW WITH VOLOCOPTER COFOUNDER ALEX ZOSEL

Eight years ago, when Alex Zosel co-founded his start-up, the idea of electric air taxis seemed completely crazy. Today, however, some cities are already testing them. Volocopter's founder explains why urban transport should turn to the sky and how his start-up wants to become more than just an aircraft manufacturer.

Alex Zosel, how will urban mobility evolve?

Urban mobility will undergo a huge transformation in the next 20 to 30 years. Following an already perceptible trend, private means of transport will be increasingly chosen for environmental reasons (efficiency, low emission...) rather than for ego-boosting (power, speed...). Many new devices will appear or co-exist: we will see cable cars, e-scooters, conveyor belts, streets dedicated to fast bikes, etc.

This evolution will certainly also depend on the evolution of society and work. New technologies could very well reduce working hours, the workforce, increase teleworking – all this will have an impact on traffic.

How does Volocopter position itself in this evolution?

We believe that in megacities with saturated roads and major traffic flow issues, the only viable solution will be the sky! We want to be one of the big players, one of the drivers in urban air mobility. This is why we talk a lot about the transformation of cities with architects

and infrastructure specialists. On the one hand, we are thinking in the long term – imagining a future with thousands of aircraft in the city skies.

On the other hand, in the short term, the first solutions, the first missions: where are the current needs for flying taxis? Where would they really make a positive impact in terms of mobility? It is on these short-term solutions that we will gradually build up the ecosystem of urban air mobility.

Which missions are you focusing on first?

On combating bottlenecks in megacities. They represent a highly critical situation that flying taxis could rapidly improve. For instance, by transporting people between airports and city centres, or between tourist attractions – an issue in a large number of cities. It wouldn't be necessary to transport everyone through the skies, but relieving some roads could rapidly help the whole system to flow better.

Short hops and no long-distance commuting, unlike the market targeted by the Uber Elevate system?

We want to fly between cities one day, but we believe that flying in inner cities would fix a more urgent problem. There is also a technological reason for this choice: we want a reliable solution now, using tried and tested, already existing batteries, which do not provide for flying over long distances. The limited range of our aircraft – 35km – is not a problem: our analysis shows that 90% of the megacities we are targeting have a major airport within 30km of the city centre. Therefore, millions of journeys are within our reach.



A Volocopter vertiport prototype. The ultimate idea is not to be exclusive, but to open up to other eVTOL models and companies.



© Brandlab / Skyports / Volocopter / CRAFT

Your targeted mission also influences some other design aspects of your solution...

Our aircraft is fully designed for this mission. Its extensive propulsion system including 18 engines, for example, makes it extremely quiet and reliable (it can fly even if several engines aren't functioning). Noise and safety are the major criteria for being approved in cities. Our speed of 110km/h is also important: flying twice as fast would be terrifying, dangerous, much noisier and, considering the short distances, it wouldn't really be a time-saver.

Are eVTOLs appropriate from the environmental point of view?

They are zero-emission which is already great. Obviously, they require more energy for taking off than a car on a flat surface. On the other hand, there is no need to build roads, bridges, tunnels – all these costly infrastructures which then generate huge maintenance costs. If you add the impact of these infrastructures to the impact of vehicles, it is clearly more efficient to go up into the sky! Slowing down or decreasing the development of the road network also makes it possible to save or reintroduce nature into cities.

Launching innovative new means of transport is often hindered by the rules which have to be created or adopted...

Integrating this aspect is part of Volocopter's DNA: we have been discussing with the authorities for over 7 years about how to integrate eVTOLs. In general, the authorities are fairly open: they want to make flights safer, which is exactly what sensors and automated systems built in the heart of eVTOLs provide for. We have been partners of the European Aviation Safety Agency (EASA) for two years. We have helped to integrate air taxis flying in inner cities – which

could also fly autonomously – in these regulations. Similarly, we have been working with the US Federal Aviation Administration, whose processes are somewhat more complex and extensive. The "Special Condition for VTOL" of the EASA was presented in early July and we are very proud to have contributed to it. The VoloCity, our new aircraft, will be the first commercially licensed Volocopter accredited to these high standards and requirements. Simply put, the safety requirements are that flying taxis will have to be as safe as commercial aircraft. They shall be.

How about integration in air traffic?

This is more of a local thing: the selection of routes, weather conditions, altitudes, coexistence with drones and helicopters... Again, we have a lot of experience, namely thanks to our cooperation with the Dubai government's Roads and Transport Authority. They asked us to participate in a project for autonomous flying devices in the airspace over their city. The feasibility of such a service was proven after a successful test with our Volocopter 2X in September 2017. This was the first-ever public flight of an autonomous urban air taxi. We are currently working with Singapore authorities, who are also interested.

So, it is city by city that Volocopter develops its projects?

Yes. Many cities have already asked us to become technical partners to advise on how to develop urban air mobility infrastructures and services. Therefore, they are motivated and very much involved. They dedicate the necessary resources and it can quickly go forward – we have no fear of not getting approvals. We start off with a first route from A to B, as a first step. Whatever happens afterwards, Volocopter can always learn a lot and it helps us to extend our offer.

Do you also work with airport operators, such as Skyport?

Yes, indeed. Not only for the integration of air taxis in their territory, but also for integrating our services with theirs. We could imagine for instance that check-in for an international flight would be possible upon embarking at a vertiport in the city. It would relieve traffic in their departure area.

The way you describe it, it would seem that Volocopter will provide services, rather than just aircraft...

You are exactly right. From the beginning, we never wanted to be a manufacturer of vehicles. We want to be a mobility provider, to sell the tickets. Everything beneath that is based on very strong local partnerships, with the authorities, real estate players, airport operators or helicopter companies, whose launch pads we could use. In a nutshell, we have to associate with all of those to ensure the smooth integration of flying taxi services in a city. At the same



© 2017 The Foreign Office Collective

time, our vertiport projects are not exclusive: other eVTOLs could also use them. Volocopter could even buy or rent aircraft from other manufacturers. We are really open – we wouldn't be able to create an air-mobility system if we were exclusive. Our eVTOLs have a head-start, so we will start with them to be the first on the market. Then we will see how to increase the scale.

▲
A Volocopter 2X flying in the inner city. The startup has worked on different types of vertiports, some integrated into city buildings.

When will these air taxis be part of our daily lives?

They have been part of my daily life for years, since I am one of the test pilots!

I think the first regular route will be opened in 2 to 3 years. The speed of their implementation will depend on several factors, including the production capacity of eVTOL manufacturers! By the time I retire in 13 years, we should have a system of flying taxis in at least 10 megacities. If not, well, in that case I will have to retire five years late! ■

FROM A SMALL DRONE TO FLYING TAXIS

© Volocopter

In 2010, Stephan Wolf, an industrial automation software development specialist, bought a quadcopter for his son. It was one of the first ones that even a child could easily control. Impressed by its manoeuvrability, stability and easy handling, Wolf immediately started dreaming: what if it was scaled up to transport people?

After some research and calculations, he developed a project. He contacted Alex Zosel, a childhood friend, who became an entrepreneur. A passionate hobby pilot and paragliding teacher himself, he didn't hesitate for a second. The two men and Thomas Senkel founded e-Volo in 2011. The startup, located near Karlsruhe, in Germany, subsequently became Volocopter.

