ANNUAL REPORT 2017

Microwave Vision Group

EDITO

> **Electromagnetic waves** are increasingly becoming a key part of our daily lives.

The list of connected objects is growing longer, and new applications are emerging. The arrival of 5G will further accelerate this trend and pave the way for new uses: by connecting our everyday devices to information networks and remote artificial intelligences, more and more tasks will be able to benefit from assistance or even be completely automated.

This movement is built on the proliferation of robust, responsive wireless connections and means that the management of a limited resource, the electromagnetic spectrum, needs to be optimized. The increased frequencies and the use of agile antennas accompanying the arrival of 5G are technological responses to this issue. These solutions, which until recently were still reserved for the space and military domains, will be widely deployed in the future to offer the ultra-reliable, low-latency wireless links required by these new uses.

The sophistication of uses and the sophistication of technology are factors pushing for increasingly demanding testing. Let's look at a concrete example: a true wireless technology hub *(see page 20)*, the self-driving car, a subject where MVG has developed indispensable expertise.

A car's self-driving capacity is classified from 0 to 5. Level 0 corresponds to a conventional car without any automation, and level 1 corresponds to driver assistance (speed control, lane changing). At level 2, several functions are delegated, but other driving tasks are performed by the driver. At level 3, all driving functions are delegated, but the driver is always in charge and must take control if the situation requires it. This is what Tesla offers on its models: automatic steering, but the driver must be prepared to intervene at any time. At level 4, the driver can do something else completely for part of the trip. Lastly, at level 5, the vehicle is completely self-driving for the entire trip, regardless of road, traffic, and weather conditions.

To date, the level 5 completely self-driving car remains a pipe dream. The most optimistic projections predict its arrival in a little less than a decade, given that many technological, legislative, and even human barriers remain to be cleared. However, level 3 and 4 self-driving cars are already a reality: at the mass production stage at Tesla for level 3 and at the prototype stage at many manufacturers for level 4. These two levels correspond to the transition from minor assistance to a quasi-self-driving car. This self-driving capacity requires much more thorough and precise testing than when simple assistance is offered.

Let's refine our example to look at radars in vehicles. A simple error of a few degrees in the information provided by a radar may be of no consequence for parking assistance but disastrous for a vehicle operating at full speed when it must avoid an obstacle. However, radars have long been considered cameras – sensors that can be installed anywhere on a vehicle so that they can function immediately. Nothing could be further from the truth, because even though a camera and a radar both allow electromagnetic waves to be viewed, the waves used by each device behave very differently. Light,

perceived by cameras, is an electromagnetic wave within a frequency band where waves are disturbed only by obstacles directly in their path. By contrast, at the frequencies used by radars, the radar's environment interacts with the radar, even if the disruptive objects are not in the direct path of the electromagnetic waves. Therefore, the canonical behavior of a radar installed behind a car's radiator grill will be modified not only by the radiator grill itself but also by items around it, the radiator, the engine, the front axles, etc. As a result, while it is very easy to verify that a camera is operating properly, the position of a radar on a vehicle must be examined with the greatest attention to meet the precision requirements of self-driving vehicles. To this end, MVG has developed a line of high-value-added post-processing systems and software specifically designed for electromagnetic testing of vehicles that, coupled with simulation software, enable this detailed, essential analysis.

And what is true for self-driving cars is also true in many other areas: connected objects *(see page 22)*, drones, NewSpace, and Defense. We are living in an exciting time at the crossroads of the widespread deployment of wireless communications, the sophistication of uses, the automation of tasks, and artificial intelligence. At the heart of this movement, MVG is committed to meeting these challenges in terms of electromagnetic testing to support its customers in these technological and societal changes.

Philippe Garreau
CEO of MVG

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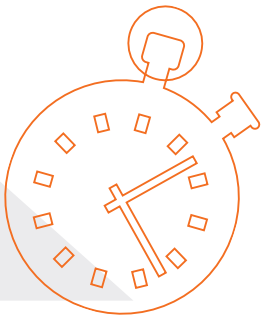
Eligible for the **equity savings plan for SMEs**

BPI Innovative Enterprise Label

22 consecutive years of growth

2017 revenue
€71.1 M
or 8% of organic growth

5G by MVG



A bit of history…

Since its creation in 1986, MVG's success developed on the international market by combining organic growth based on continuous innovation and the integration of companies opening up new markets. This path of profitable growth has also been made possible thanks to the confidence of its customers, the involvement of its employees, and the support of investors who have accompanied it throughout its development.

1986
→ CREATION OF SATIMO, SPIN-OFF OF SUPELEC

1986 1996
→ Initially focused on research and prototyping, MVG started as a research firm operating in the field of electromagnetics measurement for the French market

1996 1998
→ Change of direction
→ Development of a unique technology
→ Production of multi-sensor solutions targeting Civil Telecommunications

2003 2004
→ **2003 :** Innovative Enterprise
→ **June 2003 :** Siparex and Spef Ventures invest in the company
→ New offices: USA (2000), Italy (2001), Hong Kong (2004)

2005
→ Significant growth in revenue driven by international sales
→ IPO on Alternext

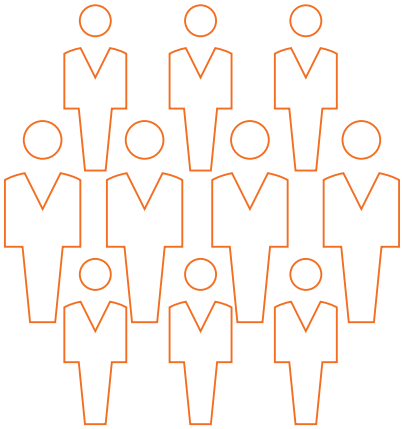
2005 2007
→ Continued growth driven by international expansion, large customers, and stronger roots in Automotive, Aerospace, and Civil Telecommunications

2007
→ Acquisition of Antennessa, a company in Brittany that designs and manufactures RF dosimeters and SAR measuring benches

2008 2009
→ Acquisition of ORBIT/FR, a provider of antenna measuring solutions in Aerospace/Defense
→ SATIMO teams up with ORBIT/FR and creates MVG

2012
→ Acquisition of Rainford EMC Systems, a manufacturer of Faraday cages

2013 2017
→ **2013 :** Renewed product line (StarLab, StarMIMO, SG 24)
→ **2014 :** Development of the EMC branch – Signing of a partnership with AR.
→ **2014 :** €28 M in funds raised
→ **2017 :** Record number of orders received: €77 M



Our values

Innovation, technological excellence, team spirit, boldness, involvement, and diversity are the values shared by MVG's employees.

Innovation

MVG's offering consists of highly innovative, distinctive products. This positioning guarantees the Group's margins. These margins allow us to maintain a high level of R&D investment and thus develop new innovative products. It is this virtuous circle of value creation that constitutes MVG's DNA.

Excellence

Excellence is a cornerstone of MVG's worldwide reputation. It characterizes the Group's ability to transform innovations into robust, scalable, industrialized products and to make every effort to exceed the expectations of its customers.

Team Spirit

As a team, MVG meets its customers' needs through a commitment to service fed by the diversity of each team member's areas of expertise and knowledge. This team spirit is based on listening, transparency, respect for others and rules, creativity, solidarity in implementing major decisions, and mutual support, particularly in difficult times.

Boldness

The confidence in our know-how and our capacity to innovate gives us the boldness to undertake, propose, and always consider that a more efficient solution can be found. MVG pushes its managers to delegate particularly large tasks, so that they can develop their own skills even further. The Group encourages those who try, even if it means failing, rather than those who attempt nothing.

Involvement

MVG strives to involve its employees in its corporate strategy, mobilize them around a common culture, and have them contribute to its overall performance. In return, the Group expects high level of involvement from its employees when working with customers and around its strategic projects.

Diversity

MVG hires people of different back-grounds, religions, countries, genders, sexual orientations, physical conditions, and professional careers. The Group believes that mixing the skills, cultures, training, and talents of each individual is an asset and contributes to the innovation and success of its projects.

> "In the dynamic, complex, changing sectors in which MVG operates, what makes the difference is our human capital, our culture, how we work together, and understanding how our values will best serve our customers.

Philippe Garreau, CEO of MVG

Our key figures for 2017 (€M)

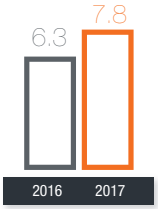
MVG had a very good 2017 financial year marked by a clear improvement in its economic indicators, thus reaping the fruits of its sales momentum and its measures to improve productivity. The Group relies mainly on its ability to supply competitive products with a high technological value.

Revenue

The MVG Group has posted revenue of €71.0 million versus €66.0 million last year, up 7.6% (9.7% at constant exchange rates). From a sectoral viewpoint, the Civil Telecommunications business registered strong growth and accounted for 49% of revenue (versus 44% last year). Meanwhile, the Defense/Aerospace sector repeated its high business volume from last year and accounted for 51% of 2017 revenue.

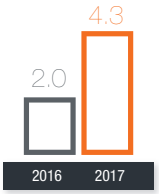
Geographically, the group continues to demonstrate its ability to seize opportunities in its main markets. This year, growth was concentrated in the EMEA and the US, which accounted for 39% and 36% of revenue respectively, with Asia contributing 25%.

EBITDA



Thanks to excellent control of current operating expenses, the EBITDA increased significantly to €7.8 M compared to €6.3 M last year (+24.8%). The impact of the fluctuations in exchange parities was not significant. The EBITDA margin rate reached 11.0% compared to 9.5% last year, i.e. an increase of 1.5 points due to operational efficiency measures.

EBIT



Non-recurring operating expenses also decreased greatly, with the Group benefiting from the judgment in the intellectual property dispute in the United States at the end of 2016. The net operating income was thus €4.3 M compared to €2.0 M at December 31, 2016, a sharp increase of 112%.

Net income, Group share

Net financial income was €(2.0) M compared to €(0.5) M in 2016, a difference explained mainly by the re-evaluation of intra-group loans on the closing date following changes in the euro/dollar parity. The impact of this latent exchange loss was -€1.8 M. The tax expense on this occasion was exceptionally high at €1.6 M. It is explained by a re-evaluation of the deferred taxes classed as assets of -€0.8 M, mainly due to the recent change in the tax rate in the United States and in France for future years. Finally, the Net Income was €0.6 M (+300%) and the group share of net income was €1.3 M (+28.6%).

Cash

Shareholders' equity stood at €69.8 M on December 31, 2017, compared to €70.4 M on December 31, 2016, with the effect of exchange rates. The cash flow generated by the activity was €5.6 M as of December 31, 2017 (compared to €4.7 M on December 31, 2016), in particular because of favorable WCR effects, which covered all investment flows (€3.0 M). The free cash flow thus increased considerably to €2.6 M (€+1.5 M compared to last year). Over the period, the Group made loan repayments of €1.2 M. At end-2017, MVG thus had a net cash flow position of €19.6 M (€1.7 M higher than at end-2016), some of which (€6.5 M) was allocated after the purchase of the Orbit/FR minority holdings in early April.

