



YOUR  
**SECURITY**  
OUR  
**PRIORITY**



# OUR COMPANY

MC2 Technologies - Microwave Characterization Center Technologies - is a spin-off from the IEMN research laboratory (Institute of Electronics, Microelectronics and Nanotechnology) based at the Haute Borne site of excellence in Villeneuve-d'Ascq near Lille (Nord). It specialises in micro and nanotechnologies, mainly applied to the fields of defence, security and telecommunications. Since April 2021, the company has been certified ISO 9001 by the accreditation body SGS.

MC2 Technologies has undergone many developments which are at the origin of its strength and expertise.

Firstly, with the creation, in 2004, of an R&D department with the aim of developing the company's expertise by carrying out work on the components of the future. Then, around 2008, the company submitted its millimetre camera project to the French Defence Procurement Agency (Direction Générale de l'Armement) as part of the RA-PID system. This project gave rise to the MM-Imager system. Finally, the year 2015 saw the in-depth transformation of the company with the establishment of a set of own products that could be marketed. The product range thus consists of UAV jammers, passive cameras as well as microwave products such as power amplifiers, transmit-receive modules etc.

The company has moved from being a very high value-added services VSE, operating in a very closed field and universe, to an innovative industrial SME open to the world. This evolution has led to an exponential increase in its turnover, with a growth rate of 675.2% between 2015 and 2018, placing it among the 500 French growth champions in the rankings of Les Echos, a French daily newspaper providing economic and financial information.

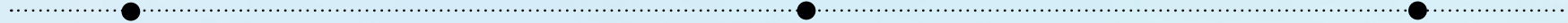
In answer to this growth, the teams have expanded and so have their ambitions. In December 2020, the company moved into its 2,500 sq.m. building located in the Haute Borne park. This infrastructure was entirely designed to accommodate its innovation and production activities.

TURNOVER  
2021

EXPORT

REINVESTMENT IN  
R&D





DETECTION

IDENTIFICATION

NEUTRALISATION

# THE THREAT OF COMMERCIAL UAVs

UAVs threats are omnipresent, they are invading our skies. Not a single day goes by without sensitive private (Seveso-type), state and military infrastructures being illegally overflown. Inexpensive, easily accessible and controllable, UAVs, although a source of opportunities in many fields (agriculture, rescue, etc.), represent a multifaceted threat (espionage, smuggling, explosive charges, etc.) which is growing exponentially.

To guarantee the protection of infrastructures, events and people, it is becoming necessary to be equipped with suitable detection and neutralisation means.

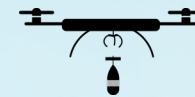
In response to this challenge, MC2 Technologies has developed high-performance, state-of-the-art solutions, entirely engineered and manufactured in France, for the detection, identification and neutralization of commercial UAVs.



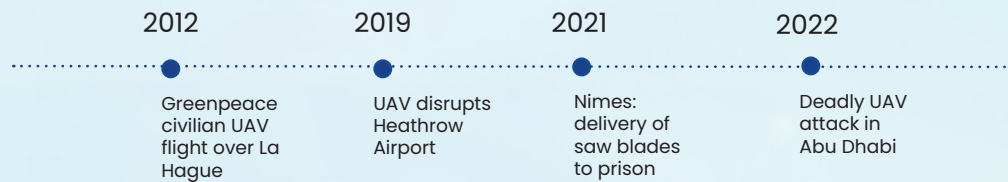
Espionage



Smuggling



Explosive charge



# DETECTION



## RF ANALYSIS

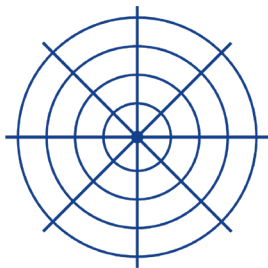
Detection and classification in real-time

## MERCAT – RF ANALYSIS SENSOR

MERCAT is a state-of-the-art listening solution that continuously analyses the radio frequency (RF) environment to warn of one or more threats within a short time. Thanks to its integrated profile library, the system is able to identify the threat. Artificial intelligence algorithms reinforce the system for the detection of unlisted profiles.

MERCAT provides information on the presence of one or more UAVs, allowing operators to initiate their security protocol (evacuation infrastructure lockdown, etc.) and to implement defensive actions such as neutralisation (see NEROD/MAJES).

MERCAT has an IA that allows it to collect information and therefore guarantee the detection of new and unknown UAVs that are not listed in the data library.



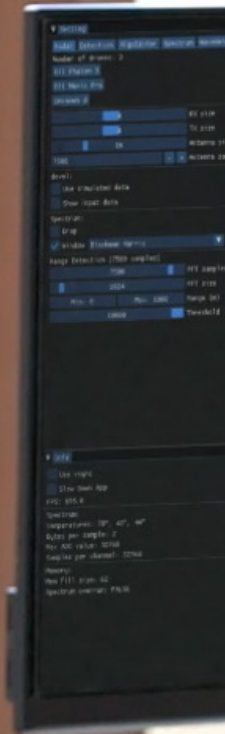
## THZ RADAR

Location and tracking in real-time

## MATIA – TERAHERTZ RADAR

Nowadays, most UAVs are made of plastic and composite materials making their detection more complex or impossible with conventional radars. The MATIA radar answers this problem by using Terahertz frequencies and Doppler and micro-Doppler analysis to detect all types of UAVs, including small, autonomous (no RF emission) and hovering ones.

