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Innovative Technologies / New Applications

DEFENSE, SAFETY & SECURITY

IVAM.

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»INNO 90«

"Defense, Safety & Security"

Welcome to this issue of INNO, dedicated to the technologies that help safeguard our lives, our infrastructure, and our environment. In times of growing global challenges–be they natural, technical, or geopolitical–innovative solutions in microtechnology, optics, sensor systems, and intelligent surveillance play a pivotal role in maintaining safety and stability.

From precision sensors monitoring critical infrastructure to optical systems enabling night vision or motion detection in surveillance cameras, high-tech developments are becoming indispensable tools. Unmanned aerial systems assist in everything from flood monitoring to securing perimeters, while advanced technologies continue to shape equipment for civil protection and defense–always with the goal of prevention, awareness, and protection.

This issue explores how cutting-edge engineering is not only shaping the future of security but also helping us better understand, anticipate, and respond to risks in a responsible and thoughtful manner.

We invite you to delve into the articles and insights that demonstrate how technology can serve safety–intelligently and ethically.

Warm regards,

Mona Okroy-Hellweg

Optical Precision in the Field: Tactical Targeting Operations Source: FISBA

Andreas Kunz / Roman Szatkowski

EMERGENT TECHNOLOGIES ENABLING NEW SWIR APPLICATIONS

Short-Wave Infrared (SWIR) imaging is a rapidly advancing technology operating in the wavelength range of approximately 1400 nm to 2500 nm, bridging the visible (VIS) / near infrared (NIR) and thermal infrared spectra. By capturing light beyond the visible range, SWIR sensors reveal details invisible to standard CMOS sensor-based cameras, making them indispensable for military and defense applications. SWIR cameras play an increasingly important role in ISTAR (Intelligence, Surveillance, Target Acquisition, and reconnaissance). This is thanks to the ability to see through fog and smoke, imaging in low light conditions (using "night glow"), and the capability to differentiate substances through their unique absorption characteristics.

Enhancing multispectral imaging with AI: Weighted fusion from VIS to LWIR for tactical superiority

More recently, two major steps in technology enhanced the application space: quantum dot sensors and AI in image processing. While long-established InGaAs sensors cover the range of wavelengths from 900nm to 1700nm, quantum dot sensors can cover a much broader range from visible up to wavelengths beyond 1700nm.

The challenge is how to use that much information from three different wavebands: VIS, NIR, and SWIR, each having its specific advantages. And how to even integrate the image information from a thermal infrared (LWIR, long wave infrared) camera?
For this task, artificial intelligence (AI) comes into play. AI significantly enhances multispectral imaging by expertly integrating and analyzing data across spectral bands from VIS to LWIR. AI meticulously sifts through these bands, assigning weighted importance to each based on its unique contribution, to efficiently extract precise, mission-critical information.

In military applications, AI uses VIS for contour and color recognition, SWIR for material-specific reflectance patterns, and LWIR for thermal signatures. Fusing these inputs creates a high-fidelity environmental image that reveals subtle anomalies like chemical residues or hidden objects. The SWIR channel sensors also detect hostile laser emissions beyond the CMOS range while overlaying visible-spectrum imagery.

From VIS to SWIR in one assembly: Challenging Optical Requirements

The recent advances in SWIR sensors regarding performance and costs lead to an ever-increasing demand of specific lens assemblies in the SWIR range. Small form factor and low weight are often crucial in defense applications. That's why it is an advantage if one lens system can be used to cover all wavebands from VIS to LWIR.

Such ultra-broadband lens assemblies are applied in two different setups: 1. In combination with a quantum dot sensor, which covers VIS to SWIR. 2. In front of a beam splitter, which splits the image from the lens assembly between VIS+NIR and SWIR. The VIS+NIR image is then projected onto a CMOS sensor while the SWIR image is projected onto an InGaAs sensor. In this case, the many years of experience with beam splitters at FISBA come into play. However, defense applications demand more than just high image quality across broad spectral ranges. Key requirements include:

- Temperature stability
- Shock resistance
- Robustness and durability
- Compact size and low weight (particularly for airborne and soldier-carried systems)

Manufacturing technologies and capabilities for SWIR optical systems

FISBA develops high-precision optical systems tailored to customer requirements. Close collaboration ensures a clear understanding of specifications, while integrated engineering and manufacturing teams drive technical innovation.
Producing high-performance assemblies relies on a broad spectrum of design and manufacturing technologies, including:

- **Optomechanical design**, translating application requirements into optical specs and designing color-corrected, and athermalized diffraction limited systems.
- **Grinding and polishing** of optical glass for flat optics and lenses, both spherical and aspherical.
- **Precision glass molding** technology, allowing high precision glass aspheres at economically feasible costs in mid to high-quantity applications.
- **Advanced coating technologies**, allow for durable coatings acting as anti-reflective-, filter-, mirror, or beam splitter coating.
- **Cementing** of lenses and prisms
- **High-precision mechanical housing**, plays a very specific role, especially when it comes to the athermalization of optical assemblies.
- **Assembly process** including active alignment and alignment turning

The package of all these capabilities enables optical assemblies that use the full potential of today's SWIR sensors, optionally combined with VIS and NIR sensors. As a result, they allow the required DRI (Detection, Recognition, Identification) values in harsh environmental conditions. SWIR is and will continue to be a game changer in drones, handheld devices, and land-based systems.

FISBA AG, CH
https://www.fisba.com

Making the Invisible Visible
Source: FISBA

Sandra von Fintel I Norbert Hanyi

PRECISION MEETS PERFORMANCE

HOW ADAPTIVE RECOGNITION AND SCHOTT ARE SHAPING THE FUTURE OF ID AUTHENTICATION

Since 1991, Adaptive Recognition has advanced Optical Character Recognition (OCR) technology with a focus on highly accurate, secure, high-performance solutions. Building on this expertise, the ID readers of the Osmond series set a new benchmark in document authentication, integrating advanced optics, multi-spectrum illumination, and electronic chip-based verification to ensure reliable, and near-instant ID and passport validation.

Engineered for mission-critical operations–border control, law enforcement, banking, and high-security access control–Osmond delivers exceptional processing speed and precision. A multi-core processor enables swift data extraction and verification, ensuring seamless throughput in high-traffic environments where reliability is essential.

Pioneering Optical Precision in Document Authentication

A key innovation in Adaptive Recognition's ID reader is its advanced imaging system, featuring a 12 MP sensor capable of capturing images at up to 700 PPI. This high resolution allows accurate detection of microprint, personalization elements like JURA's IPI™ and LetterScreen++, and detailed background graphics. Adaptive multi-spectrum lighting–white, IR, UV, and oblique (edge) lighting–enhances fraud detection and supports features such as holograms, UV inks, and OVDs. Oblique lighting is rare in compact ID scanners, making this device one of the few capable of revealing tactile security features.