Order intake

MVG showed a new order intake record of €77.6 M compared with €74.2M last year. With this excellent level of order intake, guaranteeing excellent visibility for the Group over the coming 12 to 18 months, MVG intends to continue this growth trend and improve its margins in 2018.

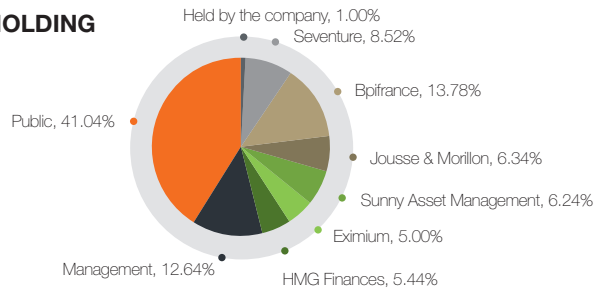
Stock exchange & shareholding

By investing in MVG's capital, you benefit from the momentum of a hi-tech company whose unique know-how brings the multitude of invisible electromagnetic waves to an unprecedented level of visualization for analysis.

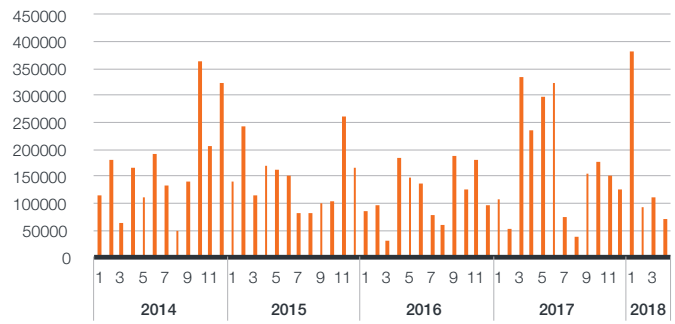
These waves are at the heart of our day-to-day lives. Smartphones, computers, tablets, cars, trains, aircraft – all these devices would not work without them. **By making "the invisible visible"** thanks to its testing and measurement equipment, MVG enables its customers to develop ever more efficient products. Building on this expertise, the Group has risen to the top ranks among its market's global players and has acquired international recognition. MVG employs more than 350 people, has offices in ten countries, and exports more than 90% of its production.

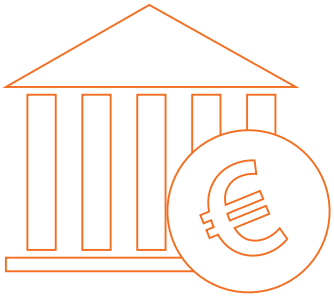
MVG'S OPENING PRICE SINCE 2014

SHAREHOLDING



MONTHLY MVG SHARE TRADING VOLUME





ANALYST MONITORING
Gilbert Dupont, Euroland Corporate

LISTING
- Listed on NYSE Alternext (ALMIC) since 6/29/2005
- Price at 04/23/2018: €11.25
- Market capitalization at 04/23/2018: ~€70 M
- 2017 average daily volume: 8,127 shares/day (2016 – 5,500 shares/day)

CAPITAL
- 6,282,186 shares
- 8,619,092 voting rights
- 8,545,266 droits de vote net
- Share capital: €1,256,433.20

FINANCIAL CALENDAR
Publication of earnings
Sept. 27, 2018

CERTIFICATION
Bpifrance's "Innovative Enterprise" Certification

ELIGIBLE FOR THE EQUITY SAVINGS PLAN FOR SMES


€5.4 M
invested
in R&D
22
international
patent families
55
R&D
engineers
© photo : Courtesy of Plume

UNIQUE TECHNOLOGICAL KNOW-HOW

Making the invisible visible

Similar to MRI scanners used in hospitals to view the inside of the human body, MVG has developed unique technological know-how: scanners that allow electromagnetic waves emitted by an antenna to be viewed, thus making the invisible visible.

These scanners allow users to:

- **Measure the amount of energy emitted by antennas.** An antenna converts existing electrical quantities in a conductor or a transmission line (voltage and current) to electromagnetic quantities in space (electric and magnetic fields), either in transmission or in reception. This measurement quantifies the efficiency of this conversion.

- **Determine in which directions this energy is radiated in space.** This involves determining the radiation pattern of the antenna. In a smartphone, for example, the manufacturer seeks a radiating pattern that is well distributed throughout all directions in space, because it is not possible to predict from the phone's direction given by the user. However, in the case of a radar, the manufacturer aims to focus maximum energy in one direction in space to measure with the utmost precision where detected devices may be located.

- **Describe the quality of information carried by the transmitted signal.** This involves transmitting data from several directions in space and reducing the level of energy emitted until communication with the device is no longer possible.

- **Test the operation of the device in real environments.** These are MIMO tests. They determine how a device will react in its real environment. Will its performance be deteriorated by or can it take advantage of the barriers and disruptive objects that separate it from emission sources?

These scanners rely on a unique, patented multi-sensor technology: MV-Scan™. Unlike conventional single-sensor technologies, which require long and tedious mechanical movements, MV-Scan™ scanners perform their measu- rements through numerous sensors equally spaced on an array. These sensors, scanning electronically, drastically reduce the measurement time by limiting mechanical mo-vements. This decrease leads to a much better return on investment for installations equipped with MV-Scan™ than for those equipped with single-sensor solutions.

The MV-Scan™ technology was initially developed for the Civil Telecommunications sector, where it perfectly met a key requirement for speed due to very short product deve-lopment cycles. For several years, it has also been deployed in the field of Aerospace and Defense, where electronically scanning radars have become imperative and require significant testing.

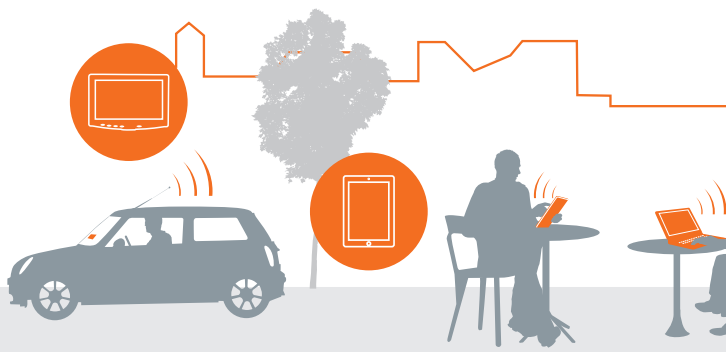
This technology is covered by several worldwide patents. It allows MVG to offer distinctive products and services to its customers.

A high level of R&D investment

The MVG group is the leader of a portfolio of technologies, patents, and diversified products, given its desire to constantly strive to develop new value-generating ideas around its foundation patent on the MV-Scan™ multi-sensor technology. To anticipate the needs of customers, MVG devotes an average of 10% of its revenue to R&D, which allows it to grow not only on its historical markets, but also penetrate related markets or conduct research projects in medical imaging or security imaging. During financial year 2017, the Group invested €5.4 M in its research and development effort (€6.1 M in 2016). In general, the aim of the Research and Development efforts is to prepare the Group for the increased frequency of communication products. The Group is also continuing the development of hardware and software sub-systems for multi-sector technologies to meet the future requirements of its markets. MVG receives the Research Tax Credit and also has labels recognizing its innovative profile in France: Innovative Enterprise and Réseau Bpifrance Excellence.

The Group mission

MVG's unique expertise makes it possible to view electromagnetic waves. These waves are at the heart of our day-to-day lives: smartphones, computers, tablets, cars, trains, aircraft – all these devices would not work without them. By making "the invisible visible" thanks to its testing and measurement equipment, MVG enables its customers to develop ever more efficient products. The Group's mission is to extend its expertise and unique electromagnetic imaging technology to all sectors where they can provide high added value, satisfying the "adaptation of technology" against "acceptable market cost" equation.



Positive advances on NSH (National Security & Healthcare)

2 R&D projects are currently in progress for two identified growth markets:

- A security body scanner intended for airport security with possible future extensions to sensitive buildings and multi-modal transport sites (train stations, subways, etc.).
- A microwave imaging scanner intended to detect breast pathologies in developed countries with a screening program, with the potential for future use in developing countries.

Encouraging detection results have been obtained with experimental prototypes:

- Security scanner (airports): using mannequins and targets placed under clothing.
- Medical scanner: using realistic phantoms of breasts and tumors.

Advances in preparation:

Experimental demonstrators with on-board rapid measurement technologies. The main objective is to acquire data with real persons and evaluate the potential for future products:

- Security scanner (airports): rapid scan of a person and calculation of the image in a few seconds.
- Medical scanner: In June 2018, first clinical trials with 30 women who have palpable breast cancers or non-cancerous cysts.

Teams organized in project mode

The Group's R&D, centralized on three sites – two in France and one in Italy – is organized in project mode, meaning that it works on defined themes with dedicated teams, allocated budgets, and deadlines to be met. This organization and the resources allocated to it allow the Group to maintain its technological lead and come up with breakthrough products on its current markets or targeted new markets.

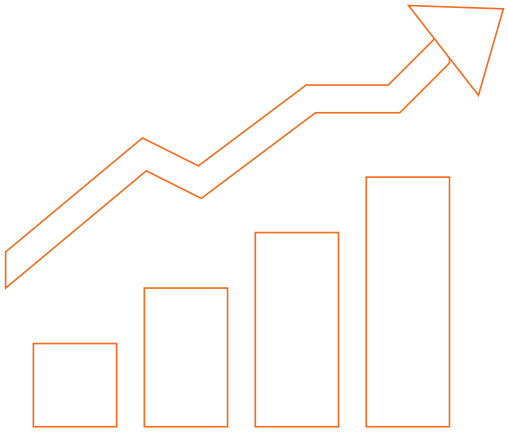
The R&D team manages mainly short- and medium-term projects. However, within this team, in the NSH (National Security & Healthcare) department, two long-term projects are currently in development:

- a security scanner, for the detection of weapons and explosives that could be hidden on the human body,
- a medical scanner, for the detection and monitoring of breast diseases.

Each of these two projects addresses specific R&D themes and also serves as a catalyst for the development of sub-assemblies that will be included in the antenna measurement systems of tomorrow. The NSH department draws future investments and employs highly qualified engineers in order to succeed in bringing about enhanced value.


3
operational
departments
78%
of revenue
by the AMS
branch
8%
growth
in 2017

IDENTIFIED GROWTH AREAS



Since 2012, MVG has structured its activities into three operational departments: AMS, EMC, EIC. This organization makes it possible to pursue a strategy of creating distinctive added value in each of the branches.