The VC1 proved in October 2011 that an electric multicopter was capable of taking off vertically with a passenger. Then, the first prototype, the VC200, was suitable for carrying 2 people. It made its first manned flight – with Zosel himself as the pilot – in March 2016. The VC200 had been financed through an instantly successful online crowdfunding (500,000 euros in 2 hours and 35 minutes!).

This model also marked a major milestone: it got a license to fly all over the country from the German authorities. The Volocopter 2X, first displayed in 2017, has since been built into a miniseries for extensive test flights in manned, unmanned (which includes remote-controlled), and automated (following a preset route with no human interference) configurations.

In only 8 years, the seemingly absurd idea of a “drone for humans” has become a certified aircraft. In the meantime, eVTOL aircraft (electric vertical take-off and landing) have generated an industrial race (see page 08). Volocopter, a visionary? In any case, that's how the World Economic Forum seems to consider the startup, as they were among the winners of the 2019 “Technology Pioneer” award which recognises companies that are “poised to have a significant impact on business and society”.

Many investors, large and small, have contributed so far to financing Volocopter, including Daimler and Intel. Lukasz Gadowski, a German serial entrepreneur and founder of Circ (formerly known as Flash) micro mobility electric scooter, is one of the personalities who have been convinced. Last September, Geely, the Chinese Group owner of



Thomas Senkel, Volocopter's cofounder, takes the VC1 for a spin in October 2011, achieving the world's first manned flight with an electric multicopter.

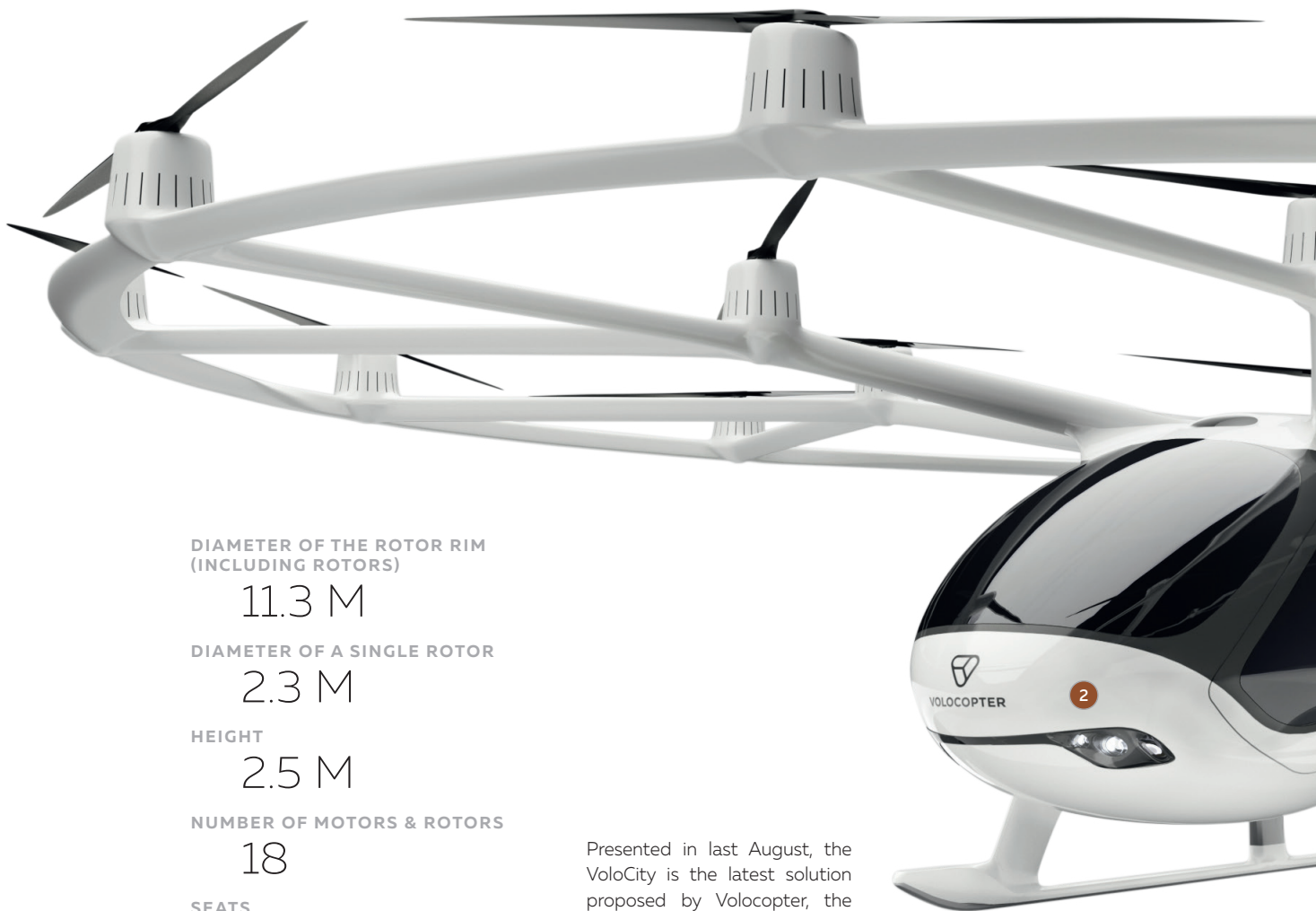
Volvo and Lotus cars, as well as Terrafugia (hybrid cars/aircraft) headed the round of private funding amounting to 50 million euros for the C Series.

This summer, Volocopter presented its next model, the VoloCity (for all the details, see page 14). Slightly larger and twice as heavy and powerful as the 2X, this multicopter is not a prototype, but rather the first to be marketed.

The startup, with a current staff of about 150, aims at becoming a mobility provider (see the interview with Alex Zosel, page 10). It has been working for several years already with Dubai and Singapore, who have requested a feasibility study on such services in their skies.

At the end of October, Volocopter conducted a public proof of concept flight in Singapore. It also displayed a vertiport prototype there, not for launching the eVTOLs (the authorisations are missing), but for testing and improving various services (reception, booking, check-in). This proof of concept on a one-to-one scale is another step towards the imminent launching of a brand new type of urban mobility. ■

MEET THE VOLOCITY



DIAMETER OF THE ROTOR RIM
(INCLUDING ROTORS)

11.3 M

DIAMETER OF A SINGLE ROTOR

2.3 M

HEIGHT

2.5 M

NUMBER OF MOTORS & ROTORS

18

SEATS

2

PAYLOAD

200 KG

SPEED

110 KM/H

RANGE

35 KM

Presented in last August, the VoloCity is the latest solution proposed by Volocopter, the first designed for actual commercial use. All of its features (number of seats, range, speed...) are related to its mission: to be an inner-city flying taxi and nothing else.