Osmond leverages BOROFLOAT glass, a high-quality, highly transparent, scratch-resistant material, to optimize its optical system. The exceptional transparency of the glass ensures perfect image quality–even at high resolutions like 700 PPI–thanks to minimal refraction, while also allowing all types of light (UV, IR, etc.) to pass

Of the United States,
in Order to form a more perfect Union,
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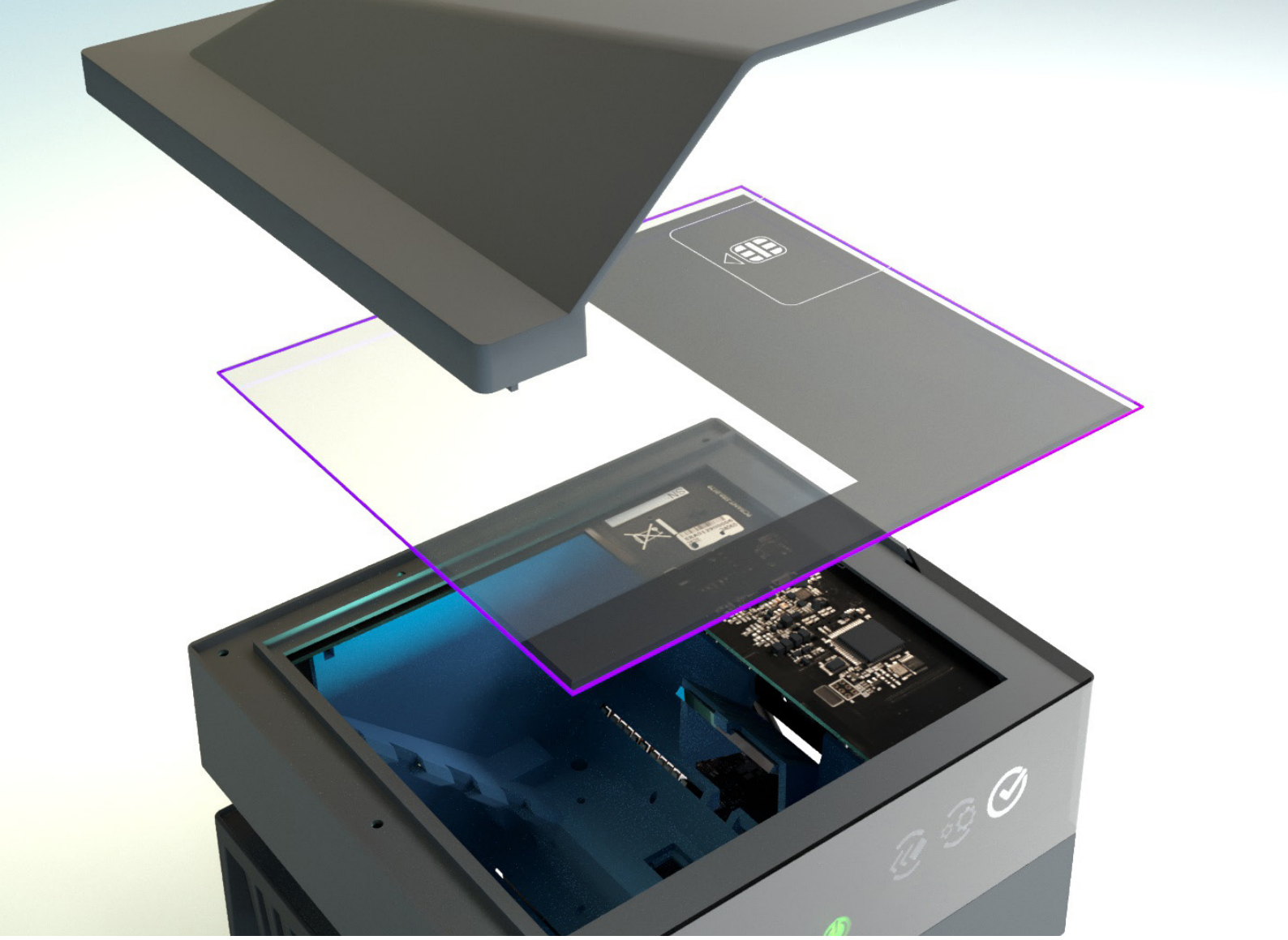


“Ultra-high-resolution imaging meets multi-spectrum analysis to deliver instant, tamper-proof ID authentication in critical security environments.”

through effectively. The glass works seamlessly with Osmond’s multi-spectrum lighting, ensuring superior light transmission and precise detection of security features. Together, this collaboration enables Osmond to achieve high-fidelity document authentication, even in the most demanding security environments.

Advanced Security for Sensitive Data in High-Risk Applications

Security is integral to Adaptive Recognition’s ID reader design. The device employs advanced encryption to safeguard sensitive data during scanning and transfer, ensuring strong data protection in line with industry best practices. The Osmond R models also feature RFID chip-reading, adding an extra layer of security for verifying biometric passports and e-IDs.
With its fusion of high-resolution optics, AI-based verification, and robust hardware, Osmond is a compact, high-performance authentication system purpose-built for secure, high-demand environments.

BOROFLOAT Glass: The Game-Changer for High-Fidelity Document Security

For more than 25 years, technical specialty glasses have enabled impressive new developments in electronic devices.
The technical specialty glass BOROFLOAT from Jena is a floated borosilicate glass according to ISO 3585. This borosilicate glass has a chemical composition with a particularly high proportion of network formers such as quartz sand and boric acid (94%) and a low proportion of network-forming alkali

oxides (4%). This chemical composition results in an almost closed network structure, leading to a unique combination of material and product properties. Developers and engineers appreciate the resistance of BOROFLOAT to sudden temperature changes, chemical attacks, and abrasive stresses on the glass surface. Additionally, BOROFLOAT impresses with high transmission in the wavelength ranges of UV-A radiation, visible light, and near-infrared (NIR) (see Figure 1).

Demanding optical systems for the authentication of individuals at border crossings, airports, hotel check-ins, and building access control require a transparent material with the highest reliability and durability.

Partnership and Quality Commitment

The Osmond ID & passport reader combines the expertise of Adaptive Recognition and SCHOTT, the manufacturer of BOROFLOAT glass, to achieve exceptional performance. SCHOTT's precision-engineered, defect-free materials contribute to optimal optical clarity and durability, while Osmond's advanced imaging and lighting technologies take full advantage of these high-quality components to deliver reliable and swift document authentication.

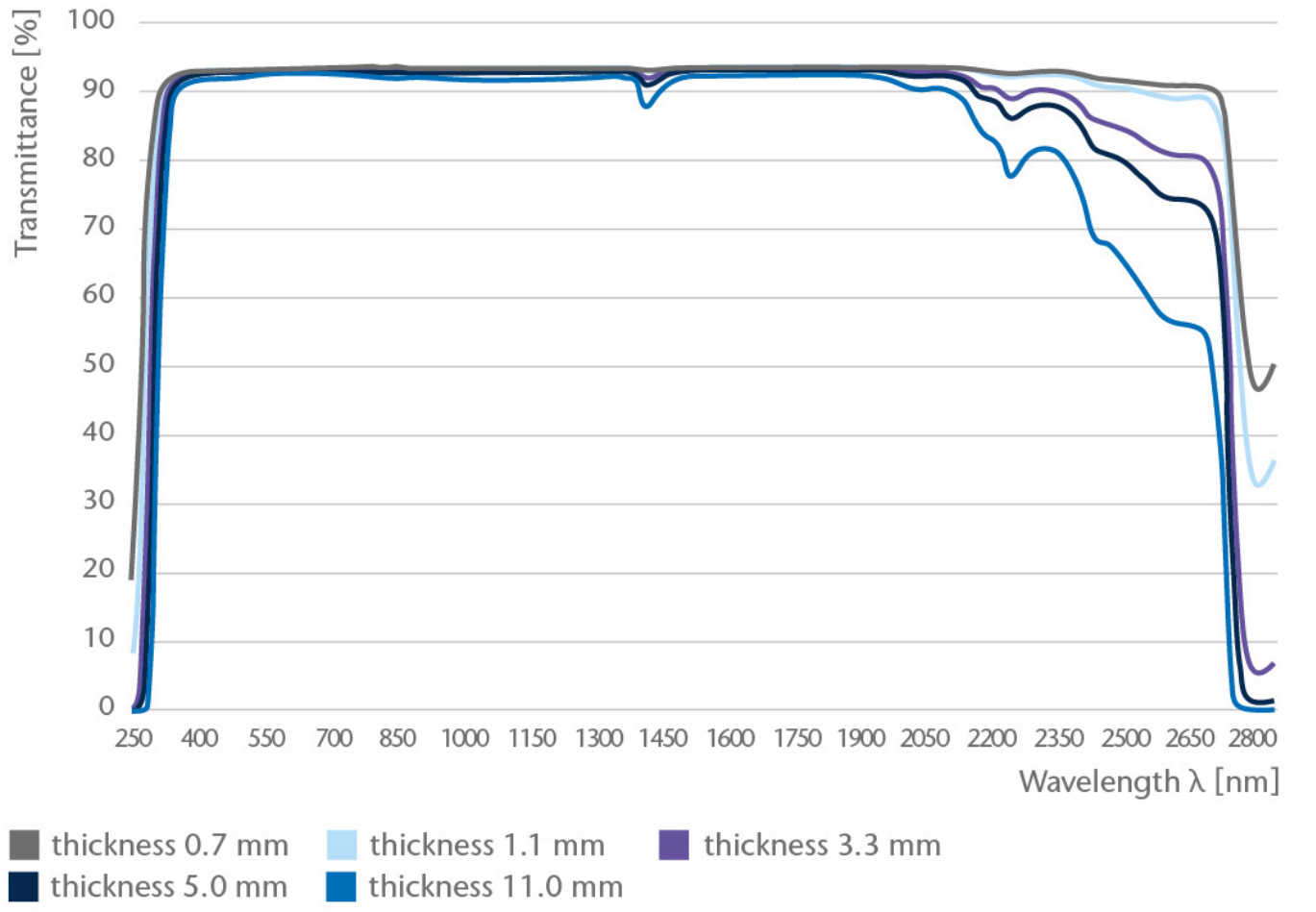
Adaptive Recognition builds on this foundation, combining cutting-edge engineering with premium materials like BOROFLOAT to maximize the potential of the ID readers. This synergy enhances the Osmond ID reader's advanced optical document authentication, with the glass providing superior scratch resistance and reliable performance in high-security applications. With over 10 years of collaboration, the partnership between Adaptive Recognition and SCHOTT continues to drive innovation, ensuring the Osmond ID reader meets the highest standards of security and reliability.