BREAKDOWN OF REVENUE BY BRANCH

AMS

THE AMS DEPARTMENT

(***A**ntenna **M**easurement **S**ystems*)
dedicated to antenna control tests, the Group's historical activity

€55.2 M

EMC

THE EMC DEPARTMENT

(***E**lectro-**M**agnetic **C**ompatibility*)
dedicated to electromagnetic compatibility testing of systems, a growth area for the Group

€13.5 M

EIC

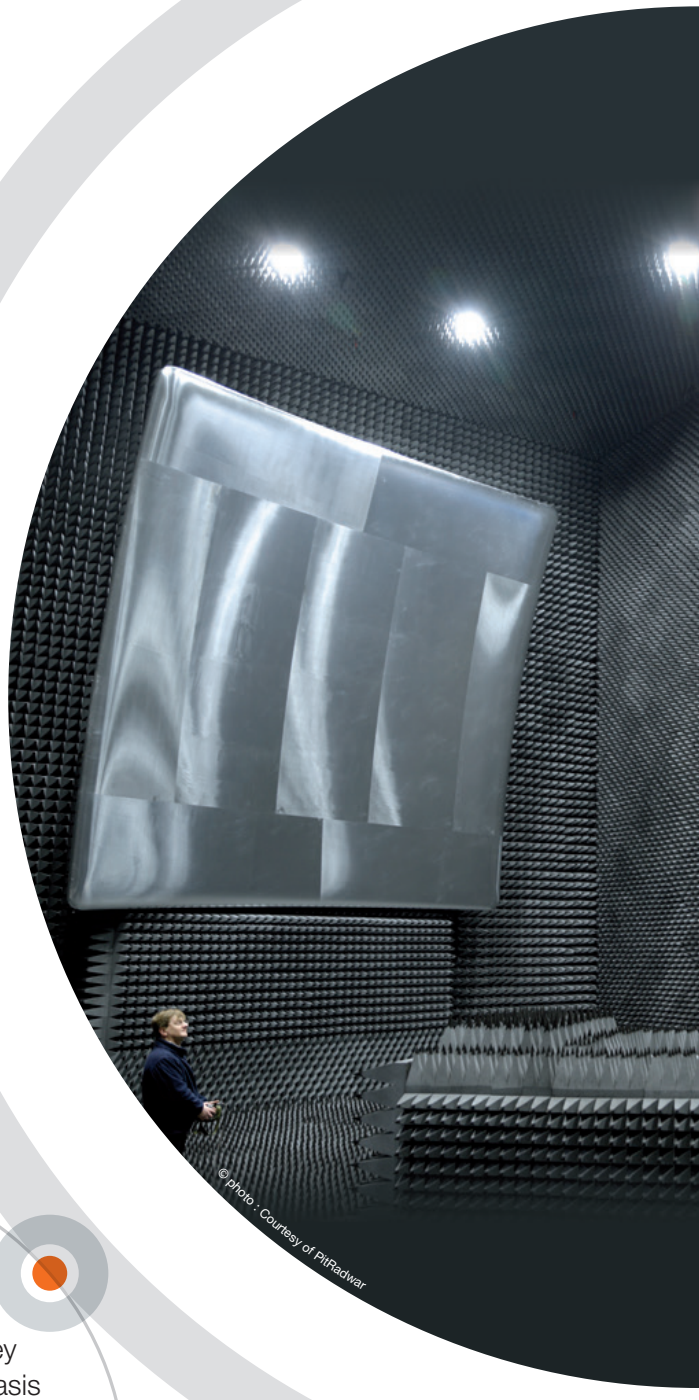
THE EIC DEPARTMENT

(***E**nvironmental and **I**ndustrial **C**ontrol*)
focuses on environmental and industrial control tests, growth drivers for the Group

€2.04 M

AMS

The antenna measurement systems department



Activity & Markets

This is the Group's core business. It brings together MVG's activities in the field of antenna measurement. MVG has acquired a position as technological player of reference in this field at the European and global levels. It addresses two sectors: Civil Telecommunications and Aerospace/Defense.

Strategy

- Provide products and turn-key solutions customized on the basis of standard technological blocks to a diversified customer portfolio
- Maintain its technological lead
- Offer support services (software upgrades, preventative maintenance contracts, relocations of facilities, etc.).

Offering

The market's most extensive range: turn-key antenna measurement systems (near-field and far-field, single-sensor and multi-sensor, radome test, RCS - Radar Cross Section - measurements). Associated software for equipment control, data acquisition, and post-processing. All solutions are designed, manufactured, marketed, installed, and maintained by MVG.

Price range

From €100 K to several million euros.

Key achievements

- Good performance of the Aerospace/Defense market
- A good start for the 5G market, the success in sales of compact ranges and the MicroLab, and the first StarLab 50 GHz orders represented €9 M
- The growing self-driving/connected vehicles market (nearly €7 M in new orders)

Structurally growth-geared markets

Satellites, planes, mobile phones, computers or touch tablets, GPS navigators, medical instruments or wireless home technology...

All these increasingly ubiquitous appliances have something in common: they have antennas, designed to convert electrical signals into radio signals. MVG's role is to design and manufacture systems allowing manufacturers to test and measure the radiation pattern of these antennas. MVG markets a range of constantly evolving antenna measurement systems to increasingly diversified markets, supported by strong growth in the space, military, automobile, and civil telecommunications industries:

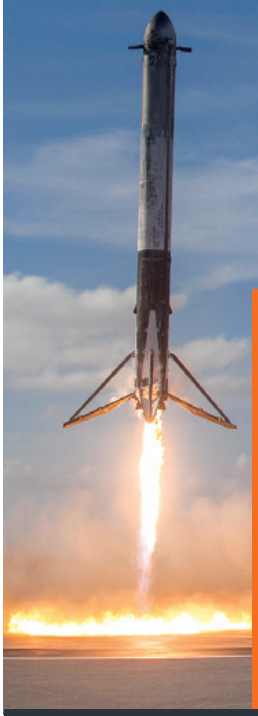
- the wireless market, stimulated by increasingly sophisticated terminals, integrating multiple communication protocols (4G, WiGig — very high-speed Wi-Fi, 5G in development in several countries, etc.),
- Land, space, and air surveillance through radars, drones, etc.,
- Newspace,
- Internet-of-things,
- connected or self-driving vehicles,
- data protection.

MVG's products, which display electromagnetic waves like waves on water, have won over the biggest names in the aerospace (NASA, ESA), aeronautics (Boeing), automobiles (Renault, BMW), as well as electronics (Ericsson, Nokia, Panasonic, Huawei) industries.

This expertise in electromagnetic wave measurement tools has been a driving force in the company's international growth since its creation. It also encourages MVG to constantly renew its offering to follow the development of protocols and permits diversification to new markets.

"NEWSPACE"

The emergence of a private commercial space industry



New launchers, constellations of micro- and mini-satellites, communication and tracking systems, which all involve sophisticated antennas

A global development, starting from the United States and reaching China. More than fifty startups already positioned on this market.

A market expected to grow eightfold over the next 30 years.

(Bank of America Merrill Lynch - sept 2017)

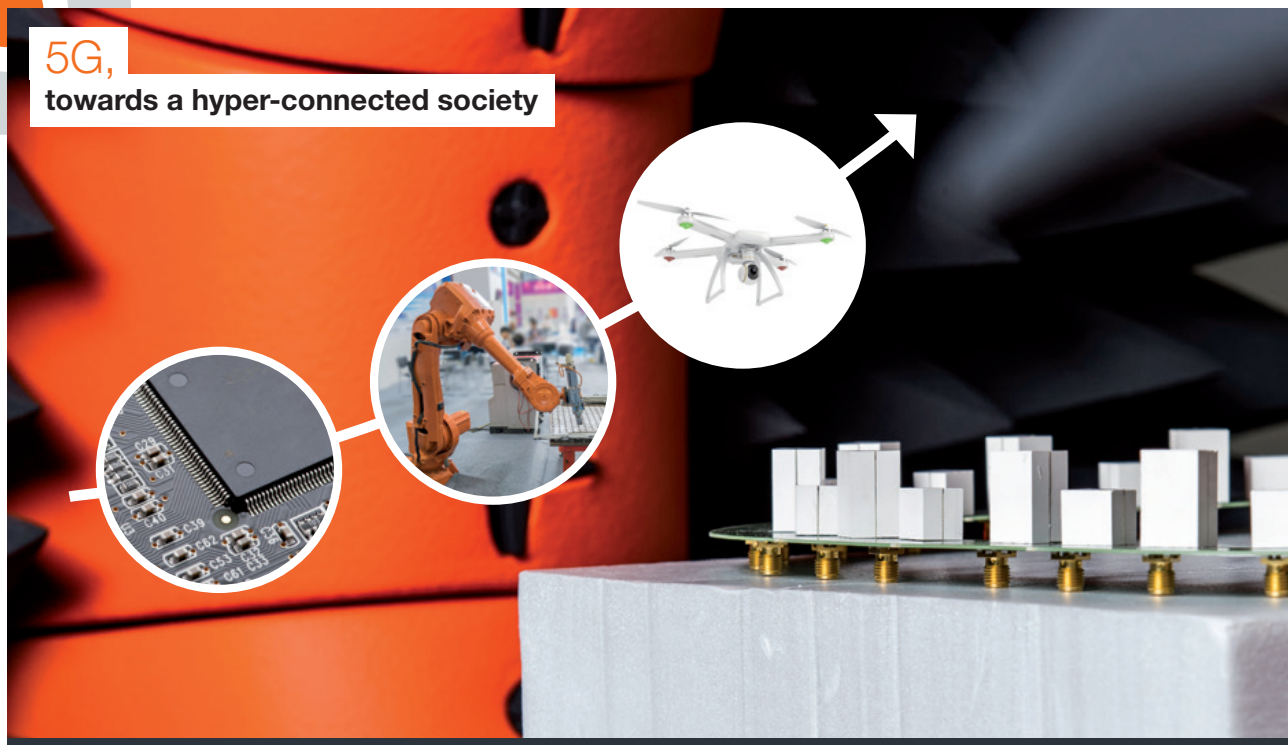
DEFENSE

Electromagnetic waves at the heart of battlefields

Agile antennas to detect, communicate, and act

The electromagnetic spectrum is an essential – and invisible – part of modern military and civilian life. Military forces use wireless networks to communicate and coordinate their operations, radar and sensors for guidance and to detect enemy forces, and electronic jammers to blind enemy radar or disrupt communications.

5G,
towards a hyper-connected society



5G IS TRIGGERING A PARADIGM SHIFT ON THE ELECTROMAGNETIC TESTING AND MEASUREMENT MARKET

Wireless testing (OTA) spans the entire value chain – from components to finished products – from R&D to production lines. It is becoming essential and will gain ground over the next 5 years.