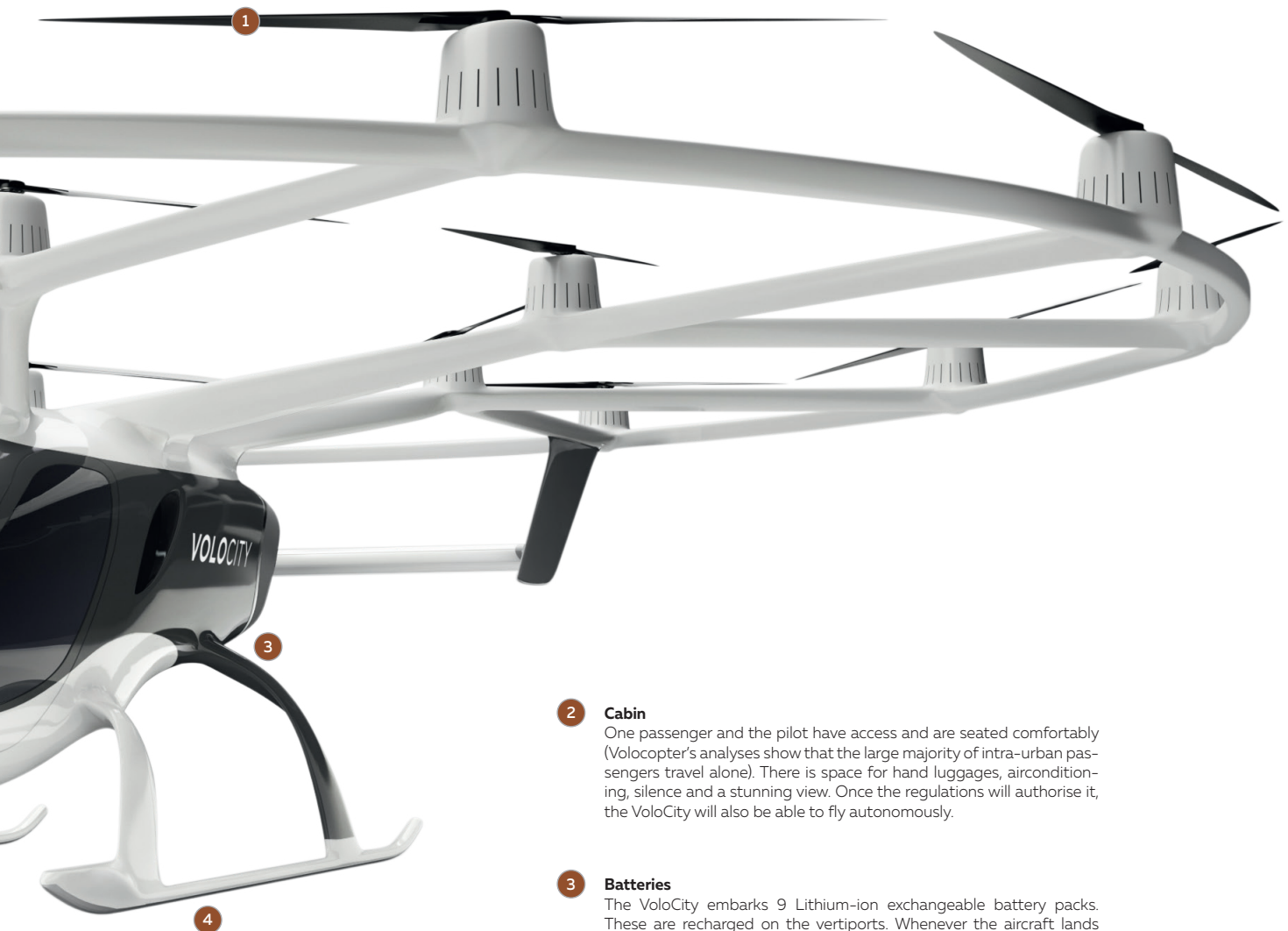
The choice of simplicity, for instance (such as direct-drive motors and fixed pitch rotors) makes the solution less costly to manufacture, more reliable (less expensive maintenance and easier to certify), lighter, so more economical and less noisy. Everything is closely linked.

The control unit is equipped with 0B, 0T and 2B Series LEMO connectors.

1

Drive

The wide span and a large number of battery-powered engines and rotors (18 of each) reduce the noise level and generate a frequency that is softer and more pleasant on the ear. It also improves safety: the VoloCity is capable of flying even if several engines are inoperative. The aircraft will fly at "only" 110kmph, which is safer (better collision avoidance) and less noisy than rapid eVTOLs.



2

Cabin

One passenger and the pilot have access and are seated comfortably (Volocopter's analyses show that the large majority of intra-urban passengers travel alone). There is space for hand luggages, airconditioning, silence and a stunning view. Once the regulations will authorise it, the VoloCity will also be able to fly autonomously.

3

Batteries

The VoloCity embarks 9 Lithium-ion exchangeable battery packs. These are recharged on the vertiports. Whenever the aircraft lands in between two flights, batteries can be changed in five minutes to fresh batteries and can take off. Its 35km range makes it possible to connect the most popular destinations (city centres, airports, business centres ...).

4

Skids

Vertical take-off and landing, so no need for wheels nor retractable landing gear. This is part of the rationalisation process to reduce weight, breakdowns, production and maintenance costs. Ground operations are ensured by conveyor belts or platforms.

THE ART OF THE RACE

The design of the Rebellion Racing cars made a splash at the last 24 Hours of Le Mans race. They were the creation of a contemporary artist, Tomyboy, who brings personality to objects by combining street art with his signature use of intense fluorescent colours. Interview and portrait of a rebel; genuine and extremely secretive.

A Ferrari GTC4 Lusso, covered in an explosion of fluorescent colours started it all.

The rather flashy car, parked at Baselworld, the showcase event of the watchmaking industry, caught the eye of Calim Bouhadra, director of Rebellion Corporation. This was exactly what he was looking for, for the Rebellion Racing cars which were to run in the legendary 24 Hours of Le Mans race three months later. Upon enquiry, he found out that the man behind this spectacular creation was Tomyboy, a contemporary artist, well-known for his unbridled creativity, marrying street art and fluorescent colours. A meeting was promptly organised with Alexandre Pesci.

Between the iconoclastic artist and Alexandre Pesci, proprietor of Rebellion and of LEMO, it clicked immediately. The same passion, the same refusal to compromise. "It was like meeting with family, you know", says Tomyboy with a laugh. "We share the same DNA." Everything was quickly decided: Rebellion Racing, the small car racing team who had been shaking up some of the major constructors in world endurance races, would express its rebellious spirit by creating spectacular "art cars". It was a first for Tomyboy – "I had done supercars, but never racing cars".

With his tattooed pirate-like looks, hoarse voice and using some very colourful language, the man is extremely easy going and warm. He is also a very private person. His real name? No comment. His age? Never mind. This "very shy guy" gives very few interviews and even prefers to wear a mask during his public appearances. "My art loves the lights", he explains, with reference to his iconic fluorescent and glow-in-the-dark creations, "I don't".

In a very pop art style, Tomyboy takes every opportunity to "rework" consumer products, with a clear preference for luxury items. Why objects? "I love to create art you can really use and take outside, into the street: jackets and watches you can wear, cars you can drive..." He breaks their codes and makes them unique, just like a tagger who transforms a plain, boring wall into a unique work of art. This is why he refuses to sign up with brands for creating mass product lines. How about colours, these fantastic neon colours? It's all about expressing and sharing joy. "When I look at art around myself, everything looks so dark, you know, quite depressing. Me, I like to make people happy and this type of colour makes people – young and old – happy. With them, things get a new life. They glow like a smile makes a face glow. And if people are happy, so am I: it's all about sharing."