Experience the precision and reliability of Osmond, engineered to elevate your security processes. Visit Adaptive Recognition's website to learn more and discover the exceptional glass technology behind it at SCHOTT's website.

SCHOTT Technical Glass Solutions GmbH, Jena, DE
Adaptive Recognition Hungary Ltd, Budapest, HU

https://adaptiverecognition.com
https://www.schott.com/en-gb

Figure1: Transmittance of BOROFLOAT® 33 of different thicknesses across UVA, visible and NIR/ SWIR spectra



Credit: J. Wang/NIST and Shutterstock.

Damian Vizár

TRANSITION TO POST-QUANTUM CRYPTOGRAPHY

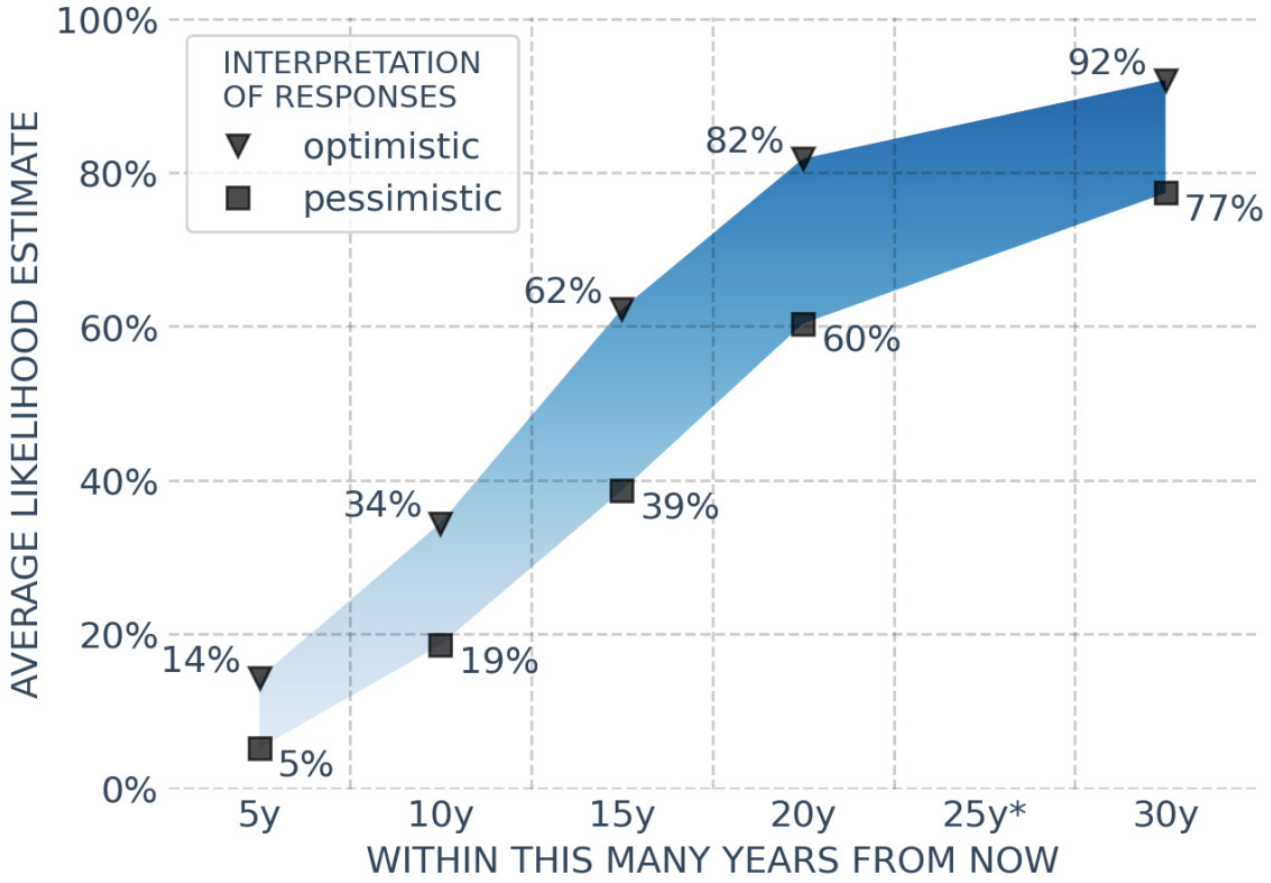


Figure 1 Average likelihood estimates for the realization of a CRQC. Image courtesy of the Global Risk Institute, from the Quantum Threat Timeline 2024 report.

Protecting sensitive medical data from wearables, preventing device counterfeiting, or ensuring security of firmware updates for industrial controllers, cryptography is the bedrock of today's connected world.

Public key cryptography (PKC), such as RSA or ECC, is important, as an enabler of security implementation at scale. Elliptic curve cryptography (ECC) in particular is very popular for connected embedded systems , as it offers strong security with minimal impact on memory and processing

But a new threat looms: quantum computers. While they promise breakthroughs in impactful problems in medicine or clean energy, they will eventually also break all the PKC used in real-world applications. While quantum computers are still in their infancy today, experts agree that cryptographically relevant quantum computers (CRQC) will arrive. This raises a pressing question for developers and tech managers: how and when should we transition to post-quantum cryptography (PQC)?