Powered by machine learning (AI) algorithms, MATIA is able to adapt to the environment to provide real-time airspace information through the detection, tracking and classification of systems approaching protected areas.





## BENEFIT FROM A COMPLETE OVERVIEW

	MATIA		MERCAT		MATIA + MERCAT
	RADAR FMCW	RF SENSOR	ACOUSTIC	OPTICAL	MULTISENSORS
Range	●	●	●	●	●
Probability of detection	●	●	●	●	●
Outside line of sight detection	●	●	●	●	●
Accuracy of detection	●	●	●	●	●
Autonomous UAV detection*	●	●	●	●	●
Swarm detection	●	●	●	●	●
Detection in urban environments	●	●	●	●	●
UAV tracking	●	●	●	●	●
Classification	●	●	●	●	●

\*no RF connection

## THEIR ASSETS

**MERCAT** : MERCAT is an advanced system for detecting UAVs by rapidly identifying their radio-frequency (RF) communication links with their remote controls. It collects real-time information allowing the detection of the UAV and its control.

**MATIA** : MATIA's performance in the Terahertz frequency range allows the recovery of highly reliable and distinctive micro-Doppler signatures from different ranges of UAVs and between UAVs and birds in a shorter time than other existing radar technologies.

## DEPLOYMENT

The deployment of both MATIA and MERCAT systems does not require any particular infrastructure allowing an easy integration in the area to be secured.

Several systems can be deployed in a network to cover sites of all sizes and geometries in order to avoid shadow zones in the airspace to be protected.

# NEUTRALISATION

## MOBILE SYSTEMS – NEROD RF | NEROD HG

In order to address the UAV threat, it is becoming necessary to equip with mobile and easily deployable means in any type of environment.

NEROD RF and NEROD HG are immediate and effective responses to commercial UAVs. Ambidextrous one-piece guns with jamming modules, antennas and battery for a reduced total weight, these systems also have an electromagnetic shield to protect operators.

Both solutions are designed to jam at a distance of several kilometres and differ mainly in the number of jamming frequencies (7 for the NEROD RF versus 3 for the NEROD HG). However, they remain complementary solutions depending on the environment and the operating context.

Finally, our close ties with the French Forces and their expert advice enable us to continually improve our systems to make them intuitive, easy to use and operationally compatible with the field.



### OUR CUSTOMERS



+

### SECURED EVENTS



+



## NEROD RF

NEROD RF is the new generation of portable UAV jammer, succeeding its predecessor NEROD F5.

Its architecture has been designed to make it effective against multi-receiver UAVs while guaranteeing the protection of the operator. With an operational weight of 6 kg, NEROD RF is capable of jamming several kilometres away by transmitting in a directional jamming cone.

### FEATURES

- Possibility to activate/deactivate jamming on one, several or all frequencies
- Integrated sights and firing selector with safety catch
- Effective against frequency hopping and spread spectrum protocols

**6 KG MONOBLOC | 8 FREQUENCY BANDS | 98% EFFICIENCY**



## NEROD HG

NEROD HG is a compact and lightweight solution with a small footprint for immediate response to a UAV threat. It ensures the protection of its operators and is effective against 95% of commercial UAVs.

NEROD HG has an operational weight of less than 2.5 kg and its ergonomics allow the user to hold the gun with one hand. Finally, the system is capable of jamming at a distance of several kilometres by transmitting in a directional jamming cone.

### FEATURES

- Possibility to activate/deactivate jamming on one, several or all frequencies
- Quick battery change
- Fast frequency selection: set up in a few seconds

**< 2.5 KG MONOBLOC | 5 FREQUENCY BANDS | 95% EFFICIENCY**

# NEUTRALISATION

## FIXED SYSTEM – MAJES

MAJES enables the neutralisation of UAV guidance systems (GPS/GLONASS) and their communication links.

Light, compact and modular, MAJES has been designed to be deployed in a fixed way for the protection of sensitive infrastructures (SEVESO, prisons, airports, etc.) or mobile for specific events (G7, 14 July, etc.) or military operations/assaults.

## NETWORK SYNCHRONISATION

Several MAJES can be deployed in a network to cover sites of varying size and geometry in order to avoid shadow zones in the airspace to be protected.

## HIGH CONFIGURABILITY

MAJES easily and quickly adapts to your security needs. Its high configurability allows you to keep control over important parameters on the frequency bands such as their activation / deactivation, the control of the transmission power as well as the locking of the maximum transmission power in order to ensure compliance with the laws in force. The control of all these parameters is done via the interface integrated in a KVM drawer (keyboard, screen, mouse) directly on the MAJES or remotely via a multi-sensor PC/C2.

## DEPLOYMENT

MAJES offers unprecedented performance and flexibility in lightweight, compact and modular 4U tactical containers. The different antenna configurations of the MAJES can be adapted to the problems of your structure to avoid any interference with your equipment.



## EMBEDDED SYSTEM - FLYJAM

Flyjam is a unique system on the market that can be integrated directly onto an UAV via a quick release system, bringing jamming to the heart of the threat.