Now, he had to apply this approach to the two Rebellion R13 cars and their backups, as well as on the Rebellion Racing stands in Le Mans, as it was decided to go for a 360-degree operation. In addition to this, there were the Cadillac, the Mercedes 600 Pullman and the McLaren cars which were to participate in the traditional pilot's parade, as well as the Rebellion Motors garage in Lausanne and on 20 RE-Volt watch models by Rebellion Timepieces. All of this in 2 and a half months. Tomyboy bursts out laughing: "Normally, a project like that takes 6 to 8 months and you plan it a year ahead! But I said yes, because I just wanted to do it, you know. So, we worked from the morning to 3 a.m, every [expletive] day!"

To begin with, the artist let himself be inspired by the design and form of the car. Together with his graphic design team, he implemented his ideas progressively on 2D files. Forms, images, texts and



© Rebellion Racing, José Mario Diaz

With their RocketByz design, Rebellion Racing cars were impossible to miss in Le Mans this year. ▲

colours... He tries, shifts and shuffles, replaces, finetunes. Little by little, the car adopts a new personality. The creative process, specific to each object, starts all over again. Race cars, with their modern design were fairly easy to accommodate. However, the Pullman from the sixties gave him headaches. *"This car is history! I didn't want to destroy its classic shape, make it look like a Disney car, you know! I needed to find the right way to flip it."*

There was a lot of going back and forth between the artist and the Rebellion team. Some of his favourite phrases – an intrinsic part of his creations – were discarded. "Because I can afford it" may sound grand in the world of luxury, but Alexandre Pesci has a solid respect for the value of things. "I don't want to be a slave to the system" could raise eyebrows among the authorities of the International Automobile Federation. Positive elements, such as "Because we are rebels" or "Good times", were selected instead. Such adjustments were not a problem for Tomyboy: *"I like to be aligned with the people I'm working with, we need to share the same feeling."*

All the visuals were then reworked in 3D, to ensure that the stickers match perfectly with the cars' curves. Once the design phase was finished, production was launched. For stickers displaying particularly vibrant fluorescent colours, Tomyboy turns to car tuning

specialists. When in Hamburg, he works with CiFol Werbetechnik and when he is in Los Angeles he works with West Coast Customs, who became popular through MTV's "Pimp My Ride" show.

Once the stickers arrived, they were cut to exact dimensions in Hamburg and sent to Switzerland and France to apply the designs. Tomyboy spent 3 days in Lausanne to work on the Mercedes, the McLaren and the Cadillac. Then they rushed to Le Mans to cover the race cars in 5 days. One team worked on the two black cars (the stickers were applied directly on the carbon body), while another team sorted out the two white cars, which first had to be covered in white, before placing the RocketByz stickers. The Rebellion teams then did some more adjustments before placing the other stickers (car numbers, sponsor logos, the drivers' names).

At each project stage, the deadlines were pushed back, but in the end everything was ready. The race cars, the parade cars, the stands... even the 20 Re-VOLT watches, which each has an individual design – a single design for this limited series would have been way too easy! *"That was insane"* says Tomyboy with a laugh, *"but we made it thanks to a great teamwork!"*

In any case, the results were spectacular.

The universe they created reminds you of a "Mad Max" which would have been filmed in the sixties. Destructive looks, street art iconography, a joyful explosion of fluorescent colours. *"It is unique, flashy and positive!"* says Alexandre Pesci. The concept is entirely RocketByz and perfectly Rebellion.

With Tomyboy, the Swiss team brought a breath of fresh air and a pinch of madness to the 160,000 spectators who crowded together in the streets of Le Mans for the drivers' parade (Parade des Pilotes).

Tomyboy, who attended, hidden behind a mask, allowed himself to be carried away by the passion of the mythical race, launched on the next day. *"It was a shock I hadn't expected. Unreal. Everything and everyone was so intense. The speed, the ups and downs, the team... it generates crazy feelings. I was not a race car fan before, now I am!"*

After many twists and turns (and a collision), Rebellion finished 4th and 5th. Racing giant Toyota and its cars powered by unbeatable hybrid engines, took the first two places on the podium. Thanks to these results, the Swiss team won the title of WEC Vice World Champion 2019 in the LMP1 category.

It wasn't only a sporting feat, but also artistic. The "freak" RocketByz cars made a sensation in Le Mans and their images received specialised media coverage around the world. *"Everybody fell in love with Rebellion!"*, says Tomyboy. It was an excellent marketing coup for both Rebellion and himself.

From the artist's point of view, there was something more to it than visibility. *"I was confident some people would love my work, but I never expected that big reaction! I told you I love to make people happy. Well, they have been very happy and they shared their happiness – it was a pure joy for me! I am so thankful to the Rebellion team for allowing me to go so far with the race cars, the parade cars and everything. It has been an amazing opportunity for me to share my art."* ■

© Sined Fotografie



Each element is designed separately and printed on special stickers.
It took 5 days to cover the racing cars by hand.

A CAREER IN NEON COLOURS

© Sined Fotografie



Why a mask?
Because Tomyboy's art is as flashy as he is discrete.



Tomyboy has always been an artist, but not always a visual artist. He was originally an R&B producer. Keen on making a difference through distinctive merchandising, he developed a visual concept combining street art aesthetics with fluorescent colours from the sixties. RocketByz (pronounced as "Rocket boys") was born.

In May 2012, during the Billboard Music Awards, the singer Chris Brown and his group went up on stage with glow-in-the-dark bikes designed by RocketByz. "I had no idea about it" says Tomyboy. "I was in Europe, fast asleep! When I woke up, I had tons of e-mails. This is really how RocketByz took off!"

With his striking fun style, Tomyboy transforms all sorts of consumer objects. Cars (Ferrari, Lamborghini, Mercedes, Minis, Rolls Royce...), Harley Davidsons, clothes, bags, sneakers, watches... Various brands have been interested in working with him and have been ordering limited series, such as Blaken, who specialises in personalising Rolex watches; or SevenFriday, whose 50 RocketByz watches sold out in two hours (and were subsequently copied in China!).

Meanwhile, his creations – classified by some as "Rockstar Art" – have attracted the attention of collectors. Tomyboy has also been exhibiting: in 2016, "Glow in the Dark" presented his fluorescent artworks in Abu Dhabi, then in Hamburg.

The artist is full of inspiration and energy. The large variety of RocketByz projects is a perfect illustration of him. Watch winders for the Infinite Watch Winder brand. A porcelain bottle for the champagne Sensorium. An outdoors installation for a football stadium in the Polish town of Gliwice. The interior and exterior decoration of a dozen cars for Carlex Design, experts in high-end personalised cars, planes and boats. His art will also be displayed on the front facade screens of the Flannels store on Oxford street in London.

Not to be outdone, Tomyboy has been preparing the launch of his own products. A glow-in-the-dark alcohol, which will be only available in a few selected bars. Boxer shorts made in the United Kingdom, so exclusive that they will be numbered.

Tomyboy's motto has never changed, since the beginning: take a consumer product and turn it into a full-blown work of art. Unique and personal. ■

HEALING THE POWER

When overly used, electrical power becomes increasingly fragile and its quality less and less reliable. The Japanese company HIOKI's constantly evolving, innovative instruments are capable of diagnosing disorders and identifying their cause.

Whenever we press a button on our PC or our television, we know what happens: thanks to the electricity network, the device turns on and stays on until switched off. The reality, however, is obviously much more complex. Electricity is neither static nor homogenous, its quality may vary and have a host of defects and shortcomings.