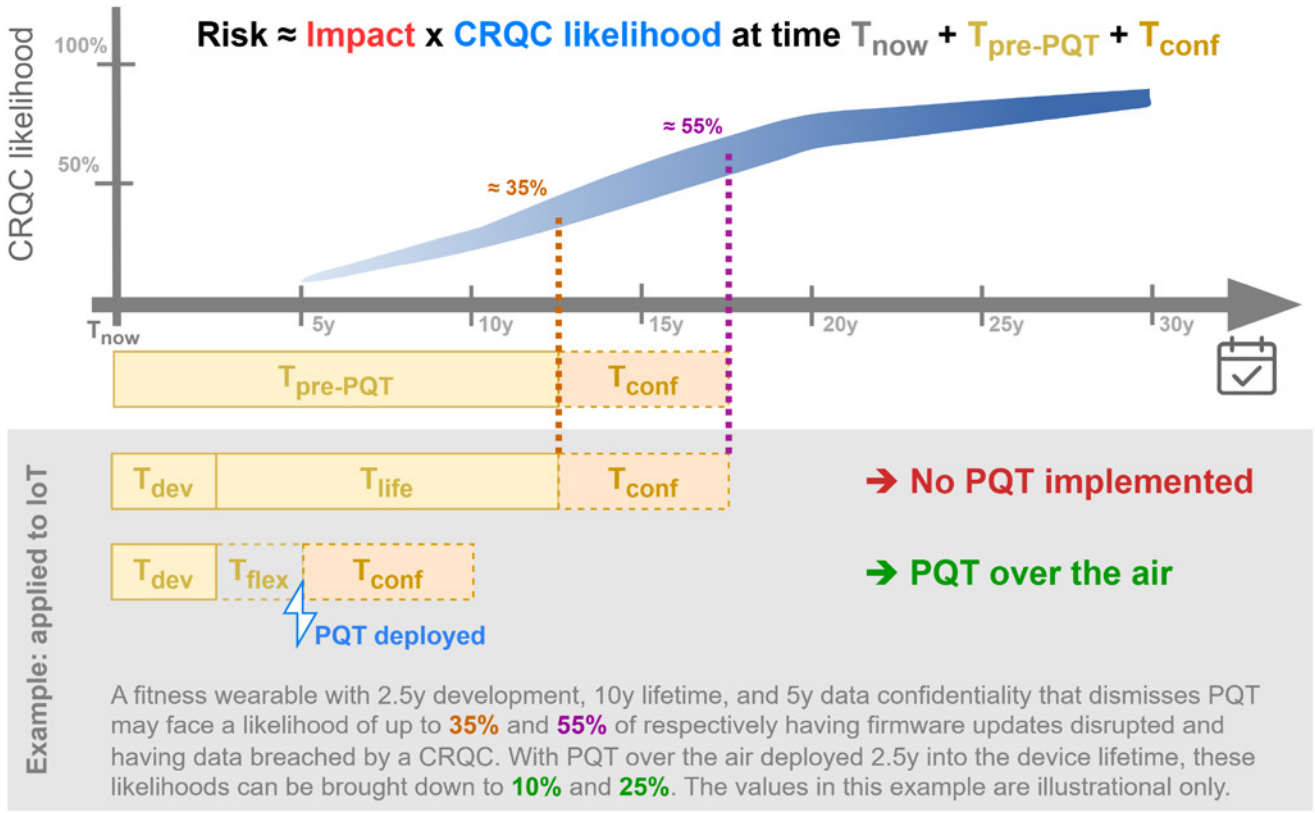
Post-quantum cryptography

The post-quantum cryptography (PQC), a contingency against CRQCs, are designed to be hard to break for both classical and quantum computers. The US NIST has recently standardized PQC algorithms for digital signatures (ML-DSA and SLH-DSA) and key encapsulation (ML-KEM), to replace classical RSA and ECC. ISO and other bodies are expected to adopt them as well.

While these standards can replace their predecessors, the transition to PQC entails challenges. Firstly, the most versatile PQC standards are as efficient as ECC in terms of computational cost. However, they have almost two orders of magnitude larger keys, ciphertexts and signatures, so they mainly strain the memory and bandwidth of constrained systems. This overhead is the lowest among its peers in post-quantum cryptography, owing to special underlying mathematical structures. This special structure is less mature than other approaches,

"Security features are vital to digital transformation—protecting wearable patient data, blocking counterfeit devices, and securing industrial firmware updates."

Post-quantum transition risk model



Legend	
$T_{pre-PQT}$	Time before PQT - an asset (data, firmware , etc) is secured using conventional cryptography
T_{conf}	Confidentiality period of the asset. Tconf = 0 for authenticity/integrity (e.g., firmware signatures).
T_{dev}	Time of initial development, ends when the first device is produced, provisioned and released.
T_{life}	Lifetime of an IoT application, from the first device release to the decomissioning of the last one.
T_{flex}	With PQT over the air, PQT can be flexibly deployed based on an up-to-date CRQC risk estimation.

Figure 2 Risk model for post-quantum transition

leading security agencies to recommend the use hybrids in the near future. This means using both PQC and classical standards, further increasing the overhead.

Post-quantum transition

The most difficult problem facing the stakeholders, however, is the postquantum transition (PQT), a replacement of the cryptography implementations and all keys, including the root of trust (RoT) keys that are hard to change, across the application infrastructure. This substantial effort in development and testing is made more difficult, as specialized PQC-ready equipment and mature implementations are only starting to appear. It is natural to ask when it is necessary to prepare and then execute the PQT? A joint statement by security agencies from 18 EU member states urges stakeholders to start the PQT now, as part of their security risk management. The decisive factor, the likelihood of CRQC appearance, estimated at around 25% in 10 years (Figure 1), carries significant uncertainty.

Counterintuitively, this 10-year horizon represents an intolerable level of risk today: when data require long-term confidentiality (threat actors may harvest encrypted data today and break it later), or for systems with a long migration period (long-lived devices, like smart meters, may still be in operation when CRQCs arrive). Application owners thus need to consider all the lifecycle phases when planning the PQT (Figure 2). The urgency of the PQT is underlined by the adoption of PQC in silicon (Infineon, SecureIC) and big tech (Google, Apple, IBM, Amazon).

PQT over the air

The PQT is particularly unpleasant for low power wireless devices in the broad umbrella of Internet of Things (IoT), such as smart city sensors, smart appliances, wearables, or industrial sensors. Once provisioned with RoT keys and deployed, these are managed remotely and manual maintenance would disrupt their cost model. The RoT keys should remain unchanged, yet they would be the primary target of a CRQC: a single broken RoT key helps usurp the entire fleet in one fell swoop, or bring about a total data breach. Factoring in the long lifetime, application owners must seemingly choose to start using PQC in the current generation of products, or to accept the associated risk for the product lifetime. The lack of industry-tested embedded PQC implementations and the impact of PQC on the embedded systems' scarce resources aggravate the dilemma. CSEM has developed a solution to alleviate this pressure, enabling PQT over the air (Figure 3).

Only the minimal prerequisites are integrated in a device's secure bootloader during the initial development. All the PQC-enabled application functionality can be developed, tested and securely delivered later, via firmware updates over the air. With a technology portfolio ranging from hardware IP for newly developed systems on chip, to software-only solutions for existing microcontrollers and legacy systems, CSEM can help create a tailored post-quantum transition solution for a variety of applications.

Please visit the "Embedded Security" page on www.csem.ch to learn more.