In the near future, the arrival of 5G will lay the foundation for a hyper-connected society

A world in which everything that can be online will be. Internet connections will move from computer and smartphone screens to a world of objects that will communicate directly among themselves.

All sectors of society will be profoundly transformed by this technology: from industry 4.0, with smart factories, to the automobile industry, with self-driving cars, not to mention the healthcare sector with remotely controlled robotic surgical procedures, and connected homes, smart cities, etc. There are many examples.

5G is based on three cornerstones. The first is an increase in bandwidth and network capacity to transmit ever greater quantities of data in record times. The second is ultra-reliable wireless connections with low latency allowing critical real-time applications to function securely (self-driving cars, remote surgery, etc.). The last is the deployment of networks that use little bandwidth and energy to prepare for the massive deployment of connected objects.
By making permanent connections possible, the arrival of 5G will be accompanied by massive usage of “cloud

5G will have an impact on all industries

- Anything that can have a connection will be connected wirelessly
- The Internet will be part of every physical object
- A world where not only people, but all objects will be connected to each other

Smart Cities and the Internet of Things

Virtual Reality and Remote Medical Treatment

Industry 4.0 and Big Data

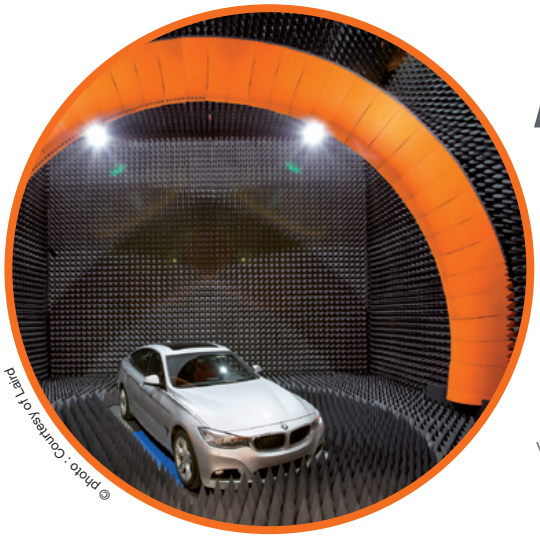
Self-Driving Cars and Transport

computing", which will make it possible to efficiently operate many new services.

The success of many of these services will depend upon wireless connection quality. Wireless connection performance will be a parameter that is difficult to control, as it will be based on both the quality of the networks deployed and on that of the hardware used. To validate performance, tests and measurements of hardware and 5G relay stations must be conducted. They will differ considerably from what is done currently.

In fact, 5G will use higher frequency bands, and compatible hardware will not have physical connectors. Therefore, they will have to be tested exhaustively in wireless mode (OTA), while many tests are traditionally conducted in wired mode.

We should there see an increase in the power of OTA tests, in which MVG is the most well-known specialist. MVG is working hard to support the industry in developing a special range of products intended for 5G tests, including systems to help re-create environments in the laboratory that are as close as possible to real life, and thus to test each peripheral and application exhaustively.



The connected car, a wireless technology hub

MVG develops systems dedicated to RF testing of vehicles. These arcs with a diameter of several meters (see photo) measure the wireless receiving and transmission characteristics of various on-board systems in vehicles in a few seconds.

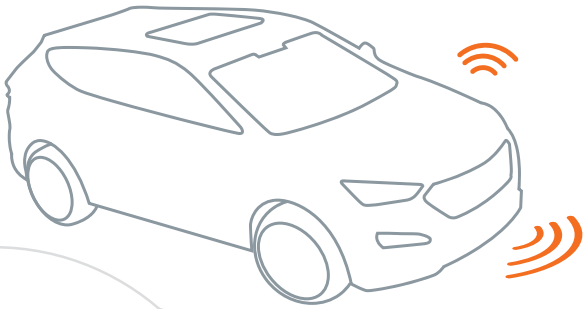
V2X
V2I - V2V - V2P

The symbol V2X (Vehicle to X) means that the vehicle communicates with infrastructure (V2I), other vehicles (V2V), and pedestrians (V2P) around it

Retrieval of position information by satellite/radio

Interactions with connected objects/clothing worn by pedestrians

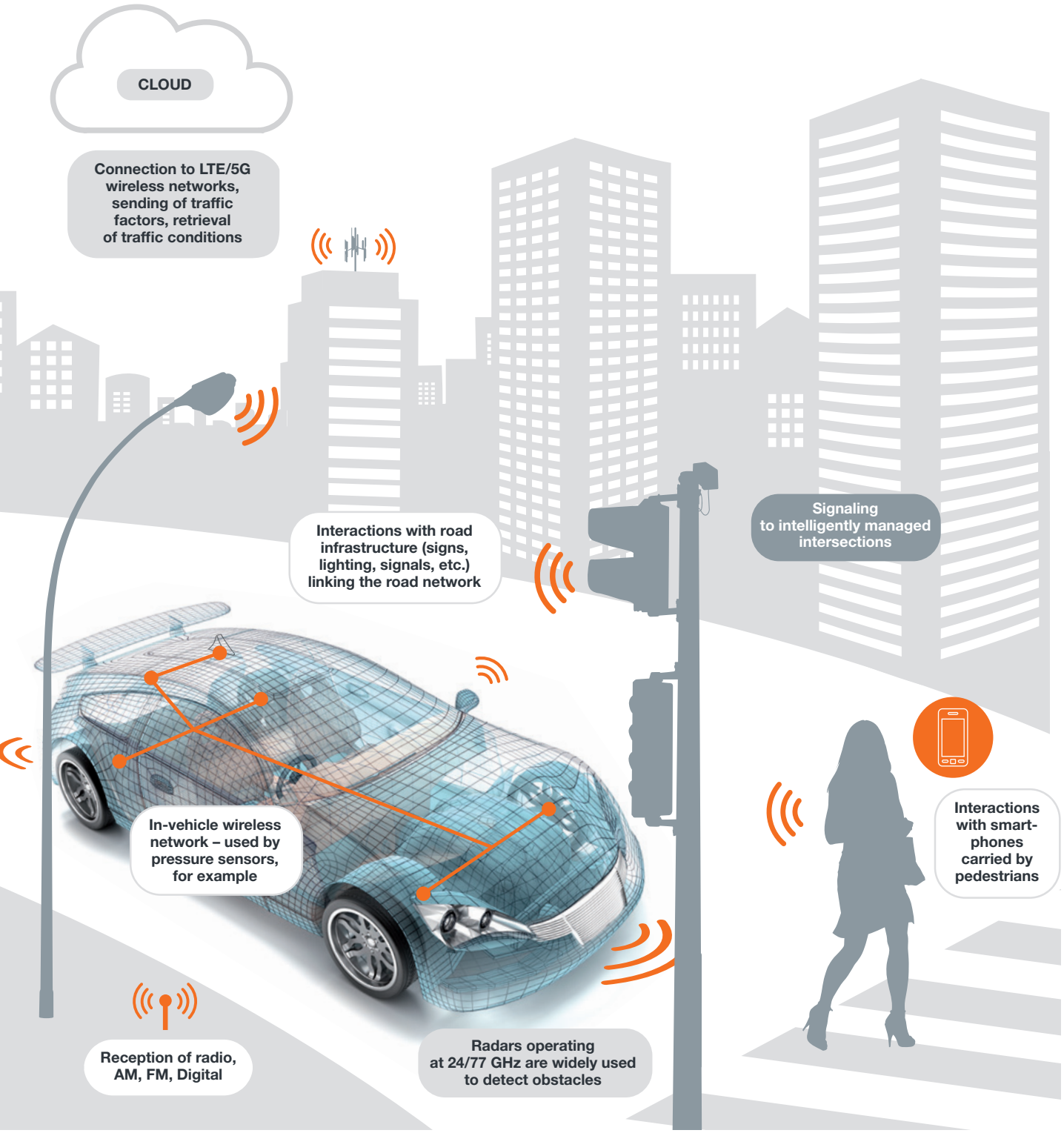
Work areas send signals to the infrastructure network



THE SMARTPHONE, THE SWISS ARMY KNIFE CARS

- Hands-free calling
- Remote access to the car (e.g. setting the temperature)
- Opening the car
- Insurance (per mile, in limited areas, etc.)
- Payment per mile
- Rental
- Emergency service
- Maintenance
- Fleet management

MVG also provides a suite of data post-processing software that extracts the fundamental parameters of vehicles in terms of electromagnetic radiation. These parameters can then be used in third-party software to simulate complex electromagnetic environments. This "virtual drive" makes it possible to verify interactions between a vehicle and other vehicles, infrastructure, and pedestrians around it in different environments – countryside, city, tunnel, wet road, snowy road – all variations that impact the radiation of electromagnetic waves. This unique combination of measurements and simulations enables auto manufacturers to test and optimize the electromagnetic performance of their vehicles. These performances play a fundamental role in the success of the self-driving car, as illustrated below.



5G | CASE STUDY - INTERNET OF THING

Plume Design, Inc., USA

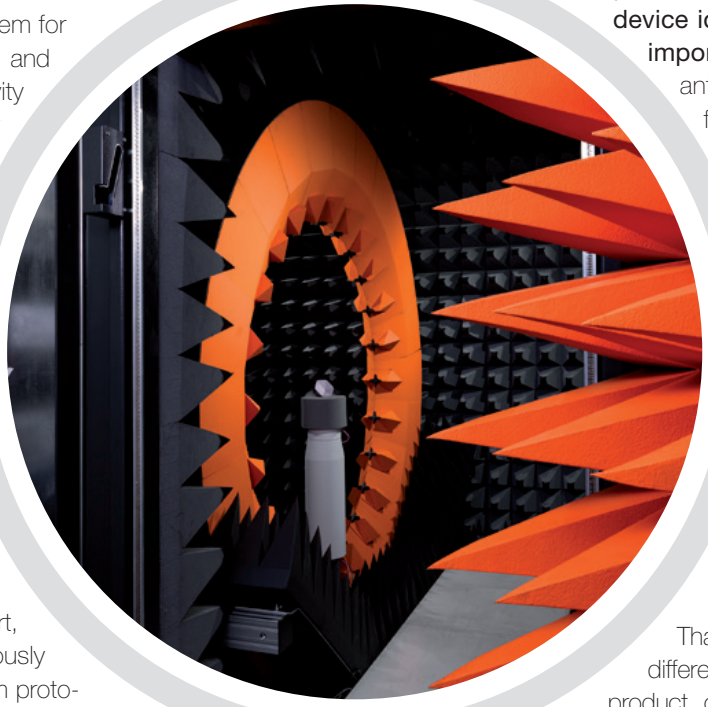
Plume®

Learn how… Plume is staying ahead of the game, ensuring time-to-market and the sustainability of its IoT products. With the knowledge that antenna performance is key in the success of IoT, Plume has invested in an MVG SG24 to test the OTA wireless performance of its Pods, gain speed and accuracy in product development, and get a head start on next-generation ideas.