In general, power quality is continually decreasing, due to the exponential growth in numbers of electronic devices and the increasing frequency of large spikes in demand, such as furnaces or rectifiers. Energy sources have been diversifying (solar, wind, fuel cells, etc.) and becoming increasingly dispersed geographically.

Therefore, grids have become more complex, which makes power distribution more complicated. Moreover, as electric devices require less and less energy, they become more sensitive to disturbances (power cuts, radiation).

Disruptions and breakdowns due to poor power quality affect end users just as much as power suppliers. It is often difficult to know whether the cause comes from one side (inside a building for example) or the other (the power grid).

Innovators have not been sitting on their hands and HIOKI is one of the companies offering solutions for power quality measurement.

The Japanese company launched its first Power Quality Analyzer in 2001 and has been providing more and more sophisticated models. Currently, it offers two models: the mid-range PQ3100, launched in late 2016 and the new flagship PQ3198, launched this year.





▲ The new PQ3198, HIOKI's flagship power quality analyser.

The new device is marketed for approximately 4,600 euros in Japan, where HIOKI is hoping to sell a thousand a year. The PQ3198 monitors and records power supply anomalies and assesses power supply problems. It is targeted for utilities, electrical contractors, energy consultants, telecom, building facilities management, factories and manufacturing facilities.

Compared to its predecessor, highlights HIOKI, the PQ3198 makes recording and analysis of power supply issues even more simple. Amongst the improvements, it is able to supply power – via its LEMO connectors – to AC flexible sensors and AC/DC sensors. You no longer need dedicated cables, which reduces space requirements and makes it possible to use in outdoor locations where power isn't available. It can measure power and efficiency on two circuits simultaneously, for example the input and output of a solar power system.

Its data is accessible at a distance via an FTP server. It is capable of recording 9999 events (breakdowns, irregularities), which is ten times more than its predecessor and gives a comprehensive overview of the situation.

The PQ3198 complies with an international standard which specifies how power quality should be measured. This standard (reference number IEC61000-4-30) covers a broad range of phenomena:

frequency, supply voltage amplitude, flicker, dip/swell/interruption of supply voltage, transient overvoltage, supply voltage unbalance, harmonic voltage, inter-harmonic voltage, rapid voltage fluctuation... The PQ3198 is in Class A, the highest level of precision and reliability, required for contractual applications or to verify compliance with standards.

HIOKI doesn't only design devices controlling power quality. Founded in 1935 in the Nagano Prefecture, in Japan's mountainous heart, the company has become a global leader in electrical measuring instruments. Its current range includes 200 main products: oscilloscopes, data loggers, battery and component testers, safety testers, probes and sensors, meters and multimeters, among many others.

Today, HIOKI employs a staff of almost 1000 in Asia, the Middle-East, Europe and the USA. You don't need a high precision measuring device to prove the company's success: sales have been solidly increasing, with over 210 million euros in 2018 (+11%). ■

THE FIREFIGHTING ROBOT OF NOTRE-DAME

When the iconic Parisian cathedral turned into a blazing inferno, a new type of soldier was sent into the very heart of the action. Now we have an opportunity to learn about Colossus, the powerful battle-proven and modular ground-based drone, in more detail.

It happened on 15th April 2019, on Île de la Cité, in the heart of Paris. Notre-Dame has been standing there for over 850 years. The iconic gothic building, a stone vessel richly decorated with arabesques and gargoyles, was built between the 12th and 14th centuries. For a very long time, it was one of the largest cathedrals in the world and the highest building in Paris. It has also been the most visited monument in France, welcoming over 20 million people every year.

That all changed on the night of 15th April.

That evening, before the eyes of appalled Parisians and shocked viewers from around the world, Notre-Dame was burning.

The alarm was first raised at 6:18 p.m. by the security PC of the cathedral. Due to an incredible chain of events (which are still under investigation), it took 30 minutes before the fire brigade were called. When the first troops arrived at around 7 p.m., it was already far too late. The fire was spreading at an incredible rate through the roof, fuelled by the famed latticework of ancient oak timbers, some of them dating back to the 13th century, so dense and vast that they were referred to as 'the forest'. Reinforcements were called.

Within the first hour, 400 firefighters tried to save as much as they could of the building. Some crews were even sent inside, risking their lives, to save the artworks and to try and prevent the collapse of the towers. However, a little before 8 p.m., they were all called back, rightly so. The roof had been gradually crashing down in several parts. Temperatures rose to a blazing 800°C inside the nave, the lead contained in the great spire melted and was flowing like lava. The spire itself collapsed a few minutes later.

As the site became too dangerous for humans, the firefighters sent in their non-human colleague: Colossus.

Colossus is a universal technical support robot. A remotely controlled ground-based drone with an empty weight of 500kg, entirely electric, 1.6m long and a little less than 80 cm wide and high. A 100% French-made design created by Shark Robotics and launched in 2016.

As its pilot, using his reinforced touchpad, guided the drone through Notre-Dame, Colossus was configured in fire extinguisher mode: carrying a fire hose pumping 2500 litres of water per minute, a day/night 360-degree camera with 30x zoom, a thermal camera, gas and temperature sensors. All of it completely watertight and resistant to heat radiation, mounted onto a platform made of aerospace grade aluminium and hardened steel, driven by crawlers. A battle-proven beast.

"Colossus is the most powerful electric robot in the world", explains Cyril Kabbara, cofounder of Shark Robotics. "Its two engines, 4000W each, deliver a torque of 300N/m – which is absolutely enormous!"



© Erwan Thépault

▲ Colossus, configured in fire extinguisher mode, with a battering ram to discard debris and obstacles.



© Christian Jakob

When, inside the cathedral, the blazing fire became too dangerous for men, Colossus took over. It fought the fire inside for several hours.

It is capable of carrying 500kg of material. Or of pulling up to 250m-long and 70mm-diameter hoses full of water, which weigh 1 ton ("you'd normally need about 15 men for such manoeuvres").

There are other industrial robots as powerful as Colossus, admits Kabbara, but they are much bigger in size and, more importantly, equipped with traditional combustion engines. "It makes them impossible to use in fire: the lack of air could choke the engine and the fuel could explode."

With its six 29.8V/46Ah lithium-ion batteries, Colossus can work for 10 to 12 hours. It moves at 3.5km/h, rolls over 30cm obstacles (stairs, rubble), goes up and down 45-degree slopes. Its radio range is 500m outdoors and 200m indoors. According to Shark Robotics, it takes no more than half a day to learn how to control it.

Colossus is not a single-mission robot, quite the contrary: it was designed from the beginning to be modular. It can be quickly configured and reconfigured, to adapt to each situation, thanks to a Picatinny rail interface (the same is used for mounting firearm accessories in a snap) and an ad-hoc connection solution (see page 25).

Among possible accessories there are all types of fire hoses, smoke extraction fans, a robotic arm to manipulate objects, a motorised ram, stretcher carrying frames, baskets for transporting material or long-distance (5km) transmitter kits.

Thanks to its multiple configurations, it can be used for fire extinguishing, land mine clearance operations, transporting material or injured people, reconnaissance operations (measurements, collecting information), or even decommissioning nuclear power plants.

All these operations have one common feature: dangerous terrain, which is no coincidence.