CSEM Centre Suisse d'Electronique et de Microtechnique SA, Neuchâtel, CH

https://www.csem.ch/en

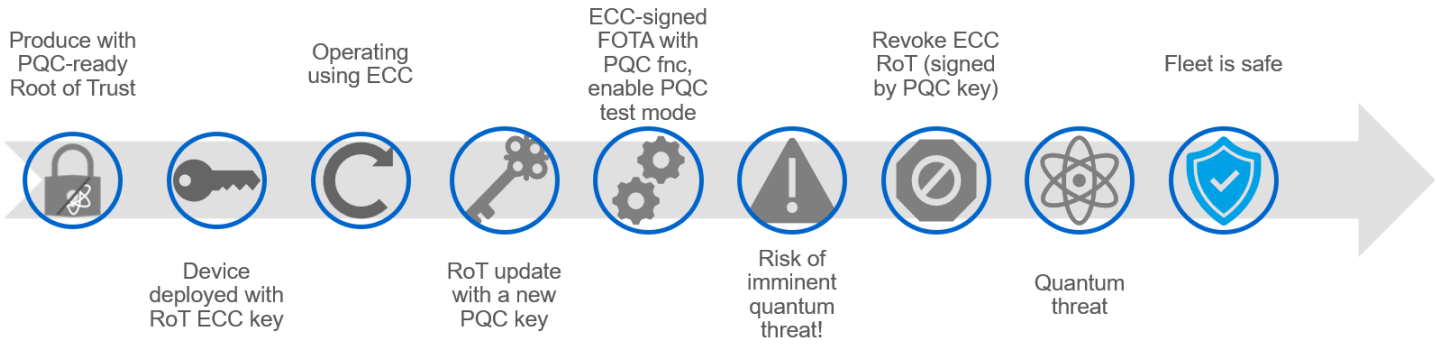


Figure 3 Post quantum transition over the air developed at CSEM.

Source: Alfred Pehamberger for In-Vision

In-Vision Team

OPTICAL INNOVATION FOR

ADVANCED DEFENSE SYSTEMS

Modern defense systems increasingly depend on optical precision and rugged reliability to gain and maintain tactical superiority. Whether detecting vehicles in the air, sea, or land, imaging, or simulation, the miniaturization of mission-critical components, photonics serves as a silent enabler of performance and control.

IN-VISION Technologies AG, headquartered in Austria, designs and manufactures optical and optronic subsystems tailored to the evolving needs of defense and security. With all development and production processes handled entirely in Europe, IN-VISION offers full IP control, flexibility, and guaranteed ITAR-free compliance–qualities essential for sensitive and fast-moving projects.

DLP and Micro-Structured Light for Defense Applications

The heart of the systems are Digital Micromirror Devices (DMDs)–fast-switching arrays that spatially modulate light with microsecond response times. These programmable elements make it possible to generate real-time exposure patterns with advanced resolution, repeatability, and stability. This capability enables a range of defense-relevant applications, including direct-write lithography for photonic integrated circuits, or MEMS sensor prototyping.

> **“Modern defense systems increasingly depend on optical precision and rugged reliability to gain and maintain tactical superiority.”**

IN-VISION's Light Engines support pixel resolutions down to 2 microns, with exposure uniformity above 95% across the optical field. These characteristics ensure both geometric precision and scalability, making the systems suitable for use in agile R&D or for the development process of highly sophisticated research programs which target new technologies to be used in aircraft or modern military equipment.

With specially designed optics and an FPGA-based exposure control, the Light Engines can be operated in individual modes tailored to the application.

Simulation and Embedded Optics

Visual simulation systems in defense demand projection optics that provide scenarios that are as close as possible to reality and enable a real-world perception. IN-VISION tailors the design of lenses based on the simulator equipment, whether it's in 4K native resolution, wide field-of-view configurations or curved dome-based simulators. Once developed, continuous quality assurance maintains stability throughout the entire life-cycle of a product and offers the same projection quality for every quantity.

In-Vision managemen: Florian Zangerl and Christof Hieger. Source: Invison Thomas Topf

A Vertically Integrated, ITAR-Free Engineering Approach

Unlike integrators who rely on dispersed engineering capabilities from suppliers, IN-VISION manages all critical technologies under one roof. From CNC-machined mechanical housings to multi-layer PCB design, elements are developed and validated in-house at the company's Austrian headquarters.

This vertical integration enables fast iteration cycles and full traceability, providing defense customers with a trusted engineering partner for sensitive or export-controlled applications. Cleanroom-conditioned assembly, advanced metrology (including spectral transmission and surface interferometry), and tight optical tolerances allow IN-VISION to meet the demands of both prototype development and serial production.

Shaping the Future of Security

In a world where defense superiority increasingly hinges on clarity, accuracy, and control, light itself becomes a decisive asset. IN-VISION Technologies invites defense OEMs, integrators, and research institutions to co-develop next-generation optical systems that will redefine what's possible in security, reconnaissance, and battlefield readiness.

IN-VISION Technologies AG, Guntramsdorf, AT

https://in-vision.at

FAIL-SAFE MONITORING

ENERGY SELF-SUFFICIENT SENSORS LOOK AHEAD TO KEEP TRACK OF INFRASTRUCTURES

Working in collaboration with the universities in Chemnitz, Paderborn and Bochum, a German research team from Fraunhofer ENAS has succeeded in developing an innovative sensor concept that operates independently of external power sources and generates the energy it needs by itself. The miniaturized, compact sensor technology creates the conditions to monitor industry, building and transportation infrastructures continuously and with long-term stability and to optimize maintenance cycles. The unique combination of a piezoelectric element and a memristor enables shocks and vibrations to be detected and potential risks to be uncovered at an early stage. This allows both failure times and downtimes to be minimized and unnecessary costs to be avoided.

Historic buildings, sensitive transportation goods and industrial machinery – on a daily basis, these are all subjected to vibrations and shocks that are caused by external environmental influences, such as traffic noise, transport-related shocks and vibrations during operation, and that lead to wear and material fatigue. Over the long term, mechanical stresses of this nature can cause cracks in buildings and freeway bridges or result in entire industrial plants failing. Permanent sensory monitoring is therefore essential in order to reliably maintain the functionality of infrastructures and ensure safety.

"This type of close, permanent monitoring typically requires hundreds of sensors and hundreds of thousands of kilometers of cables, taking up human resources and giving rise to huge costs. In addition, electrical auxiliary energy in the form of batteries, for example, is needed to operate current wireless sensor solutions. These batteries have to be serviced at regular intervals and replaced preemptively in order to guarantee that the sensors function perfectly at all times. This also creates a huge environmental problem, as batteries often contain toxic substances that can be harmful to nature when they are disposed of," says Dr. Sven Zimmermann, Head of the Group "Nano Devices/PVD," at Fraunhofer ENAS explaining the motivation behind the development.

Self-sufficient system: The sensors cover their own energy needs

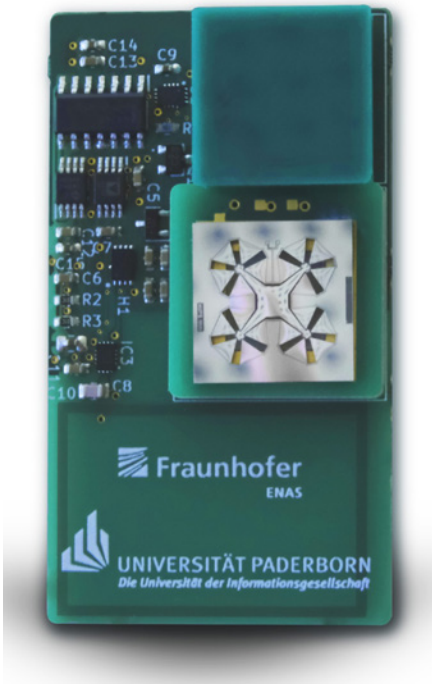
The researchers have been working on a solution to the above problem and have developed an energy self-sufficient microsensor system that works entirely without batteries or cables and that generates its energy exclusively from the measured variable. In this concept, the transducer is simultaneously the energy supplier.

At the heart of the new solution are two microtechnological components: One is a piezoelectric converter measuring around 2 x 2 centimeters that detects mechanical movements such as vibrations and shocks and converts the mechanical energy into electrical energy. "This energy is enough to continuously collect data from critical harmful events, such as those that indicate possible wear to components, and to store this data on a memristor. At up to 600 nanometers in size, the memristive cell is some orders of magnitude smaller than the tiniest batteries, yet it has enough memory capacity to reliably store a large amount of information over long periods," says Dr. Sven Zimmermann.