It flies in hard-to-reach areas, allowing the threat to be dealt with quickly and effectively where no other system can. Flyjam ensures maximum security of the site under protection by preventing intrusion by malicious UAVs.

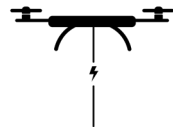
Its use adapts to the needs of the end user and the final vector carrying the system, thus offering a multitude of possibilities.



Patrol



Hard-to-reach and dangerous areas



Continuous monitoring



In support of troops



## SPECIFICATIONS

**95%**  
EFFICIENCY

**3**  
FREQUENCY  
BANDS

**<2.5**KG  
WEIGHT

# DNA-DRONE

## COMPLETE SOLUTION

Thousands of incidents involving UAVs are reported each year. Their proliferation on the market and ease of acquisition have transformed the airspace, making it vulnerable.

To face this security threat, we have combined our know-how to offer a global multi-sensor solution: DNA-Drone. This new generation system consists of 3 elementary bricks that interact via a command centre - C2.

### 1. PROTECTIVE PERIMETER

To organise airspace protection, it is essential to know the airspace situation in real time. Thanks to its multi-layer approach, DNA-Drone combines the performance of detection, tracking, classification and neutralisation technologies to control the threat. The flexibility of our systems allows us to create a protection bubble adapted to your problems and the geometry of your spaces. DNA Drone ensures permanent surveillance thanks to an intelligent technological network spread over the area to be secured.

### 2. DETECTION OF MALICIOUS UAVs

Detection plays a crucial role in the process of neutralising UAVs. A global understanding of the threat allows us to provide an adapted solution, which is why we have combined our terahertz radar with Doppler and micro-Doppler analysis, MATIA, and our radio frequency (RF) analyser MERCAT.

Wherever MERCAT does not operate, MATIA intervenes, especially against autonomous UAVs which have the particularity of emitting no RF signal, making them invisible to RF analysis systems, but detectable by our radar.

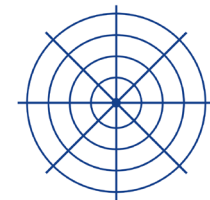
### 3. NEUTRALISATION OF THE THREAT

When the threat is detected and identified, countermeasures can be implemented automatically or by manual activation by the operator via the DNA-Drone interface. Configuration of MAJES neutralisation system is flexible and can be adapted to the problems of the site under protection.



### RF ANALYSIS

DETECTION AND CLASSIFICATION  
IN REAL TIME



### RADAR THZ

LOCATION AND TRACKING  
IN REAL TIME



### NEUTRALIZATION

COUNTERMEASURE SYSTEM TO NEUTRALIZE  
DRONES



PROTECTION AGAINST RADIO CONTROLLED IMPROVISED EXPLOSIVE DEVICES (RC-IEDS)



# THE THREAT OF **RADIO-CONTROLLED IMPROVISED EXPLOSIVE DEVICES**

Radio Controlled Improvised Explosive Devices (RC-IEDs) are proliferating in theatres of operation and are a real danger to civilian and military populations. The threat against deployed forces has never been greater and the demands for effective and robust protection against these RF threats have never been so important.

The Ministry of Defence website gives a more general definition :

*«Any homemade bomb, entirely or only partially manufactured from freely available chemicals (e.g. fertiliser) or from conventional ammunition diverted from its original purpose, is an IED».*

Most radio-controlled IEDs are of rudimentary design, sometimes camouflaged as innocuous objects to carry out attacks and assassinations.

These threats, mainly used in asymmetric conflicts by irregular combatants, are one of the main risks for soldiers and civilians alike. These devices cause both physical and psychological injuries.

Improvised explosive devices are not conventional threats, so there is no precise procedure to defuse them.

In response to this threat, MC2 Technologies has developed, with the support of French institutions, a compact and lightweight technology to neutralise the communication protocols between the trigger and its improvised explosive device.

# SPART

SPART – Smart Protection Active Reactive Technology – is a compact, intelligent jamming solution that can neutralise one or more threats simultaneously.

With a real-time listening capability, the system detects and generates an effective jamming, enabling communication between the trigger and its improvised explosive device, leaving time for the demining teams to manage the device. SPART offers a protective radius around the user, ensuring maximum safety during operations.

Its ultra-wide bandwidth and responsiveness make SPART a unique reference solution in the fight against RC-IEDs.

Thanks to an extensive library of existing threats and a dedicated software, users are able to create mission programs. The operator is thus able to upload the mission to one or more SPART prior to the operation.

Easy to use and lightweight, the system can be carried directly by the intervention forces or on an embedded system such as a vehicle, robot or drone in remote mode.