"All our robots are designed to keep people away from hazards", highlights Kabbara. "We created our company exactly for this purpose."

Shark Robotics was founded in 2016 in La Rochelle, on the Atlantic coast. *"For historical reasons, but also because the area is highly suitable: major universities and large machining factories bring us their knowledge and expertise."* Cyril Kabbara is a business intelligence specialist, with an army and defence industry background. The other co-founder, his friend Jean-Jacques Topalian, is a mechatronics engineer and, as Kabbara calls him, *"the brilliant inventor of the firefighting robots in France."*

Shark Robotics designs and manufactures everything in-house in La Rochelle – including machining and assembly. The SME only develops the hardware. The software is flexible, customers decide what they need to add.

"From the very start, we wanted to be a profitable company and not a drip-fed start-up" says Kabbara. "We wanted to sell and so we had to propose products that were already mature." Therefore, Shark Robotics involved potential users – fire brigades, military and industrial special forces and others – from the very beginning. "We told them 'use our robots and break them if you have to!' which generated rather high costs, but it also helped us achieve our goal: to provide powerful, reliable, durable solutions best adapted to the sector."

Shark Robotics robots – currently about ten models – are fully standardised. It was necessary for convincing fire brigades, the police, the French army, ArianeGroup, Total, Thalès, Areva... customers that are regular users of their robots: *"Our robots are deployed in real-life situations about a dozen times a week in France."* estimates Kabbara. *"Which gives us a lot of feedback."*



© Erwan Thépault

Among their most spectacular interventions, there was a fire in January 2018 in Choisy-le-Roi, in the southern suburbs of Paris. A massive fire burnt down two levels of an underground parking area, destroying about fifty cars with temperatures rising up to 600°C. Colossus was fully deployed.

Shark Robotics has 20 employees and regularly strengthens its team. Around 30 robots, including 10 Colossus, have been sold in France and in Belgium. The SME has started shipping to other foreign countries as well, in the Middle-East, South America and Japan. *"We have firm orders worth 5 million euros for the next 2 to 3 years. We are now planning a minimum production of 10 to 15 robots a year."*

In April this year Colossus was deployed for several hours in the Notre-Dame fire. Its camera and thermal sensors were the "eyes"

that made it possible for the firefighters of Paris to estimate the situation continuously and to locate the hottest fire spots to better target their efforts. Its fire hose shot millions of litres of water inside the cathedral, extinguishing fires and lowering the temperature of the nave's walls.

After hours of exhausting battle, the firefighters managed to protect the cathedral's main structure, its two famous square towers, its treasury and the better part of its artworks. A miracle in itself, because Notre-Dame has only narrowly escaped its complete destruction. It was all a matter of minutes, which makes Colossus' role even more decisive.

The press acclaimed the heroic bravery of the firefighters. It has also published a number of enthusiastic headlines on Colossus, that Cyril Kabbara is keen on amending.



▲
The robot is capable of pulling hoses that weigh over a ton and shooting up to 2,500l of water per minute.

"Colossus did not save Notre-Dame! It is merely a tool, the firefighters did the job." This is true, but if we imagine the robot, working stoically, all alone in the middle of the nave transformed into an inferno, we perfectly understand why journalists have made Colossus a hero worthy of the Marvel universe. ■

NAME

COLOSSUS

DIMENSIONS

160 x 78 x 76 cm

TARE WEIGHT

500 kg

PAYLOAD

550 kg

ELECTRICAL MOTOR ENERGY

2 x 4000 W

AUTONOMY ON OPERATION

6-8 hours

LEMO FOR DECISIVE SPEED OF ACTION

LEMO is acknowledged for its extremely reliable and robust connectors. Shark Robotics chose the Swiss brand for another of its qualities: the ease of use of its Push-Pull system, that it had invented.

The plug and play accessories of Colossus are fitted with LEMO connectors.

"Saving time means potentially saving lives" explains Cyril Kabbara. *"On site, firefighters must be able to change the configuration of Colossus extremely quickly. Without any tools and without taking off their gloves!"*

It takes them less than a minute to reconfigure the robot, for example to switch from a "fire extinguisher" configuration to "material transport". *"LEMO's solutions – IP67 and extremely practical – perfectly meet these needs of modularity and speed."*

SINGING THROUGH THE PAIN

Is it possible to relieve the stress of a surgical procedure without any drugs? It is now thanks to an appropriately named solution: HappyMed. Its creator explains how his start-up has helped more than 100,000 patients, with surprising results.

Philipp Albrecht, reclined in his dentist's chair, averting his eyes from the doctor's gaze, was staring at the white ceiling, as usual. This was back in 2014 when, at the age of 25, he suddenly realised that he'd been staring at the same dull white ceiling for over two decades, every time he had been at the dentist. "Why is that so?" asks the man who describes himself as a technologist who started programming at age 14. "Why has this experience never been improved? What can I do about it?"

The young man discarded the idea of a screen attached to the ceiling immediately – the dentist's head would always get in the way. How about video glasses? They already exist, but the world of healthcare does not tend to use them. There must be a reason for this and obviously a market for a custom-developed solution.

Two years of market research resulted in a prototype (a wooden case held together by duct tape), developed from scratch. Albrecht presented it to around 70 hospitals (considered to be a more relevant market than dentists). A lot of feedback was gathered on the device and the operating system, both of which were developed in-house.

HappyMed was finally launched in mid-2017. Version 2 (with an optimised operating system, a higher screen resolution, improved batteries and new functionalities) followed a year later. The solution, in the form of a monthly subscription service (approximately EUR 200 per month) has found its market. Albrecht mentions several hundreds of hospitals who are subscribers, as well as over 100,000 patient-users. "HappyMed has been recognized and is becoming increasingly well known. We now have positive momentum." All this sounds like an encouraging launch.

HappyMed appears to be like any other video glasses, like a virtual reality headset, only lighter. Two HD screens with Zeiss lenses, surround sound headphones and a small media



© HappyMed

centre including a screen and a minimalist remote controller. With just a few clicks, you can immerse yourself in films, concerts, documentaries or meditation sessions.

Does it work? Every parent who has ever put a child in front of a screen to calm them down or to keep them busy during a long journey knows it: the child's attention is captivated, completely cut off from the outside world. It turns out that this method of distraction and relaxation can work just as well in the context of a medical procedure.

"HappyMed is beneficial before, during and after an intervention", highlights Albrecht. Patients are less stressed. They breathe more slowly, their heart beats more calmly, and pain perception decreases. During the operation, the beeps and audible alerts are muted, people in masks and all the horrible tools are out of sight. The whole intervention moves into the background. Therefore, patients need less tranquilisers and painkillers. "In one third of the cases, HappyMed is able to replace medical sedation" estimates Albrecht.

Similarly, patients are able to replace general anaesthesia with more local pain relief instead. *"Moreover, HappyMed has no side effects!"* he adds with a smile.

All of this contributes to reducing surgical risks, as well as the duration of interventions and wake-up times. It also improves recovery

HappyMed cuts off patients from the stressful environment of a medical operation, reducing the need for tranquilisers

and reduces the duration of the patient's hospital stay. Its effects have been confirmed by studies on positive audiovisual distraction, quoted on the startup's website. They have also been supported by HappyMed own study conducted over two years and soon-to-be published in medical reviews.