The Challenge: Ensure faster Time-to-Market with Faster Prototype Testing

Plume offers a new system for people wanting fast and consistent connectivity in every corner of their home. Plume works through a set of hexagonal "Pods" designed to plug directly into wall sockets around the home.
Plume aims to deliver the best combination of hardware and software to improve the reliability of Wi-Fi network coverage in the home. With this goal at heart, their products are rigorously tested and retested, from prototyping to production, particularly the antennas.

"The process of developing a prototype requires the device performance to be assessed rigorously with great accuracy, which means iteration is key: reproducible and repeatable performance. It takes about 100 antenna measurements to get a connected object right and fully optimized", explains Miro Samardzija.



Many start-ups in IoT have the great device idea, but skip-out on the importance of antennas. The antennas and the IoT device form a whole in determining the wireless performance. **It is therefore imperative that the antennas, and in particular their interaction with the device, be taken into consideration from the onset of the design process.** Doing so is the best guarantee that the connectivity of the device will be seamless.

That's why, across the different stages of the Plume product cycle, from research and development to production, antennas are a vital component to be tested and optimized. Time-to-market also depends on the speed at which product testing is to be carried out and validated. Last but not least, as a prospering IoT company, Plume aims to make sure their finalized products are sound and sustainable.

Most start-up businesses in IoT have one great wireless device idea but don't think about antennas. Connected devices are often so small that you can't buy an antenna off the shelf and hope it works. Antennas should be considered in the design process from Day 1 to guarantee that the connectivity of the device will work seamlessly.

Miro Samardzija, *Antenna Engineer, in charge of designing, developing and testing antennas at system level for integration into Wi-Fi products*

It was therefore crucial for Plume to be equipped with a reliable solution for fast, standardized, and automated antenna measurements. Included in their requirements were advanced antenna testing features, such as antenna pattern measurements and OTA testing capabilities, to accurately predict real-world wireless device reliability, safety and performance.

The Solution:

Plume decided to invest in an antenna test system and chamber solution. They chose an MVG SG24 to ensure their capacity to develop and test all of their new and future IoT ideas. The SG 24 measures frequencies from 650 MHz to 6 GHz, with integrated OTA capabilities, fitting their needs for a variety of IoT antenna testing. It has proven ideal for speedy and effective testing of Plume's devices such as the Pods.

"The more effort we put in design, integration and testing, the better the final product comes out and the better customer satisfaction is. This MVG solution is by far the most reliable and effective solution for our measurement needs", adds Miro Samardzija.

Supplier Chosen with No Compromises

Miro Samardzija explains the reasons behind the supplier selection for this project:

"Plume means no compromises. This is also our spirit when choosing suppliers. MVG was the most understanding of our needs and had the most advanced solutions and expertise. Of course, we talked to other vendors before making our choice. Having used both MVG and its American competitor during the course of my career, I can testify that tech support is excellent at MVG. They were flexible in terms of solution customization. The installation and validation process was efficient, and we appreciate the fact that they remain available for any question or issue."

Next Steps:

"Our current goal is to grow the company and test more new products. This will eventually mean expanding our testing capability. As we are very satisfied with our current SG 24 test system, MVG will be no doubt our preferred supplier for any future testing solution purchase", concludes Miro Samardzija.

Product information:

The SG24 chamber is a multi-probe antenna measurement system, ideal for the OTA testing of mobile device conformance at high throughput or high frequencies, particularly for LTE, Wi-Fi 802.11a and Wi-Fi 802.11n protocols, but also for all current protocols.

It is available in 3 sizes. The model used by Plume is compact (C), measuring frequencies from 650 MHz to 6 GHz.

THE BENEFITS:

For Plume, the benefits of choosing the MVG SG24 test system are:

- Cost-saving: budget is controlled, and the expense of measurement services at third-party labs is eliminated
- Quick troubleshooting process: easy to test, check, modify and re-test within minutes to get the product exactly right
- Customized turn-key solution: tailored to meet Plume's full requirements
- High level of measurement repeatability: ensured by the minimalized mechanical movements of the multiprobe system
- Excellent technical support: based on proven past experience with MVG
- MVG is CTIA-standard compliant and has a strong track record in antenna testing
- Software supporting all wireless communication protocols in the CTIA and 3GPP test standards
- Sustained wireless performance of devices : error corrections are limited throughout the product cycle

EMC

The electromagnetic compatibility department (EMC)

Strategy

Integration of the value chain through strategic acquisitions, positioning as a supplier of turn-key systems.

Activity & Markets

The MVG-EMC division was created in 2012, thanks to the unique combination of AEMI's expertise in absorbing materials and Rainford's expertise in Faraday cages. The EMC division provides solutions to test the ability of devices to operate in electromagnetic environments and avoid generating disruptions themselves. This activity also extends to the EMC certification of electronic devices, protection against strong fields (data, people), and protection against eavesdropping.

Key achievements

An expanded product offering

Increasing demand, especially in the US

Offering

A range of EMC test chambers, mode-stir chambers, shielded rooms (control rooms, embassies), shielding for data centers, and shielding for MRI installations.

EMC test chambers

Absorbing materials

Antenna measurement chambers

Faraday cages

Doors

Accessories (masts, positioners, controllers, etc.)

The EMC division also provides project management, maintenance, certification, reinstallation, and installation upgrade services.

Price range

From €10 K to several million euros.

EIC

The environmental and industrial control department

Activity & Markets

The EIC division brings together the devices used for monitoring electromagnetic waves, quality control on production lines, and the NeptuLink by MVG dedicated to Internet connectivity in coastal environments.

Strategy

Go from “follower” to “challenger” by relying on a modernized portfolio of distinctive products.

Price range

From €350 to €180 K.

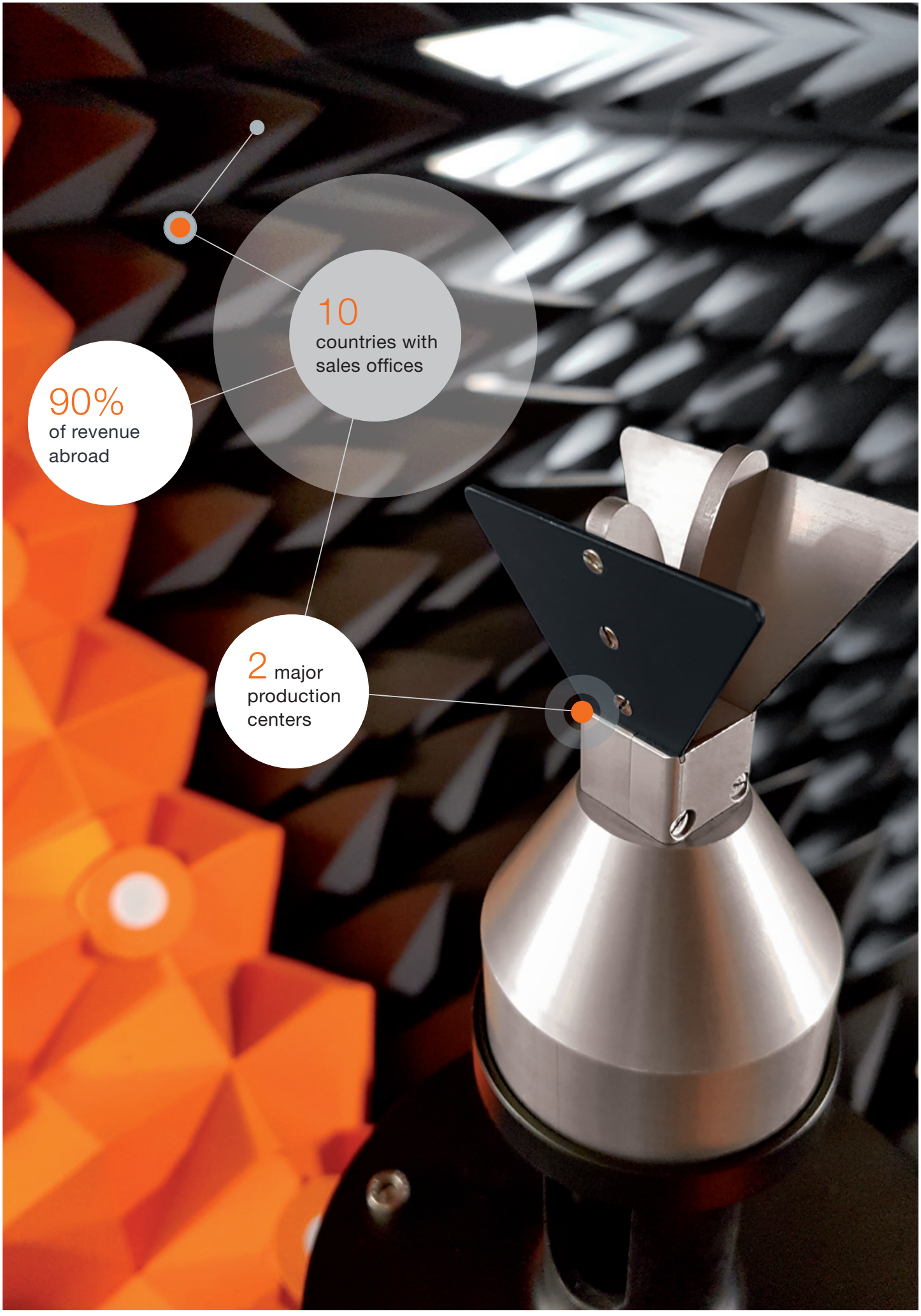
Offering

A wide range of products:

- Portable RF exposure meters (EME Guard, EME Guard XS, EME Spy)
- Fixed RF exposure meters (FlashRad)
- Software for 3D simulation of exposure to electromagnetic waves (EMF Visual)
- Control system for rock wool and glass wool on production lines (Dentro)
- 4G modem to optimize land/sea connections (NeptuLink by MVG)

Key achievements

- Many deliveries for the EME Guard XS and NeptuLink products
- Continued success of partnerships with US distributors


10
countries with
sales offices
90%
of revenue
abroad
2 major
production
centers

KEY ASSETS

Since 1996, the year that marked an industrial turning point for the Group when it decided to move forward by turning its unique design office into an industrial manufacturer, MVG has developed two main assets:

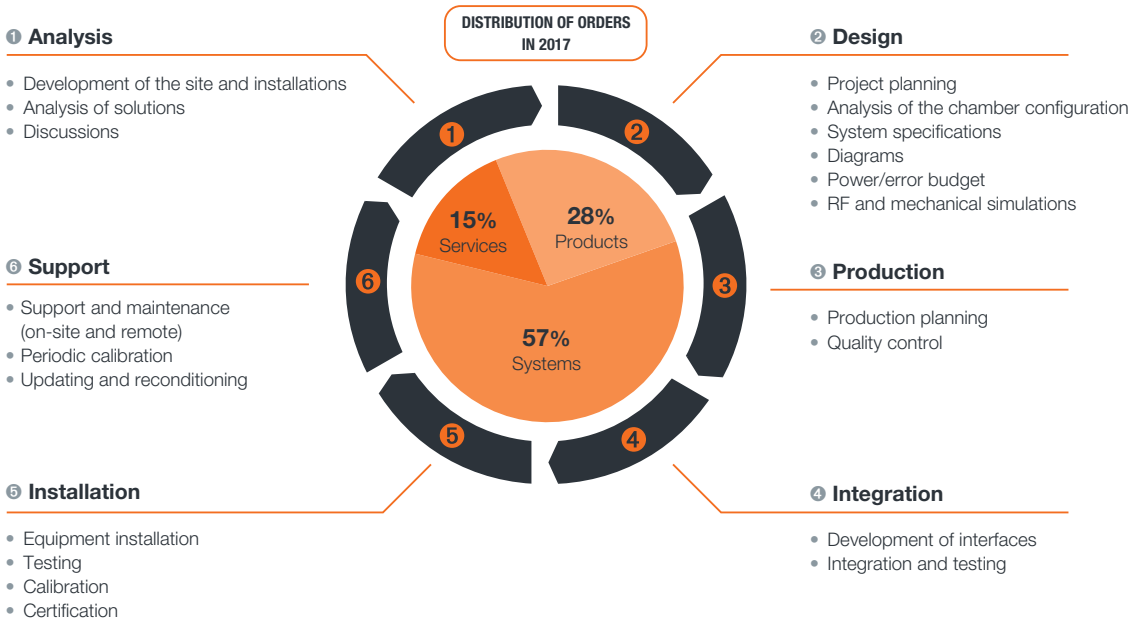
- a solid business model, including a high proportion of recurring revenue,
- a multi-country/multi-sector positioning.

A solid business model

MVG proposes systems with high added value, designed from standardized technological blocks, guaranteeing controlled margins. Its know-how extends from the analysis, sales, and design stages to production, integration, installation, and support. These systems accounted for 57% of new orders in 2017.

Alongside these systems, MVG develops, manufactures, and markets off-the-shelf products, such as the SG 24 *(see page 22)* and the StarLab 50 GHz *(see page 38)*. These projects require little adaptation from one customer to another and can be put into service quickly. They represented 28% of new orders in 2017. Lastly, the Group offers engineering and maintenance services. These represented 15% of orders. Service, engineering, and maintenance contracts, associated with the products, represent 43% of sales and are not significantly affected by adverse market conditions. This solid business model is reinforced by a diversified customer portfolio: the top customer accounted for 3% of the Group's 2017 revenue, and the top five customers accounted for 14%.

SYSTEM SALES CYCLE



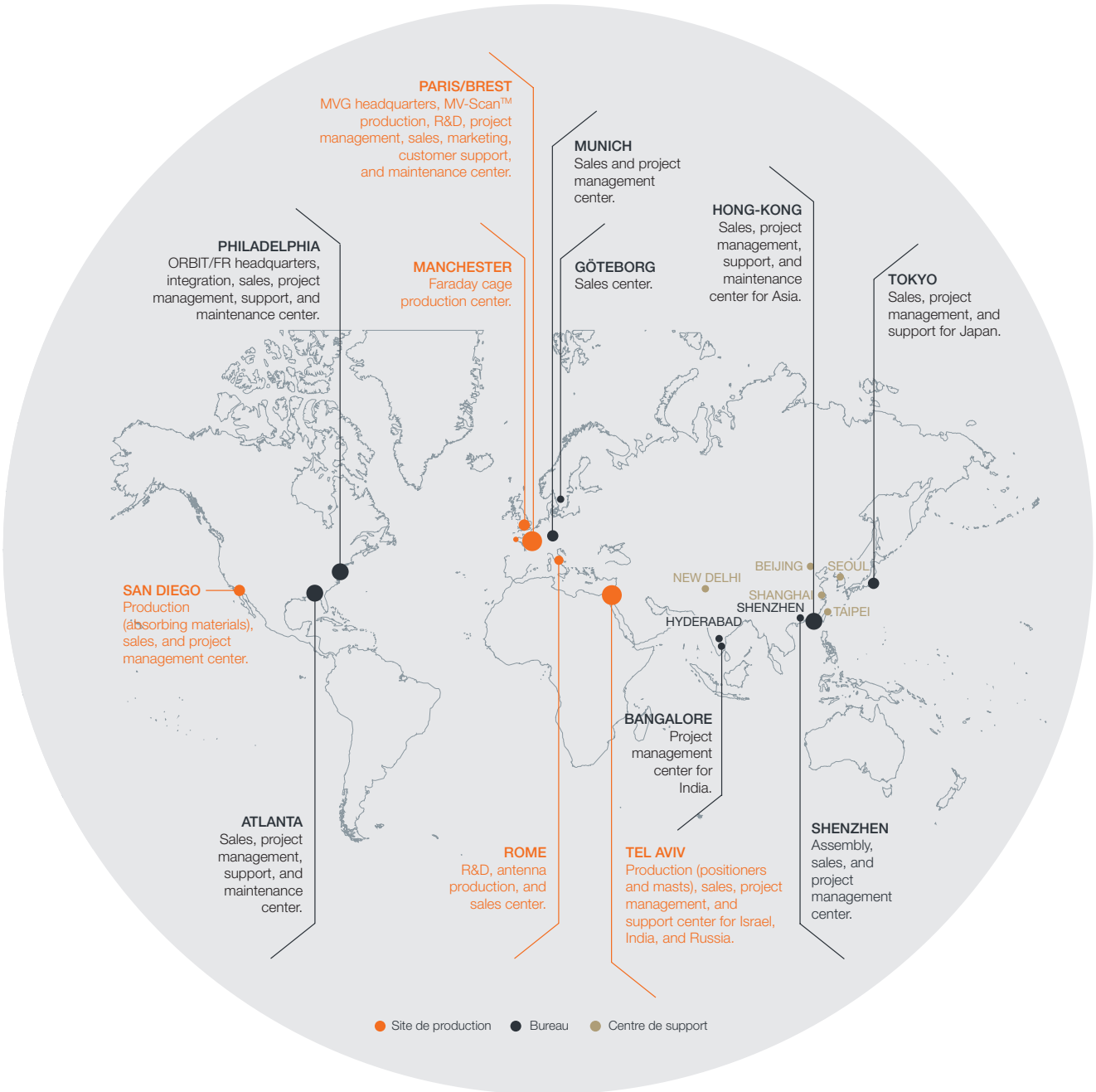
An international group

MVG exports more than 90% of its production. The Group spans Europe, Asia, and America through 20 locations in 10 countries.

In 2015, a reorganization resulted in a centralization of its mechanical production in Israel, an almost fully sales and service-oriented structure in the United States, and ultimately a more productive, more efficient Group focused on the future.

It currently consists of two large major production centers: one in France, focusing on electronics and multi-sensor technology, and one in Israel, focusing on mechanics and single-sensor technologies, working in perfect synergy. These two production centers rely on three skill satellites: one that produces Faraday cages (Rainford - England), one that produces absorbing materials (AEMI - USA), and one that designs reference antennas necessary for system acceptance (MVG - Italy). With its local offices, the Group is closer to customer cultures and is therefore better able to follow through with customer needs and with higher understanding, in turn limiting travel and transport expenses.

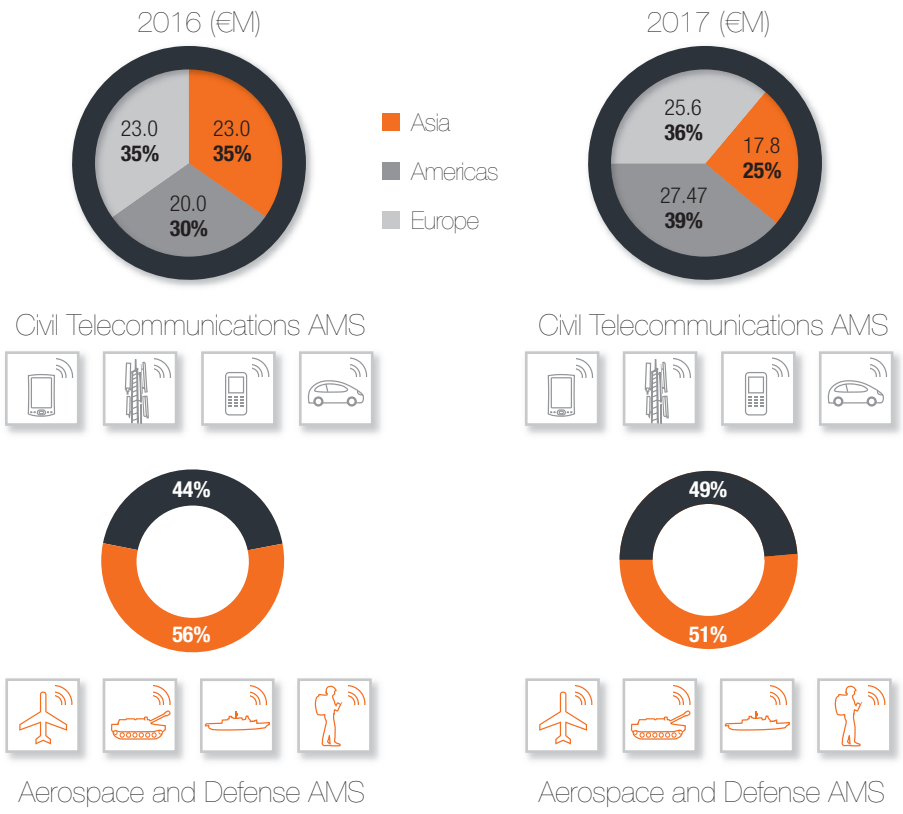
MVG IS PRESENT IN 10 COUNTRIES, THROUGH 20 SITES, INCLUDING 2 MAJOR MANUFACTURING FACILITIES



A multi-country/multi-sector positioning

The Group is strengthened by a diversified and balanced sector and geographic presence. From a sector perspective, it works in the Aerospace/Defense and Civil Telecommunication sectors. Civil Telecommunication activities saw strong growth and represents 49% of 2017 revenue (vs. 44% last year). Meanwhile, the Defense/Aerospace sector repeated its high business volume from last year and accounted for 51% of 2017 revenue. In geographic terms, the Group operates on three continents. This year, growth was concentrated in the EMEA and the US, which accounted for 39% and 36% of revenue respectively, with Asia contributing 25%.