2018

Afghanistan:  
three US service members  
killed by IED  
near Ghazn

2019

28 soldiers  
killed in  
complex IED  
attack on  
Mali border

2020

Sahel / Lake  
Chad Basin:  
nearly 300 civilians including  
9 refugees  
killed by mines  
and explosive  
devices

2021

5 Malian  
soldiers were  
killed and four  
injured with  
improvised  
explosive  
devices

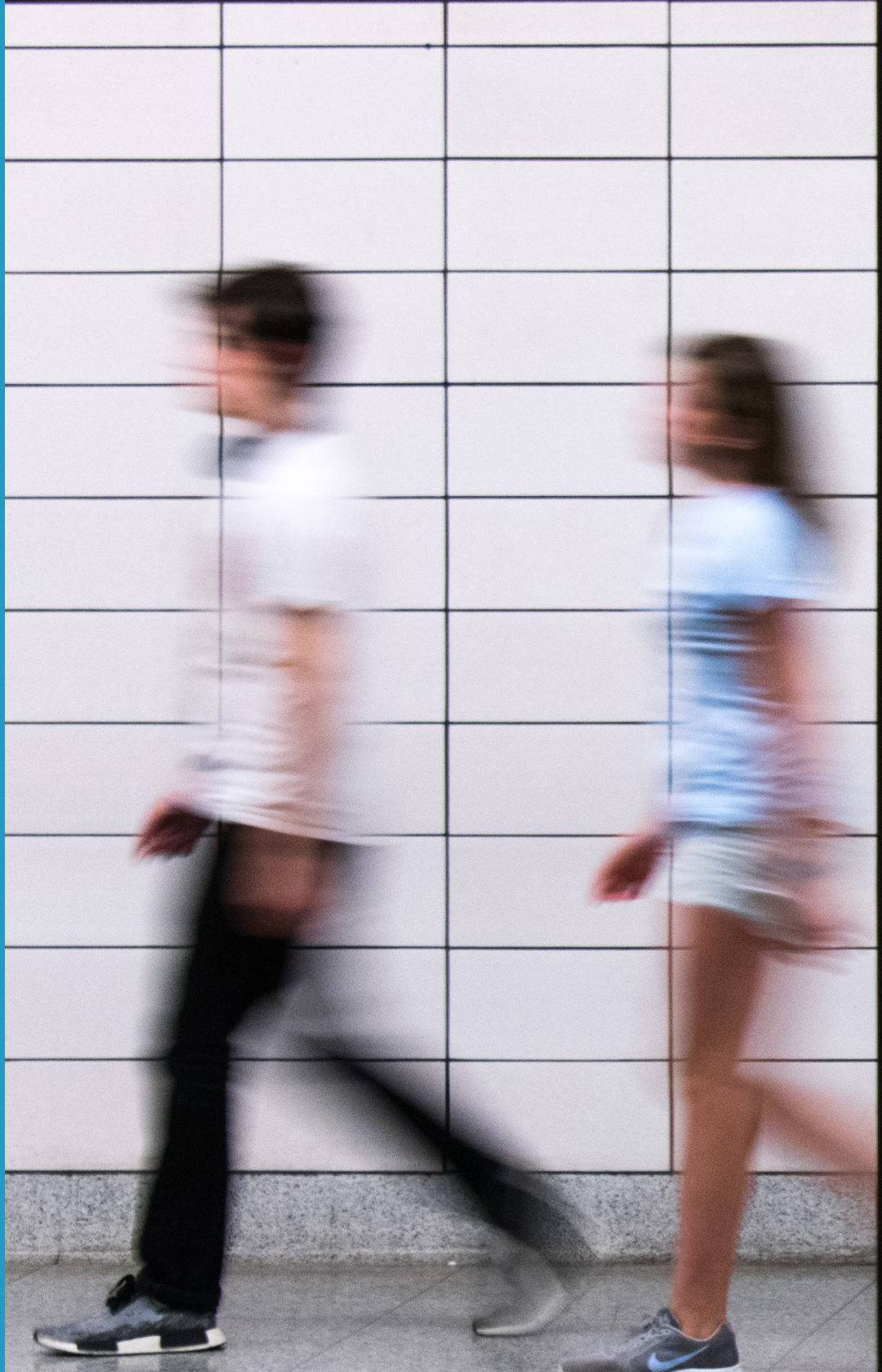
### 3 OPERATING MODES

**A** **Active** : Active mode allows the programming of continuous jamming of specific frequencies and thus forms a protective bubble for the intervention team. This mode continuously emits radio frequency signals on the frequency bands programmed upstream of the operation.

**R** **Reactive** : A reactive mode with 100% autonomous listening, detection and neutralisation. This mode allows the intervention team, using SPART, to listen to the environment and jam only when a threat is detected. Reactive mode uses very short periods of observation, which allows the team to search for new threats while jamming known active threats.

**H** **Hybrid** : Hybrid mode is the combination of active and reactive modes, the two strengths of SPART technology, to ensure maximum safety for the intervention teams.





TRAIN STATIONS



UNDERGROUNDS



SPORTS EVENTS



RASSEMBLEMENTS  
GATHERINGS



# SECURITY CHALLENGES FROM HIDDEN THREATS

In a world where the threat of terrorism is omnipresent, traditional security systems are reaching their limits and are no longer adapted to the ever increasing flows.

Sensitive infrastructures, major events and public places such as railway stations, airports, stadiums and other places with high reception capacities are the most vulnerable to this threat.

New means of control must be put in place to ensure the safety of individuals without creating disruption or delay that could alter the experience of individuals and pose a security risk through the creation of assembly points.