Divert attention in order to diminish the perception of a painful reality... isn't that an obvious idea? *"It was, but its implementation wasn't!"* replies Albrecht. *"To be adopted in the medical field, a number of challenges had to be solved and this is what we have succeeded in."*

The first challenge was the same as for all medical device manufacturers: to create a technology which complies with the extensive safety and hygiene certifications. This influences the choice of materials (which have to resist repeated cleaning with alcohol), wave emissions (electromagnetic field, WiFi, Bluetooth, radio, processor frequency...), but also manufacturing processes or the company's operations.

"On the other hand, HappyMed had to be as simple as possible, so that all, from young children to elderly people, the healthcare team and the patients are able to use it. Any difficulty would result in rejection by the user, who has much greater worries to handle at the same time." All aspects have been carefully considered. For example, instead of a single switch, for muting the device while talking to the patient, there are two, on both sides of the headset to provide for easy access.

Albrecht concluded very quickly that efficient hardware, along with a user-friendly interface would not be sufficient. If he wanted to conquer the market, a major challenge was to be handled: the content.

Content distribution by a hospital is not considered as private, but rather as commercial use. It is subject to special terms and hospitals are not willing to spend time either on negotiating or taking the risk of circumventing them.

HappyMed could not afford to pay an expert lawyer, so Philipp Albrecht himself learnt all about it. *"It is complex and it takes a lot of time to get into it"* – a slight understatement by the young man, who went off to the Cannes Film Festival to present HappyMed to film producers in search for solutions. He has also contacted Hollywood directly. *"Sometimes we had to negotiate for 2 and a half years to get a deal approved. Since the contracts are valid for only 1 or 2 years, you have to do it over and over again."*

Luckily, the catalogue doesn't have to be extensive, explains Albrecht. There's no need to compete with Netflix or Amazon. Patients generally use HappyMed for one to three hours and most of them will only rarely get the opportunity to use it again.

For hospitals, the most important thing is that HappyMed makes up the catalogue. They don't have the time to choose appropriate content.

Contents are automatically updated, videos are downloaded from HappyMed's servers overnight (via WiFi or cellular). During the day, everything is on the device, nothing is broadcast live, which avoids monopolising the bandwidth and creating radiation.



HappyMed system: a headset, a media centre and a remote control.

© HappyMed

With its certified hardware and its worry-free content management, *"HappyMed is a truly plug-and-play solution"* says Albrecht. *"That's what we were aiming for since the very start."*

Ten years ago, Philipp Albrecht left his native Germany to study in Austria. He never went back and it was in Vienna that he founded HappyMed in January 2015. Today the start-up has a staff of a dozen employees and it has been regularly growing in numbers.

The team is currently working on improving their device. They have also been studying the possibility of new content categories, such as *"personal development films, for instance, empowering patients with knowledge to help their recovery."* HappyMed are even planning to add another string to their bow by producing their own content. The startup would like to broaden their market beyond Europe and *"is open to new investors."*

The young entrepreneur says he is confident and is not afraid of competition. *"We are way ahead of them!"*

What makes him especially proud today? *"Making a difference"*, he answers with no hesitation. *"Making a difference for people going through hard times."*

In fact, HappyMed is regularly used during cardiac catheter examinations, long chemotherapy sessions, spinal marrow aspiration, orthopaedic operations... Some of those situations – often the worst moments in a person's life – that we all wish to avoid, absolutely, instinctively. This is exactly what HappyMed help to do, with their distracting, interesting, perhaps even inspiring escape solution.

"We get a lot of nice testimonials from our customers", say Albrecht. *"Some patients start humming in the operating theatre. Some even burst out laughing in the middle of an operation!"* The young entrepreneur adds, with a touch of emotion, *"This is such a nice thing."* ■

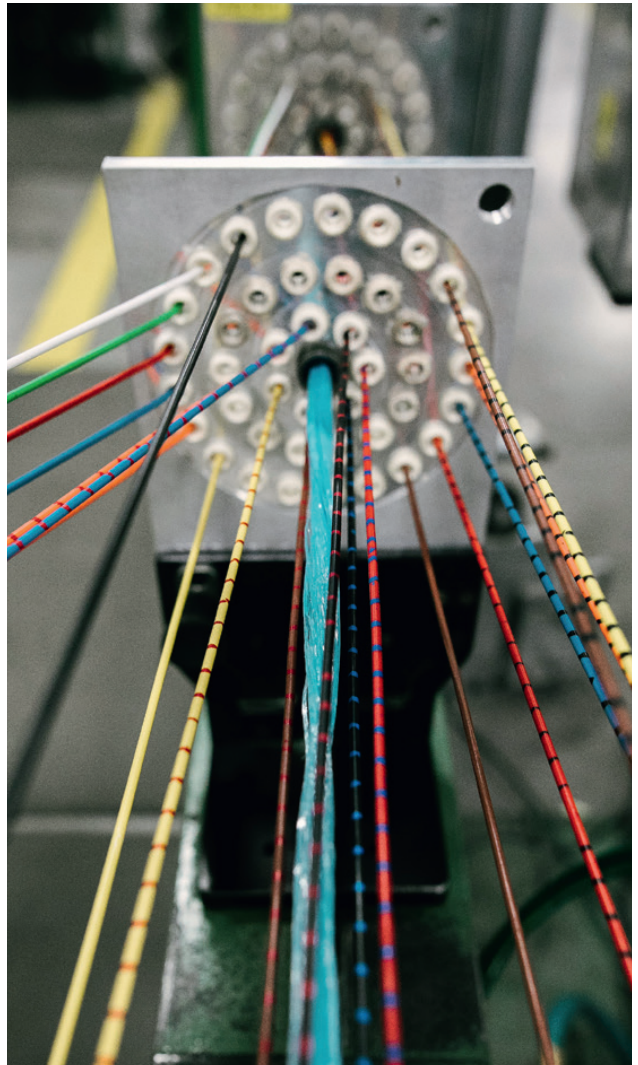
2014: WHEN LEMO CONNECTED TO NORTHWIRE

It's been just over 5 years since LEMO acquired US cable manufacturer NORTHWIRE. It was an important step "beyond connectors" for the Group and a new dimension for NORTHWIRE. It was also a natural marriage between two perfectly complementary family-owned companies.

Ormund Kravik founded NORTHWIRE in 1972 in Osceola, Wisconsin. His parents had chosen to emigrate to the beautiful northern territories of the USA, where both the landscapes and the climate reminded them of their native Norway. The name of the company and its logo (a compass) are a tribute to their beloved North.

During its first years, the family business created and produced low voltage cords for the US market. The mid-nineties brought the first big change. Then CEO Mark Kravik, pivotal in the company's growth and repositioning, decided to push NORTHWIRE towards higher value-added specialties, complex control cables. The right people were hired, and investments were made in new equipment and new buildings. The company moved and officially launched its transition in 1997.

►
The complex cables that Northwire specialises in, are capable of integrating a multitude of wires.





▲
NORTHWIRE's headquarters in Osceola (Wisconsin) have benefited from major investments since the acquisition.

Kevin Depratter is one of the people hired to successfully manage this major shift. With 22 years' experience in wires and cables, he started in 1995 as a manufacturing engineer. *"NORTHWIRE established itself as a recognised brand in complex cables for the machine business, factory and process automation"*, says Depratter. Their customers come from the fields of industry, aerospace, defense and energy.