Perfect memory: memristor stores information without limitations

With their “zero-energy” solution, the researchers are surmounting the challenges presented by current, commercially available sensory monitoring systems that operate with external energy sources or energy harvesting concepts. In those systems, an interruption to the power supply will sooner or later result in all the generated data being lost, meaning that it will no longer be possible to evaluate critical parameters. This shortcoming is overcome by the memristor as a nanoionic storage medium. “Memristors have an interesting memory effect: If current flows through them, they change their resistance. These changes in resistance are not only stored non-volatile, but can also be evaluated precisely. Even if no current is flowing, the data is retained and can be read out and reset with an NFC-enabled end device such as a standard smartphone,” the Fraunhofer expert explains.

Wireless sensor system for self-sufficient shock and vibration monitoring. Source: Fraunhofer ENAS



From acute hazard elimination to predictive maintenance

The data that is read out maps mechanical load patterns and provides information on the duration and number of physical events, shocks and vibrations, that have acted upon industrial plants or buildings, for example. Experts can use this long-term monitoring and the collected signals to draw valuable conclusions on the structural condition of machinery, for instance, and to assess whether mechanical components need to be replaced. As a result, it is possible to plan ahead for maintenance rather than base it on defined time periods. In addition, defective components can be replaced preemptively in good time, before a harmful event even occurs, preventing possible machine downtimes caused by wear or material fatigue and avoiding the time and costs involved in fixing such issues.

An unlimited range of applications for “zero-energy” sensors

In addition to applications in industrial settings and in the fields of mobility and transportation, the scientists also envisage that their sensor solution could provide new approaches for optimizing how things are done in the logistics and architecture sectors: “For example, fragile cargo needs to be transported safely from one place to another without being damaged. Sources of stray acoustic radiation in historic buildings cause damage to the building structure over the long term and regular structural tests have to be carried out. In these scenarios, a permanently operating sensor can deliver valuable, traceable data and enable changes in the condition of buildings or products to be measured. Applied to a flexible substrate, the sensor is also almost invisible, and its low weight means it does not affect the properties of components or infrastructures,” Dr. Sven Zimmermann explains. These advantages will in future allow applications to be addressed that

> **Modern defense systems increasingly depend on optical precision and rugged reliability to gain and maintain tactical superiority.”**

– until now – have not been able to be monitored due to unfavorable structural conditions regarding routing wiring harnesses or sequential battery replacements.

A German research partnership: the “UpFUSE” joint research project

The innovative sensor system is the result of a close cooperation between Chemnitz University of Technology, Ruhr University Bochum, Paderborn University and Fraunhofer ENAS in Chemnitz. The sensor technology has been developed as part of the four-year “UpFUSE” project, which has been funded by the German Federal Ministry of Education and Research (BMBF), together with industry partners. The aim of the project was to explore passive wireless sensor systems for energy self-sufficient shock and vibration monitoring

Fraunhofer Institute for Electronic Nano Systems ENAS

https://www.enas.fraunhofer.de/en.html

SELF-MONITORING PROPELLERS FOR IMPROVED DRONE PERFORMANCE

Researchers at the Fraunhofer Institutes IMS, IOSB and IVI have developed a pioneering technology that sets new standards for the safety and reliability of drone systems. By integrating advanced sensors directly into the propeller blades, they have created a 'smart propeller' that can monitor its own condition in real time. The elastic deformation of the propeller geometry, vibrations and shocks as well as the temperature during operation are recorded.

This innovation has the potential to fundamentally change the drone industry. 'By integrating sensors into the propeller blades, we can detect potential damage at an early stage and thus minimise the risk of crashes,' explains Dr Alexander Utz, head of the System on Chip group at Fraunhofer IMS.

New standards for condition monitoring

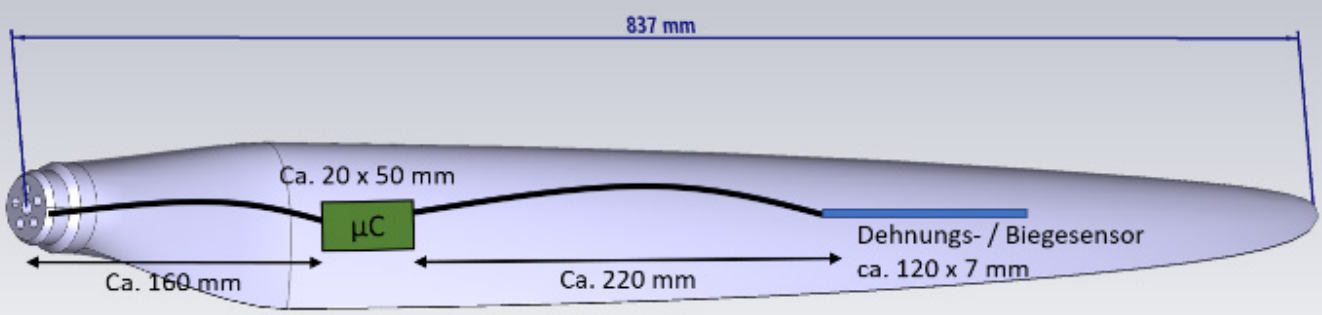
A microcontroller processes the sensor signals and transmits the data wirelessly to the drone's on-board control system. The collected information can be analysed in real time to monitor the condition of the propeller and detect potential deviations at an early stage.

This prevents costly failures and minimises risks. Continuous monitoring also makes it possible to plan and carry out maintenance work in a more targeted manner. Ultimately, the real-time data can be used to optimise the flight parameters.

The intelligent propellers can be integrated into drone systems in a variety of ways. The use of drones offers enormous potential for various industries, including...

Agriculture: Precise monitoring of fields and accurate application of pesticides.

Figure 2: Polygon turning offers the possibility of mproducing nonround contours on lathes.
Source: Horn/Sauermann



Search and rescue: Effective search for missing persons in rough terrain.

Delivery services: Safe and reliable delivery of parcels in all weather conditions.

Innovative production technologies for intelligent propellers

The propeller blades are manufactured using High Pressure Resin Transfer Moulding (HP-RTM), a special process that is suitable for large-scale production. In this process, several layers of particularly light and stable carbon fibres are laid along a foam core. In the next step, this so-called preform is impregnated with a special resin and cured at 120 °C.

During this preforming process, the tiny sensors are carefully placed between the individual layers. The result is an extremely stable and lightweight propeller in which the sensors are firmly bonded to the material and can precisely measure the smallest changes.

Seamless integration into the on-board electronics

The sensor data is transmitted to a communication module in the ALBACOPTER®. This module acts as a central collection point for all information available to the drone. The data is then sent to the ground station via a 5G mobile phone connection.

There it can be analysed live by the pilots or technical staff. At the same time, the data is also stored in the drone itself so that it can be precisely analysed again later. As the module in the ALBACOPTER® is already designed for the wireless transmission of data, the sensor data from the propeller can be seamlessly integrated into the existing system.

The developments therefore provide a solid basis for future research projects and commercialisation in collaboration with industry.

Fraunhofer Institute for Microelectronic Circuits and Systems IMS

https://www.ims.fraunhofer.de

“ALBACOPTER is a Fraunhofer lead project with a project budget of eight million euros. It is funded by the Fraunhofer-Gesellschaft.”