To ensure the safety of individuals, MC2 Technologies has developed, with the support of the French army and the European Commission, MM-Imager, a passive millimetre wave camera that can detect hidden objects on moving people without any radiation.



Weapons



Powders



Projectiles



Liquids



Ceramics



Explosives

# MM-IMAGER

MM-Imager is a passive camera based on Terahertz technology, which is able to detect any type of hidden object on a moving subject without any radiation.

It measures the natural microwaves that are emitted, reflected and transmitted by objects and the human body. Its capabilities in terms of detection, field of view and image quality are state of the art.

This solution has been approved by the French authorities as an innovative solution to secure the 2024 Summer Olympic and Paralympic Games in Paris.

## REAL-TIME DETECTION

MM-Imager differs from all other detection systems in its efficiency in detecting objects on moving people. Threats are displayed on the screen thanks to custom developed image processing algorithms. They allow the operator to analyse and consider the threat.

## IMPROVED FLOW AND EXPERIENCE

The real-time detection capacity makes it possible to fluidify controls and thus avoid crowds that could represent a risk. In addition, MM-Imager avoids body pat-downs, which are often considered intrusive and a source of anxiety. This remote detection without contact with people is part of a post-COVID era.

## RAPID DEPLOYMENT

Several MM-IMAGERS can work in parallel with a common remote control centre (hy-pervisor).



2016

Attacks of 22 March 2016 at Brussels-Zaventem airport and metro

2019

Ceramic knife attack at Condé-sur-Sarthe prison

2019

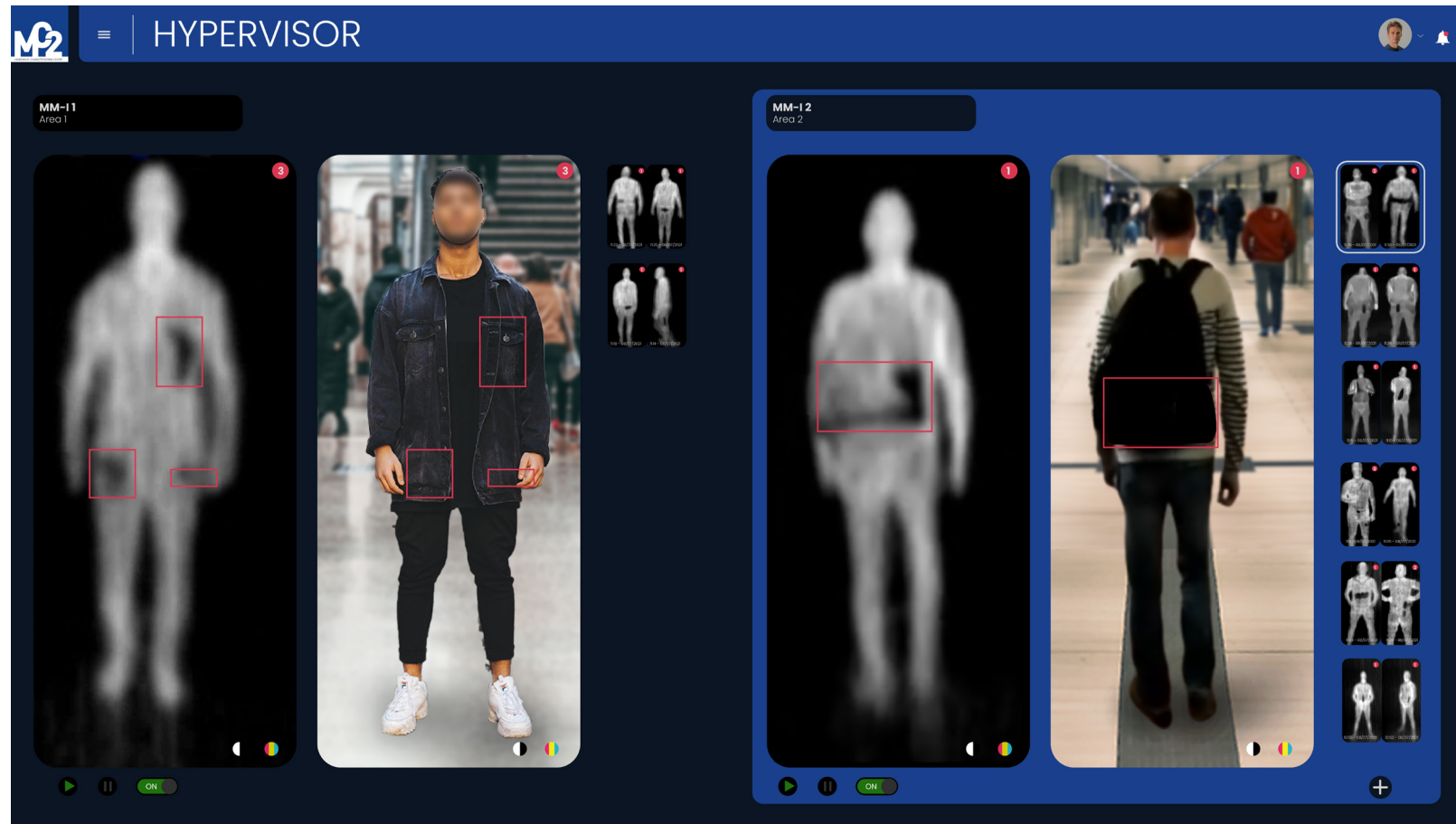
Man with ceramic knife arrested at Orly airport during boarding

## A SAFE AND NON-INTRUSIVE TECHNOLOGY

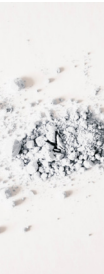
Developed to monitor individuals on the move, MM-Imager is a passive system that uses patented sensor technology that does not emit waves and is therefore safe for people. Its detection algorithm allows the visible image to show objects hidden on the individual, thus ensuring ethical compliance.