BREAKDOWN OF REVENUE BY GEOGRAPHICAL REGION/2016 AND 2017



A diverse customer base that protects the group from any dependency on its main customers

MVG's business model relies on a diversified customer portfolio. From year to year, the share of the top customer and the top five customers remains contained. The top customer's share in the Group's 2017 revenue was thus only 3%, and the top five customers accounted for 14% of revenue for the year.

Share of revenue in €K	2013	2014	2015	2016	2017
No. 1 customer	3,790	5,665	4,480	5,970	2,782
Top 5 customers	10,942	15,149	10,534	13,464	10,130

An experienced team holding shares

- An experienced team bringing together more than 30 nationalities
- The management is a shareholder of the Group

GROUP

Dr. Philippe Garreau, *CEO*

SUPELEC, Engineering PhD
Started his career at the European Space Agency (ESA)
1992: Joined SATIMO - responsible for antenna measurements
1996: Promoted to CEO of SATIMO then the MVG Group in 2008

Olivier Gurs, *CFO*

Holds an MBA from ESCP
Began his career as an auditor at Arthur Andersen Became CFO of Hybrigenics then SpineVision
2003: Joined Grant Thornton
2015: Named CFO of MVG

Lars Foged, *Scientific Dir.*

Graduate of the California Institute of Technology
1991: Joined Space Engineering (Italy) in the space antenna R&D dept.
Currently Scientific Dir. of MVG

Gianni Barone, *Sales Dir.*

Graduate of the University of Torvergata and SupAéro
1991: Joined Space Engineering (Italy)
1996: Participated in the launch of Altran in Italy
2000: Joined MVG
Currently Sales Dir. of MVG & Managing Dir. of MVG Italy

Eric Beaumont, *Marketing Dir.*

SUPELEC engineer/M.S. in E.E. Georgia Tech
1996: Joined SATIMO in charge of Signal Processing
2000: Joined the Mobile Network Design dept. of Alcatel
Currently Strategy Dir. of MVG

Nicolas Gross, *Applications Dir.*

ENSTA Bretagne engineer
2006: Joined SATIMO as antenna engineer
2007: in charge of multi-probe systems development
Currently Applications Dir. of MVG

Benoît Basle, *COO*

Master's in engineering from ECAM Rennes
2004: Joins FAGORBRANDT as Production manager
2006: Joins PARROT and moves to China to set up the supply chain in Asia
2012: Joins SAFRAN Identity & Security
2018: Joins MVG

SUBSIDIARIES

MVG Industries / MVG

Arnaud Gandois, *Managing Dir. of MVG Industries*

ENSIL engineer
1996: Started his career at SATIMO
Currently Managing Dir. of MVG Industries

John Estrada, *Managing Dir. of MVG USA*

Graduate of Auburn University and Georgia Tech.
2001: Joined SATIMO
Currently Dir. MVG USA and Dir. US Sales

Luc Duchesne, *R&D Dir. of MVG Industries*

Graduate of ENSI and SupAéro
6 years of experience at DASA (Germany)
2000: Joined Satimo
Currently head of R&D of MVG Industries

Yann Toutain, *Head of Brest Site*

Engineer at Télécom Bretagne
2001: PhD from Université de Bretagne Ouest
2001: Joined Antennessa (acquired by MVG in 2007)
2015: Named head of the Brest site

ORBIT/FR

Per Iversen, *CEO of ORBIT/FR*

Graduate of UCLA
1991: Joined the Antenna division of the ESA
1998: Tech. Dir. of SATIMO then Dir. of the Atlanta site
2008: Named head of ORBIT/FR

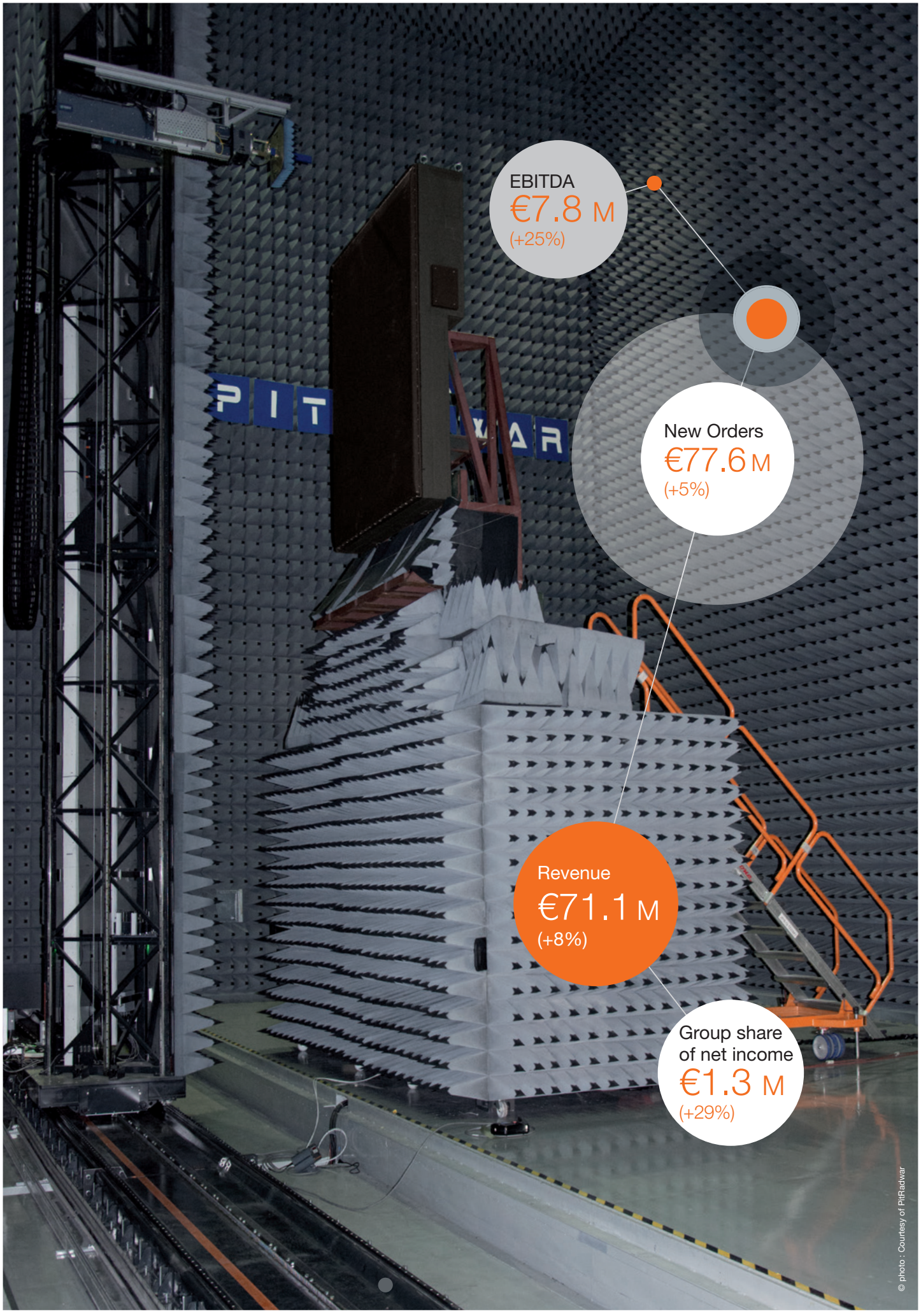
Roni Braun, *Dir. of ORBIT/FR, Ltd*

Graduate of Technion – Israeli Institute of Technology
1996: Began his career as a mechanical engineer at Orbit/FR, Ltd
2009: Named Engineering Director of Orbit/FR, Ltd
2015: Named Dir. of Orbit/FR, Ltd

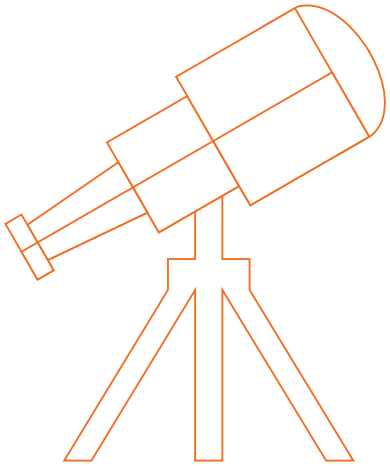
MVG-EMC

John Noonan, *Dir. Rainford EMC & AEMI, Inc.*

1991-2008: Dir. of Supaseries Ltd
2006: Dir. of Blackbeam Ltd
2009: Dir. of Rainford EMC Systems Ltd
2017: Dir. of AEMI, Inc


EBITDA
€7.8 M
(+25%)
New Orders
€77.6 M
(+5%)
Revenue
€71.1 M
(+8%)
Group share
of net income
€1.3 M
(+29%)
© photo : Courtesy of PitRadwar

EARNINGS AND OUTLOOK

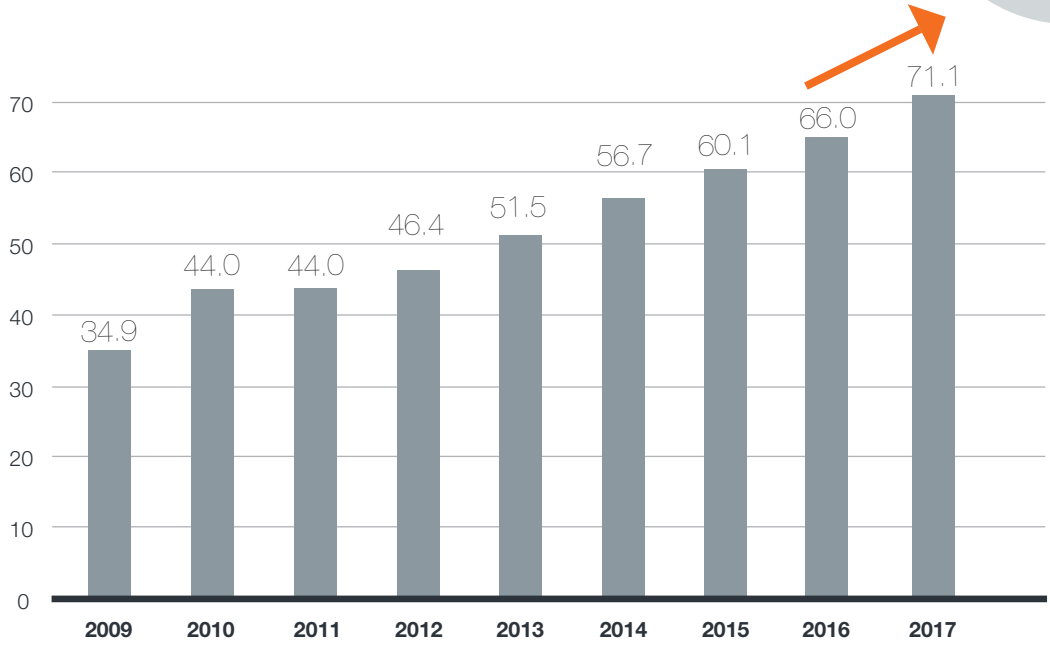


MVG had a very good 2017 financial year marked by a clear improvement in its economic indicators, thus reaping the fruits of its sales momentum and its measures to improve productivity. The Group relies mainly on its ability to supply competitive products with a high technological value.