DORTMUND

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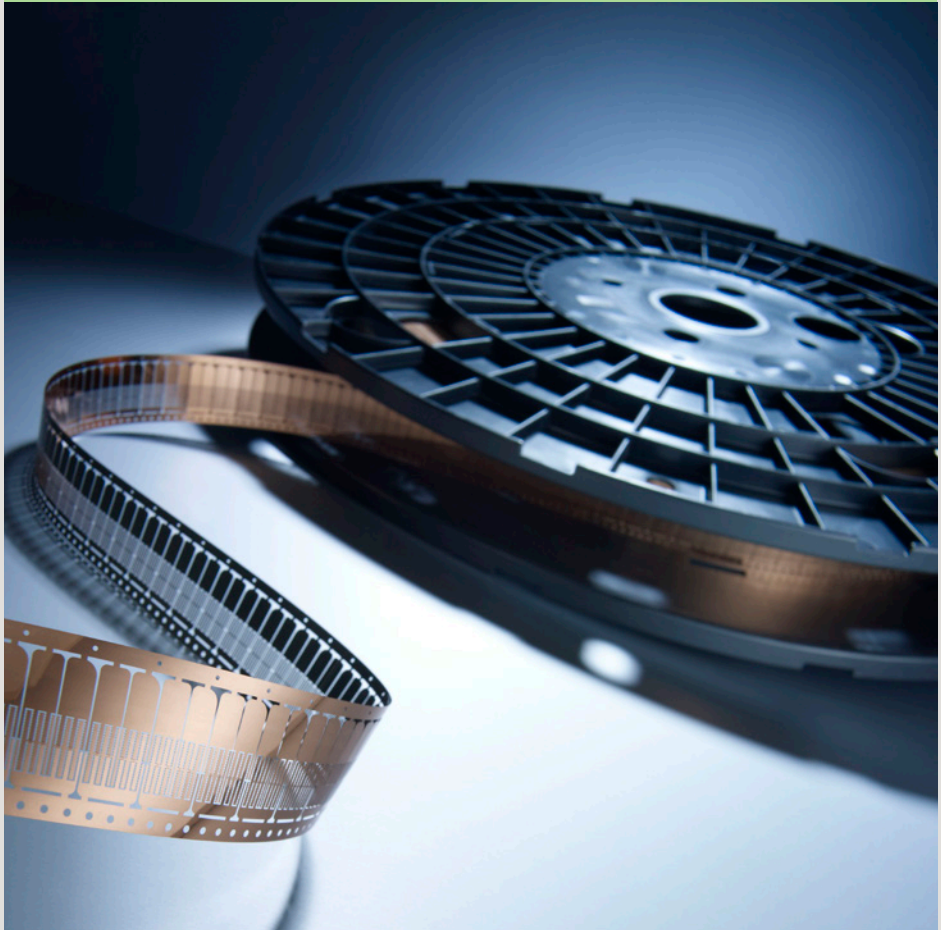
City of Dortmund
Economic Development Agency



MICROMETAL ADVANCES PHOTO-CHEMICAL ETCHING (PCE) TECHNOLOGY

Micrometal Group is leading innovation in photo-chemical etching (PCE), offering high-precision, burr-free, and stress-free component manufacturing for industries like medical, aerospace, automotive, and electronics. The company's cutting-edge technology enables the creation of ultra-fine, complex parts with scalability and minimal environmental impact. PCE supports a variety of materials and is used in applications such as surgical tools, aerospace components, and electronic shielding. By continuously refining its processes, micrometal helps manufacturers overcome design limitations and stay competitive.

https://www.micrometal.de/

OPPORTUNITIES, POTENTIAL, TRENDS AND INNOVATIONS IN (NANO-) MATERIALS AND THEIR APPLICATIONS

The 11th NRW Nano-Conference welcomes contributions from the entire spectrum of nanotechnologies and innovations in materials and applications. Source: Nano Conference

On September 30 and October 1 2025, the 11th NRW Nano-Conference will take place at the Westfalenhallen Congress Centre in Dortmund.

As Germany's leading and highly interdisciplinary platform in the field of nanotechnology, advanced materials and their applications, the 11th NRW Nano-Conference 2025 will bring together over 400 experts from academia, industry and politics. Over the course of two days, the international community will have the opportunity to explore all relevant topics related to research and applications in the high-tech sector – all in English, the official conference language. Organised by the Ministry of Economic Affairs, Industry, Climate Action and Energy of the State of North Rhine-Westphalia, the NanoMicroMaterialsPhotonics.NRW (NMWP.NRW) cluster and Dortmund Economic Development Agency, the conference once again sets the bar high when it comes to content and quality. Drawing on the experiences of previous years, the organisers have developed a dynamic and valuable programme designed to benefit both science and industry, showcasing practical insights and best practice examples. For further information and registration links, visit: www.nanoconference.de

Cluster NanoMikroWerkstoffePhotonik.NRW
https://www.nanoconference.de

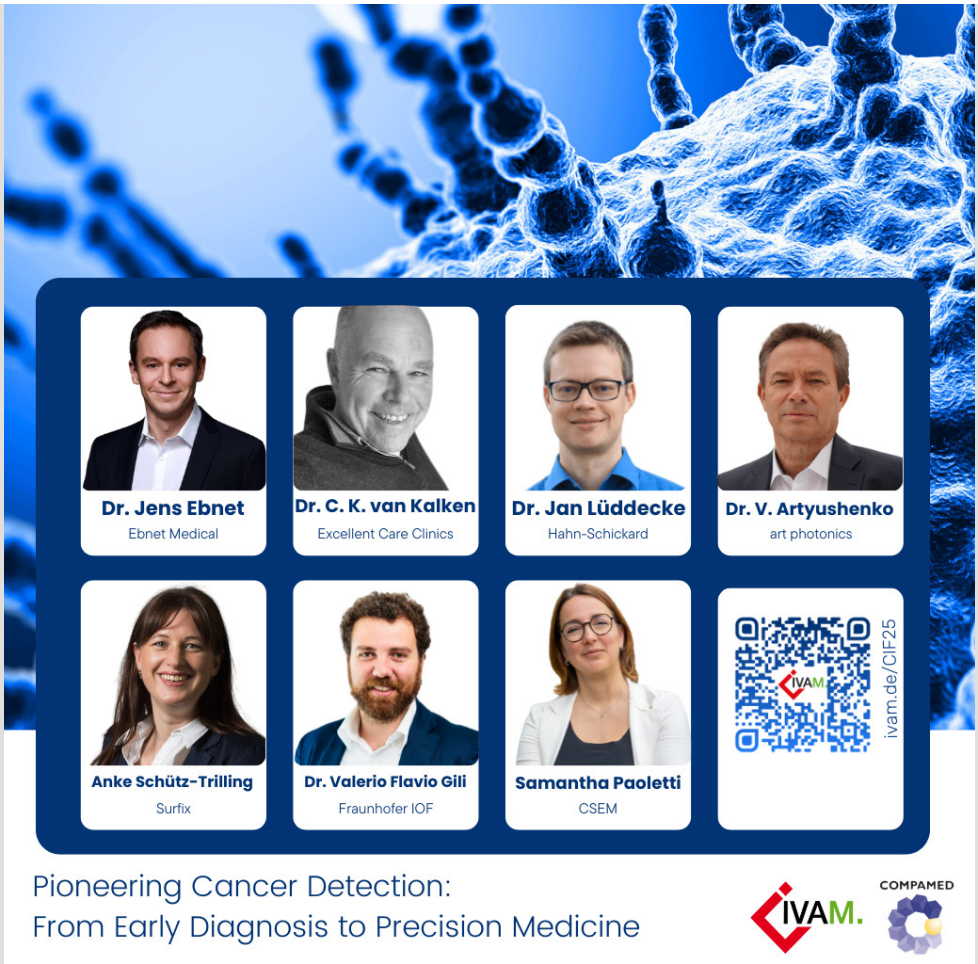
CORTEC AND HERAEUS MEDEVIO JOIN FORCES IN NEUROMODULATION

Freiburg-based CorTec GmbH and Heraeus Medevio, headquartered in Minneapolis, USA, have entered into a strategic partnership in the field of neuromodulation. The aim of this collaboration is to offer customers a seamless solution–from early-stage development to full-scale manufacturing–of implantable medical devices.