As of 2010, with growing specialisation and complexity, NORTHWIRE – still led by Mark Kravik – entered the medical market with power and data cables for the diagnostic industry. *"We were steadily gaining presence in the medical field, but we were only at the start of a long journey."*

NORTHWIRE was now at an important crossroads, it had to grow further. The third generation CEO Katina Kravik wanted a more global presence, which the company, established only in the USA (in Osceola and in Santa Teresa, New Mexico), had so far never succeeded in. An office had indeed been opened in Holland in 2007, but it didn't last long.

"NORTHWIRE didn't have the necessary means to succeed in international markets" explains Fabian Weber, VP of Innovation and Business Development. *"Neither for developing the necessary local presence to really understand the specific needs of the customers, nor for spearheading R&D endeavours that would extend our product portfolio."*

Revenue – stagnating for several years – confirmed the situation: if NORTHWIRE were to stay alone, it was bound to remain one of the many wire and cable manufacturers in North America.

Enters LEMO.

The Swiss group has always been in search of high-end cables for its high-end connectors. For decades, it has been buying and assembling cables in order to provide customers with complete solutions. Acquiring a cable manufacturer was the natural evolution, another asset in controlling the value chain. Furthermore, LEMO and NORTHWIRE are focused on similar markets, including the medical field.

The alignment of the two family businesses was discussed and then approved. In 2014, Alexandre Pesci, grandson of LEMO's founder and Katina Kravik, granddaughter of NORTHWIRE's founder, signed the agreement. The US brand joined the Swiss group's three brands – LEMO, REDEL and COELVER.

Both sides started working on a smooth integration and on developing synergies.

Well-positioned in the high quality market, LEMO was keen to ensure that NORTHWIRE was truly aligned to this market leading position. *"We did quality work, but not at LEMO's level"* says Depratter. *"They guided us to raise our quality system and to make quality the top virtue of our culture. We got to the next level."*

Production equipment is being modernized to increase capacity and capability: over 5 million dollars have been invested in NORTHWIRE. Brand new extrusion lines have been installed. A fine wire gauge extrusion line, running since April 2019, makes it possible to produce finer cables for medical applications. Unsurprisingly, these new lines integrated quality management in production to save time and gain in productivity.

In parallel, NORTHWIRE's staff has grown from 200 in 2014 to currently 275. The subsidiary company is now managed by LEMO USA's GM, Farhad Kashani, with Joe Van Landschoot in the management team.

NORTHWIRE's innovation was also boosted. Scarcely had the ink dried on the acquisition agreement, when Alexandre Pesci challenged his new company to develop SMPTE cables (the connectors were created by LEMO for SONY to become a global standard in broadcasting). *"We had never worked with glass optical fibre before"* said Depratter *"So we had to adapt!"*

Very quickly, LEMO also entrusted NORTHWIRE with the creation of a cable that would compete with silicon solutions in the medical market. Within a matter of months, the US subsidiary developed a new material and the Biocompatic product line was launched in the same year.



Northwire's cable expertise completes LEMO's interconnection solutions.

"Through LEMO and its R&D partners, NORTHWIRE is able to benefit from unprecedented collaboration opportunities for bringing new products to life." said Fabian Weber. *"As a Group, we can also finance numerous feasibility studies and R&D activities, which are often costly and which NORTHWIRE was not in a position to undertake independently before."*

Other spectacular innovations are also in the process of being finalised in NORTHWIRE's laboratories. Light emitting cables, smart cables as well as PTFE (fluoropolymer) cables, resistant to aggressive and inorganic chemicals and solvents over a broad temperature range. These latter are to be launched this autumn by NORTHWIRE.

"All of these are exciting projects", highlights Weber, *"that we could never have developed without being part of the Group."*

For LEMO as well, these new synergies have boosted innovation. Thanks to its new cable know-how, for instance, the company was able to obtain funds for exploring new materials. A confidential research project that may very well revolutionize the design of connectivity solutions. It would be yet another game changer for LEMO, inventor of the Push-Pull system.

Sales, marketing and distribution are of course not left aside either.

"Business has opened up", explains Kevin Depratter, who is now Director of Research and Development. *"We are getting a lot of leads and prospects from the Group."* The integration of NORTHWIRE sales into the Group has also been beneficial: *"We can talk directly to LEMO's clients and provide them solutions they – and sometimes even LEMO – wouldn't have thought of."*

NORTHWIRE's new products also go through the Group's marketing channel, reaching a wider market.

Since 2016, LEMO's European Distribution Center, located near Amsterdam (see page 04), hosts a considerable stock of NORTHWIRE cables. This is the first solid foothold of the US company in Europe.

NORTHWIRE is not just one of many wire companies in North America anymore.

The results were rapidly visible.

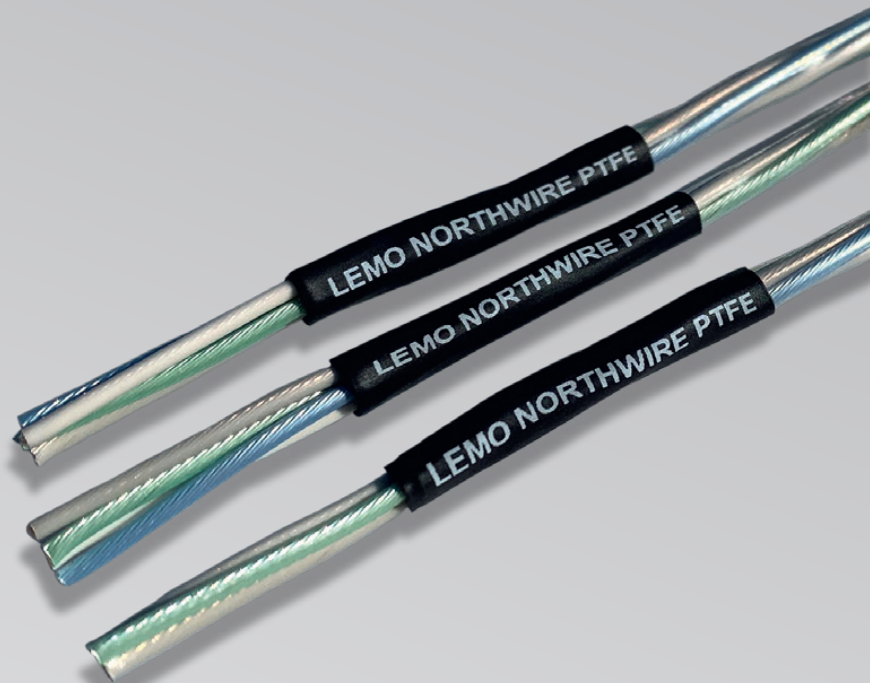
"Our revenue has increased by a Compound Annual Growth Rate of 14% over these last three years" says Fabian Weber. NORTHWIRE's market position has been strengthened in the high-end, high-complexity business. *"Solutions for the medical market now represent 22% of our total sales, up from 15% three years ago, while commoditized cables (still 50% in 2014) have recorded a steady decrease".*

Still, the integration of NORTHWIRE is a work in progress, says Weber. Processes are still to be standardized, synergies to be capitalized on. The recognition of the US brand has already been growing, *"but this is only the beginning."* ■



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**NORTHWIRE'S NEW HEAT RESISTANT GRADE
PTFE CABLE SOLUTIONS.**



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