## A SIMPLE AND INTUITIVE INTERFACE

MM-Imager possesses an innovative hypervisor software that is fully configurable for either one or two MM-Imagers. The software is capable of controlling up to two units and displaying video and millimetre images from all units at the same time. In addition, for each unit, the software provides automatic detection of hidden objects in real time. The size of the objects to be detected can be set within the limits of the device's capabilities depending on the application.



Weapons



Powders



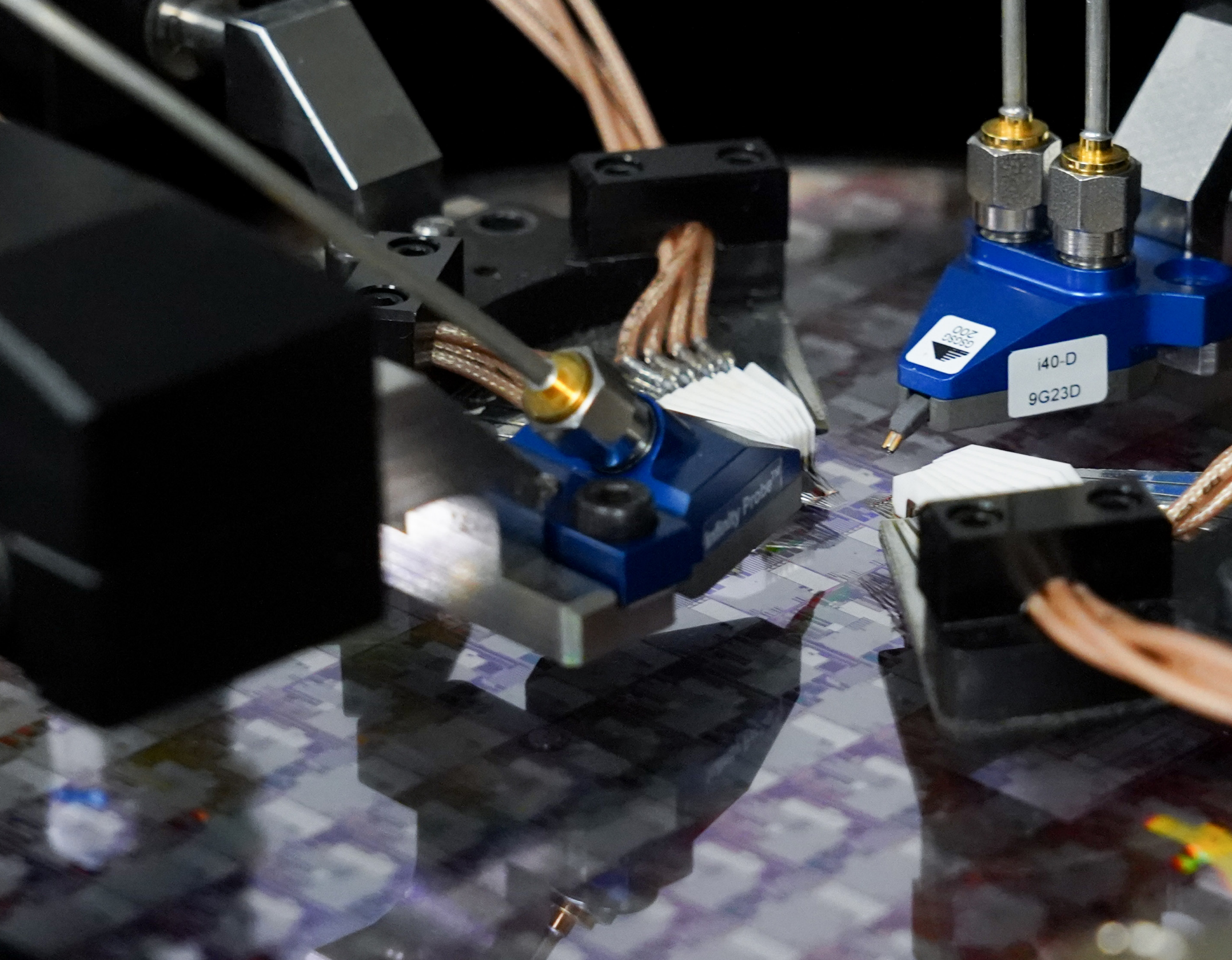
Projectiles

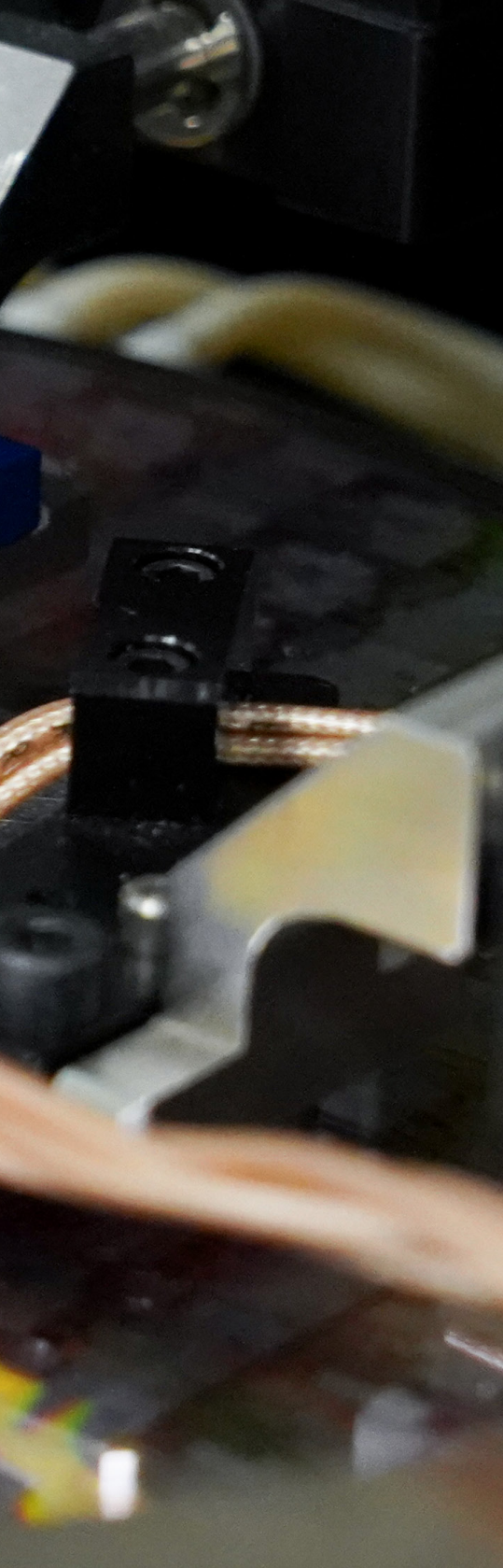


Liquids



Ceramics





# MICROWAVE CHARACTERISATION CENTRE

The company specialises in the characterisation, modelling and design of microwave components and devices for civil and military applications. This is the company's initial activity, which has allowed it to acquire very strong expertise in the very broad field of microwaves. Several million euros worth of high-tech equipment have been invested to give it autonomy in electrical measuring equipment up to 220GHz, micro-mechanical machining and microwave component assembly. This organisation allows engineers to control each stage of a product's design. MC2 Technologies offers its customers a high value-added service centred around the modelling, characterisation and design of microwave systems.