CorTec contributes its expertise in developing, prototyping, and small-series production of advanced neuro-electrodes, while Heraeus Medevio serves as a trusted industrial partner for scaling up to high-volume manufacturing. Together, they will provide comprehensive support to OEMs and help bridge a critical gap in the rapidly growing neuromodulation market.

Transatlantic Collaboration for Next-Generation Implantable Medical Technologies
By combining their strengths, both companies aim to set new standards in quality, innovation, and customer service. Initial mass production of electrodes based on CorTec's patented laser microfabrication technology is expected to begin by the end of 2025. The partnership marks a significant step forward in accelerating global medical innovation through integrated, transatlantic cooperation.

CorTec GmbH
http://www.cortec-neuro.com/en



PIONEERING CANCER DETECTION

This year's COMPAMED Innovation Forum is dedicated to the latest trends and technologies in cancer diagnostics. The online event is aimed at companies that develop components and systems for medical technology, as well as medical professionals who want to find out about the latest developments.

Participation is free of charge, but registration is required.
Registration is now open.

https://www.ivam.de/events/compamed-innovation-forum-2025

HIGH-TECH FROM NORTH RHINE-WESTPHALIA FOR THE SECURITY AND DEFENSE INDUSTRY

Key technologies such as nanotechnology, micro- and microsystems engineering, advanced materials and photonics are not only shaping civilian applications. They are also becoming increasingly important for the security and defence industry. New threat scenarios and geopolitical developments are accelerating technological progress – existing components are being optimised, and entirely new systems are emerging.

NRW as a Strong Partner to the Defense Industry

North Rhine-Westphalia offers ideal conditions in this context: as a technology hub with high innovative capacity, it presents great opportunities for business, science and society. To harness this potential, the state cluster NanoMicroMaterialsPhotonics. NRW (NMWP.NRW), together with AeroSpace.NRW, automotiveland. nrw, Kunststoffland NRW and NRW.Global Business, organised the networking event "High-Tech from NRW for the Security and Defence Industry" in Düsseldorf. The event brought together more than 100 stakeholders from politics, business and research.

North Rhine-Westphalia's Minister for Economic Affairs, Mona Neubaur: "Russia's war of aggression against Ukraine represents a turning point for the European peace order. It demonstrates the importance of actively defending our democracy and our freedom. This includes integrating manufacturers of important high-tech products in the security and defence industries closely into national security and defence policies. Given the changing global security architectures, it is essential that in close partnership Germany and Europe increase their defence readiness. In consequence the Bundestag's decision in March to exempt a large portion of security and defence spending from the debt brake rules was a groundbreaking decision. Now a new federal government must ensure that additional funds will be used efficiently and transparently to achieve maximum impact. The world has changed – and we must respond. New solutions, strategic partnerships, and close cooperation at the national and European levels are needed. In these challenging times, we in North Rhine-Westphalia are ready to take responsibility to actively defend our values."

Dr. Harald Cremer, Cluster Manager of NMWP.NRW, added: "Among German federal states, North Rhine-Westphalia ranks among the leaders in high-tech and advanced materials. Alongside major players such as Rheinmetall, Thyssenkrupp, KNDS and Dynamit Nobel, it is above all the many medium-sized suppliers – some of them hidden champions – who provide crucial momentum through their innovations. The fact that the NRW Ministry for Economic Affairs has entrusted NMWP.NRW with the coordination of activities in the field of security-relevant key technologies sends a strong signal."

Driving Innovation through Networking

Through a range of networking activities, NMWP.NRW is now pursuing the goal of making the security and defence industry more accessible to as many relevant stakeholders from NRW as possible – transforming innovative technologies into tangible economic success. In its new coordinating role, NMWP. NRW is building a resilient network that effectively leverages the existing strengths of the region.
Further information can be found online: www.defence.nrw

Cluster NanoMikroWerkstoffePhotonik. NRW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TIM MERFORTH APPOINTED NEW MANAGING DIRECTOR OF IVAM

The Executive Board of the IVAM Microtechnology Network has appointed Tim Merforth as its new Managing Director. The digitalization expert officially took office on May 1, 2025, succeeding Dr. Hans van den Vlekkert, who most recently served as interim managing director.

In his new role, Tim Merforth will further develop IVAM's strategic direction and actively drive its implementation in day-to-day operations. Particular focus will be placed on digitalization and internationalization to ensure that the association is modern and future-ready for its members.

Tim Merforth grew up in South Korea and gained extensive international experience in Asia, the U.S., and Europe after studying economics at the University of Witten/Herdecke. His career path has included positions at Bertelsmann, the Handelsblatt Media Group, Amazon, and most recently Mazda Europe, where he was responsible for the automaker's digital platforms across Europe.

https://www.ivam.de/news/ivam-microtechnology-network-tim-merforth-appointed-new-managing-director

GET TO KNOW IVAM MICROTECHNOLOGY NETWORK - JOIN A Q&A SESSION

Have you ever thought about whether your company could benefit from a membership in a network? Perhaps an IVAM membership may be the right solution for current challenges in your microtech-, biotech- oder deeptech-company! We cordially invite you to get to know the network better. You are welcome to bring specific questions, which we will then answer personally. Additionally you have the possibility to arrange an individual appointment.

membership@ivam.de

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EVENTS

03 June 25

SPOTLIGHTS DER MIKRO- UND NANOTECHNOLOGIE @

Die Bänder eines Halbleiters und die Lücke dazwischen: Warum sollte die Lücke groß sein, wenn man Leistungselektronik machen will?

05 June 25

COMPAMED INNOVATION FORUM 2025@

Pioneering Cancer Detection: From Early Diagnosis to Precision Medicine

18 June 25

MID WEEK COFFEE BREAK - MICRORELLEUS@

Virtual technology talk between IVAM Members

10-12 Sep 25

MEDICAL FAIR THAILAND 2025

Special Exhibiting Area
"Manufacturing Processes and Components for Medical Technology"

17-20 Nov 25

COMPAMED 2025

Product Market "High-tech for Medical Devices"

3-5 Feb 26

MD&M WEST 2026

Medical Design & Manufacturing - IVAM presents Micro Nanotech Area in Hall C, Anaheim Convention Center, CA, US

4-6 Feb 26

ASIA PHOTONICS EXPO 2026

Discover the Future of Photonics with IVAM, Singapore, SGP

9-11 Sep 26

MEDICAL MANUFACTURING ASIA 2026

Manufacturing Processes for Medical Technology, Marina Bay Sands, Singapore, SG

BUSINESS PARTNERS 2025

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AEMtec

AMA Association for Sensors + Measurement – Linking Innovators

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epiphany – PHOTONIC DESIGN HOUSE

Fraunhofer ENAS

GRANTLIFT

In|Die RegionWestfalen – KOMPETENZREGION FÜR GRÜNE PRODUKTION

IMT – PRECISION ON GLASS

INFISION – Future built on light.

itb – Ingenieurgesellschaft für technische Berechnungen mbH

JÜKE – Ideas in Technology

lambda – glass solutions

LouwersHanique

Markt UND MITTELSTAND

MICRODUL – Customized Swiss Microelectronics

micronit

11th NRW Nano Conference – Innovations in Materials and Applications – 30.09. - 01.10.2025 – The Dortmund Congress Centre

OptoSigma

PERCIPIO ROBOTICS

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PLANOPTIK

RAITH

SmarAct | group

smart MEMBRANES

Stadt Dortmund – Wirtschaftsförderung

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velixX – system development – perfect healthcare solutions