Activity

+9.7%
growth at constant exchange rates

CHANGE IN REVENUE (€M)



Organic growthin revenues: 7.7%

The MVG Group has posted revenue of €71.1 million versus €66.0 million last year, up 7.6% (9.7% at constant exchange rates).

From a sectoral viewpoint, the Civil Telecommunications business registered strong growth and accounted for 49% of revenue (versus 44% last year). Meanwhile, the Aerospace/Defense sector repeated its high business volume from last year and accounted for 51% of 2017 revenue.

Geographically, the group continues to demonstrate its ability to seize opportunities in its main markets. This year, growth was concentrated in the EMEA and the US, which accounted for 39% and 36% of revenue respectively, with Asia contributing 25%.

Significant improvement in the main financial indicators

Consolidated data - IFRS - €k

SIMPLIFIED STATEMENT OF COMPREHENSIVE INCOME	2016	2017	% variation
REVENUE	**66,019**	**71,072**	**+7.7%**
Purchases consumed	(24,511)	(26,204)	
GROSS MARGIN	**41,508**	**44,867**	**+8.1%**
Margin	*62.9%*	*63.1%*	
Other external expenses	(11,891)	(12,681)	-
Payroll expenses	(22,445)	(23,653)	-
EBITDA	**6,250**	**7,801**	**+24.8%**
Margin	*9.5%*	*11.0%*	
RECURRING NET OPERATING INCOME	**3,718**	**4,405**	**+18.5%**
Margin	*5.6%*	*6.2%*	

The gross margin rose from €41.5 M to €44.9 M, an increase of 8.1%. The gross margin increased by 0.2 points to 63.1% under a favorable product mix leaning towards "all electronic".

Thanks to excellent control of current operating expenses, the EBITDA increased significantly to €7.8 M compared to €6.3 M last year (+24.8%). The impact of the fluctuations in exchange parities was not significant. The EBITDA margin rate reached 11.0% compared to 9.5% last year, i.e. an increase of 1.5 points due to operational efficiency measures.

Consolidated data - IFRS - €k

SIMPLIFIED STATEMENT OF COMPREHENSIVE INCOME	2016	2017	% variation
RECURRING NET OPERATING INCOME	**3,718**	**4,405**	**+18.5%**
Margin	*5.6%*	*6.2%*	
Non-current operating expenses	(1,715)	(152)	
NET OPERATING INCOME	2,003	4,253	+112%
Net finance costs	(465)	(2,022)	
Income tax	(1,374)	(1,580)	
NET INCOME	**163**	**652**	**+300%**
NET INCOMEGROUP SHARE	**1,044**	**1,343**	**+28.6%**

Non-recurring operating expenses also decreased greatly, with the Group benefiting from the judgment in the intellectual property dispute in the United States at the end of 2016. The net operating income was thus €4.3 M compared to €2.0 M at December 31, 2016, a sharp increase of 112%.

Finally, net financial income was €(2.0) M compared to €(0.5) M in 2016, a difference explained mainly by the re-evaluation of intra-group loans on the closing date following changes in the euro/dollar parity. The impact of this latent exchange loss was -€1.8 M.

The tax expense on this occasion was exceptionally high at €1.6 M. It is explained by a re-evaluation of the deferred taxes classed as assets of -€0.8 M, mainly due to the recent change in the tax rate in the United States and in France for future years.

Finally, the Net Income was €0.6 M (+300%) and the Group share of net income was €1.3 M (+28.6%).

New growth in operational cash flows and very healthy balance sheet

Shareholders' equity stood at €69.8 M on December 31, 2017, compared to €70.4 M on December 31, 2016, with the effect of exchange rates.

Consolidated data - IFRS - €k

	SIMPLIFIED STATEMENT OF FINANCIAL POSITION	12/31/2016	12/31/2017
ASSETS	**NON-CURRENT ASSETS**	**29,700**	**29,247**
	CURRENT ASSETS	**73,351**	**69,787**
	- of which, inventories	10,366	10,526
	- of which, trade receivables	30,800	28,751
	CASH ASSETS	**26,655**	**25,236**
	TOTAL	103,051	99,034
LIABILITIES	**EQUITY CAPITAL**	**70,420**	**69,800**
	NON-CURRENT LIABILITIES	**6,450**	**5,631**
	- of which, non-current financial debts	5,657	4,735
	CURRENT LIABILITIES	**26,181**	**23,604**
	- of which, current financial debts	3,080	924
	- of which, trade payables	10,486	11,131
	TOTAL	103,051	99,034

The cash flow generated by the activity was €5.6 M as of December 31, 2017 (compared to €4.7 M on December 31, 2016), in particular because of favorable WCR effects, which covered all investment flows (€3.0 M). The free cash flow thus increased considerably to €2.6 M (€+1.5 M compared to last year).

Over the period, the Group made loan repayments of €1.2 M. At end-2017, MVG thus had a net cash flow position of €19.6 M (€1.7 M higher than at end-2016), some of which (€6.5 M) was allocated after the purchase of the Orbit/FR minority holdings in early April.

Consolidated data - IFRS - €k

SIMPLIFIED FINANCING TABLE BY ANALYSIS OF CASH FLOWS	2016	2017
Consolidated Net Income	163	652
Group share of net profit	1,044	1,343
Operating cash flow before financecosts and taxes	4,878	5,789
Change in WCR related to operations	681	1,482
NET CASH FLOW FROM OPERATIONS	**4,679**	**5,650**
Net cash flow from investment	(3,599)	(3,040)
Net cash flow from financing	(1,971)	(1,748)
Impact of currency fluctuations	91	(512)
CHANGES IN CASH POSITION	**(892)**	**862**
OPENING CASH POSITION	**25,678**	**24,886**
CLOSING CASH POSITION	**24,886**	**25,236**

Sound prospects for growth in 2018

A very substantial order book supporting a new year of growth

At the beginning of 2018, MVG showed a new order intake record of €77.6 M, which led to an order book on January 1, 2018, of €69.8 M. With the benefit of this high visibility, the Group is aiming for 2018 to be new year of growth for its revenue and margins.

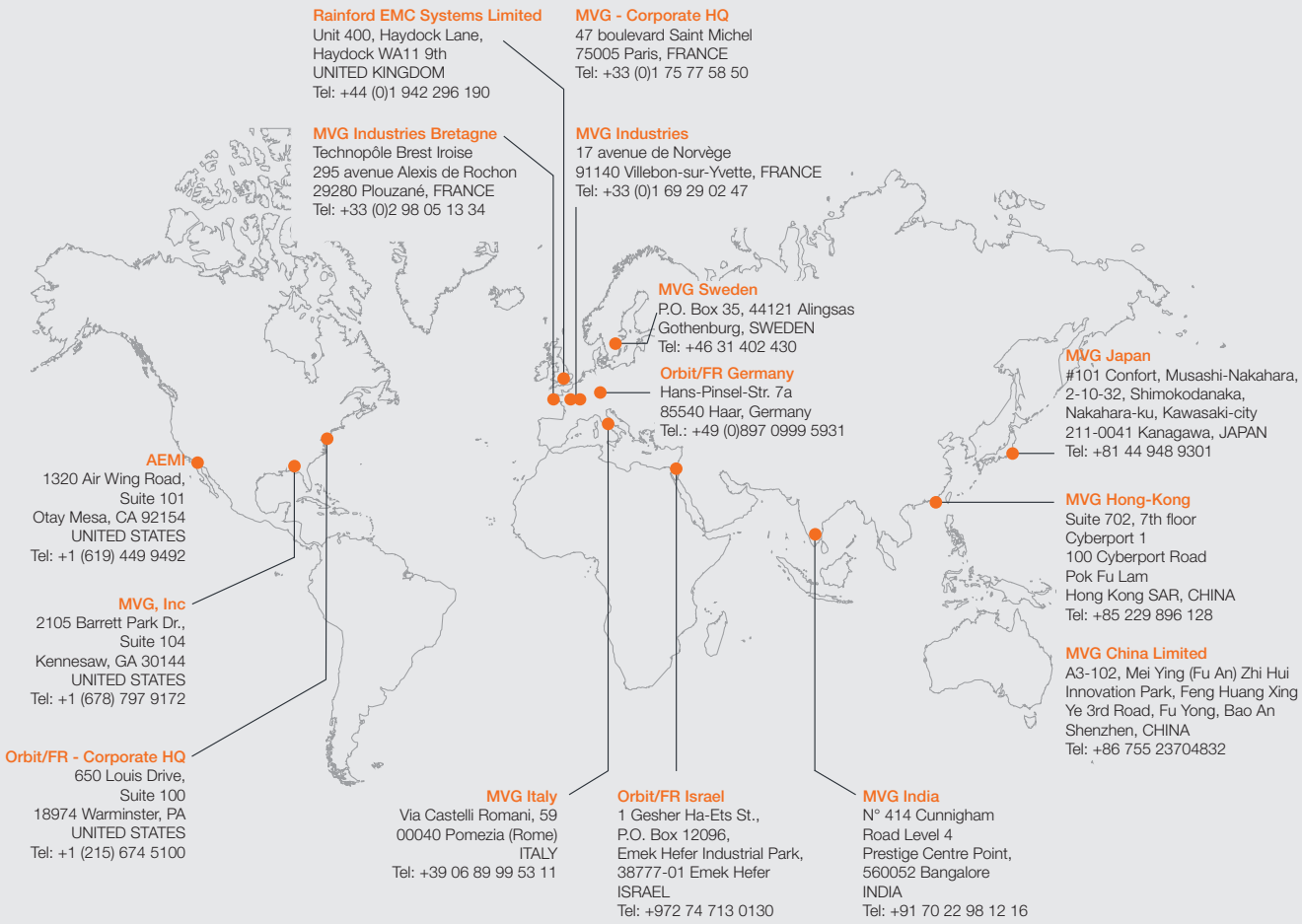
On the technological side, Microwave Vision intends to increase its technological progress on the 5G very high frequency market, which is a real challenge for the main telephone service providers. MGV is ahead on this market which presents major technological barriers and high potential. Sales of 5G products, including those for the connected vehicle, are already very promising and allow the Group to expect a solid growth driver in this activity over the next few years.

Simplified organizational situation with the purchase of the ORBIT/FR minority holdings

The purchase of the Orbit/FR minority holdings paves the way to simplifying the legal structure of MVG, extending organizational synergies and developing new innovations within the Group.

A global presence

Microwave Vision exports more than 90% of its production outside of France. The Group spans Europe, Asia and America through 15 main locations in 10 countries.



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