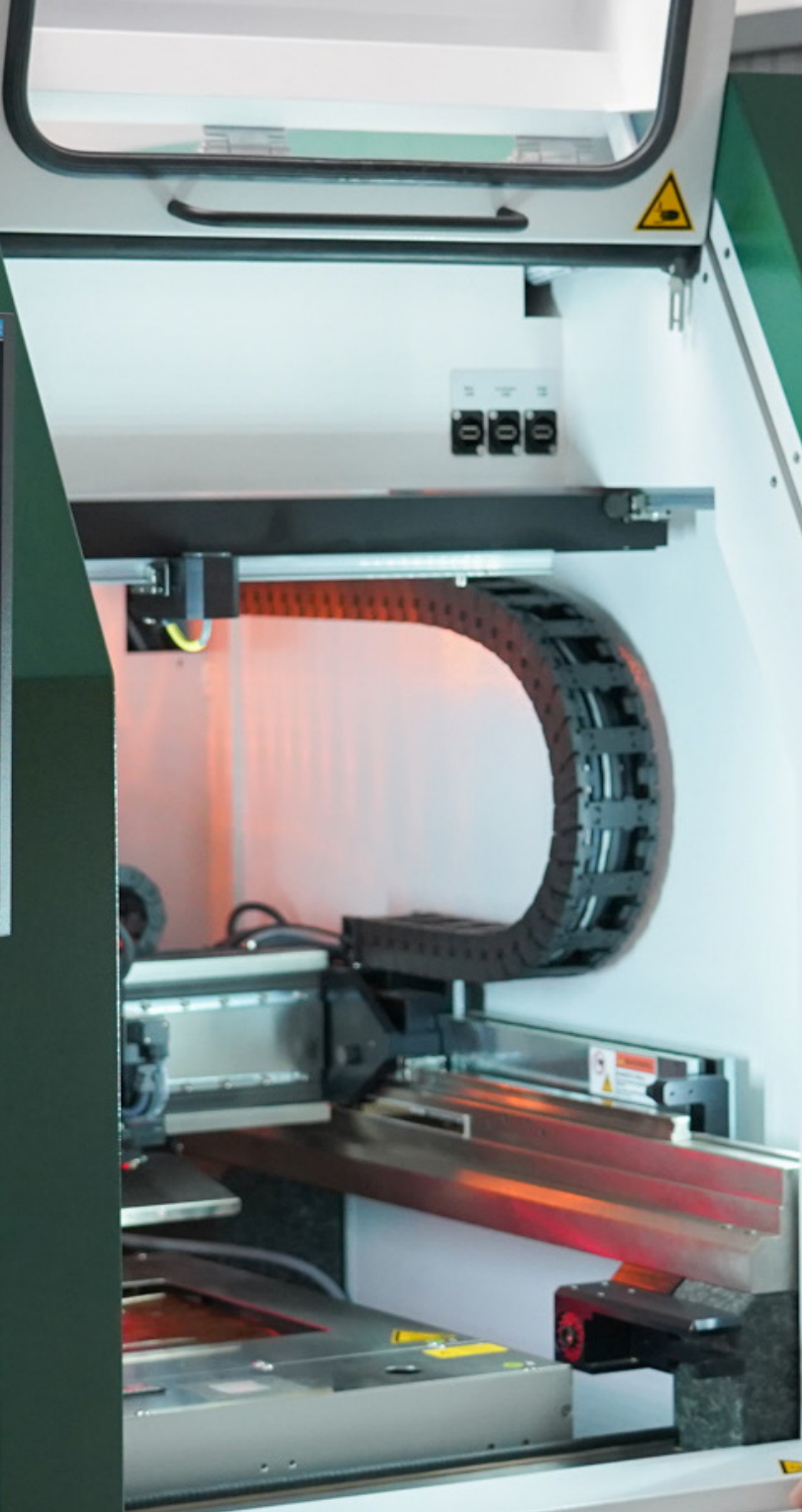
## **Modelling & design**

The wide range of electrical measurements allows engineers to offer a modelling service to provide accurate electrical models for each measured component required for the design phase of monolithic or hybrid circuits.

The use of models provided by foundries or extracted from measurements made by MC2 Technologies leads to the design of MMICs or hybrid circuits. 2.5D, 3D, electrical and EM simulation engines are used for the design of circuits.

## **Characterisation**

Component characterisation is a service that aims at verifying the electrical characteristics of microwave components and circuits, upstream or downstream of their design. It consists of carrying out specific electrical measurements at very high frequency. The company's core business, the service activity offers foundries a range of noise, power and linearity measurements at microwave frequencies up to 220 GHz.



HESSE  
MILITÄR  
18-20

A person in a white shirt is seen from the side, looking towards a screen. The background is dark, and the person's shirt is bright white.

# MICROWAVE SYSTEMS PRODUCTION CENTRE

For more than 18 years, MC2 Technologies has been characterising, modelling and designing microwave components and devices for civil and military applications. As a guarantee of quality, the company relies on its own developments for the critical components of its systems, whose performance, quality and reliability have been convincing on a national and international scale.

## **Provide the building blocks for your systems**

True French technology centre, the company has evolved from a design entity to an industrial company capable of :

Designing and assembling microwave monolithic integrated circuits (MMICs)

Produce active and passive electronic components (power amplifier, low noise amplifier or bias tee,...), circuits and systems (hardware, firmware and software).

MC2 Technologies guarantees the quality and conformity of all its products through its complete control of the value chain.

## **Invest in materials and people**

Because the field in which the company operates leaves no room for error, MC2 Technologies only allows excellence by training its employees, investing in research, development and the latest state-of-the-art equipment.

By offering 100% French know-how, MC2 Technologies contributes to the autonomy and resilience of the French and European electronics industry in the fields of Electronics, Telecommunications Networks, Space and Defence & Security.

# SOME ONGOING PROJECTS

## **BPI NOROGOW+**

NOROGOW+ is a structuring project for the French Extra High Frequencies sector. It aims to develop sovereign inter-connection and module solutions based on MMICs up to 220 GHz. The project partners will research and develop sovereign solutions in the field of microwave systems for the 75-110 GHz and 140-220 GHz frequency ranges.

## **ANR ASTRID DEPOSIA**

ASTRID (Accompagnement Spécifique des Travaux de Recherches et d'Innovation Défense) aims to support projects of a highly exploratory and innovative nature, for a 18 to 36 month period, with the following objectives :

- Stimulate the opening of new research avenues and maintain the innovation effort on themes of interest for defence, in line with the guidelines set out in the Document de Référence d'Orientation de l'Innovation de Défense (DROID) 2020,

- Explore scientific or technical hard points by promoting the development of skills and the identification of potential technological breakthroughs that are sources of beneficial innovations for defence, civilian research and industry.

## **Région SLEMBI (Simulation hybride Logiciel Et Matériel pour la conception de Brouillages Intelligents)**

The objective of the project is to develop tools and methods that will make it possible to be more responsive to technological developments in UAVs and to design intelligent jamming, i. e. that consumes less energy, limits exposure to EM fields of staff and is capable of affecting only the target UAV without affecting surrounding communications.





## OUR VALUES & COMMITMENTS

**To design, manufacture and produce on French or even European soil.**

It is a will anchored in the soul of the company in order to create wealth while creating direct and indirect jobs for different levels of qualification and training.

**To master the entire value chain of our products.**

**To develop ethically respectful solutions that are not harmful to health.**

*Nicolas Vellas*

# MC2 technologies

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