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JOANNEUM RESEARCH

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THE MAGAZINE FOR TECHNOLOGICAL INNOVATIONS
SECURITY AND DEFENCE

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INTERVIEW

Better safe than sorry

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Editorial

The importance of security and defence is more prominent than ever in society, politics and the economy. For many years, we have been making a significant contribution to bolstering security and defence in Austria, alongside our long-standing partners – the Federal Ministry of the Interior (BMI), the Federal Ministry of Defence (BMLV) and with significant support from the Federal Ministry of Finance (BMF). This dependable partnership enables us to offer highly customised solutions, specifically relating to assistance systems, ground and air-based systems, cybersecurity, communication, sensor and simulation technologies and AI-supported image analysis methods, as well as medical wound care and vital signs monitoring for operational forces and emergency responders.

Our scientific excellence and comprehensive expertise when it comes to implementation also make us a strong partner in addressing threats to critical infrastructure. We also put our skills to work in various national and international programmes including KIRAS and FORTE as well as ESA, and EDF to help drive the development of high-performance security and defence research systems.

Defined by a clear sense of responsibility, our highly motivated researchers are working to make the future safer. Find out all about our capabilities in this edition of Joannovum and feel free to get in touch for more details.

PHOTO: SALON DELUXE

Heinz Mayer
Managing Director, JOANNEUM RESEARCH

Heinz Mayer

Content




Bundesministerium Finanzen

FFG

KIRAS

K-PASS

FORTE

Many of the articles in this issue are related to research projects financed through national funding programmes such as **KIRAS, K-PASS and FORTE**, which are backed by the **Austrian Finance Ministry** and implemented through the **Austrian Research Promotion Agency (FFG)**. We would like to thank the funding providers for their support for these important research activities.

BETTER SAFE THAN SORRY

Shifts in the balance of global power, the war in Ukraine, and extreme weather events intensified by climate change: the world has undergone some radical changes in the space of just a few years. And the importance of security and defence research is growing as a result. We spoke to Alexander Almer, Coordinator of the Security and Defence business area at JOANNEUM RESEARCH, about some of the latest developments.

By Petra Mravlak

Alexander Almer

Security and defence research

Alexander Almer is the Coordinator of the Security and Defence business area at JOANNEUM RESEARCH. With the company since 1990, he started his career in applied research with a focus on **satellite remote sensing, and later made a significant contribution to the development of multimedia information** systems for the general public. Research priorities and challenges have been evolving at a rapid pace over the years. Over a period spanning more than 20 years, the focus has increasingly shifted towards disaster management, security, and defence. Alexander Almer has contributed **to over 100 publications**, a number of which have received awards.

Business area
Security and defence

PHOTO: BERGMANN

PHOTO: JOANNEUM RESEARCH/RAISER

In the development of multisensor solutions for the detection and localisation of unmanned aerial objects, the domain of acoustics – in this specific instance, we are talking about microphones on a drone – has proven to be an indispensable element.

What are the greatest threats to security in Austria? Almer: There has been a significant increase in hybrid threats. These involve the coordinated use of methods used by state or non-state actors to garner illegitimate influence. Examples of this include cyberattacks on critical infrastructure, the disruption of democratic decision-making processes through widespread disinformation campaigns, and the use of social media to influence political narratives. Cybersecurity and cybercrime falls under the remit of the Federal Ministry of the Interior (BMI) and the Austrian Armed Forces. In terms of disaster management, Austria's fire and ambulance services are very well equipped. In fact, our fire brigades are unique worldwide. But even so, from a technical perspective both the fire service and the armed forces require more assistance systems. And this is where JOANNEUM RESEARCH comes in: we work closely with the Ministry of the Interior and the fire brigades to develop precisely these kinds of assistance systems.

What exactly are they? Currently, we are working on projects in the field of UAVs, or unmanned aerial vehicles, as well as and UGVs – which are unmanned ground vehicles. A major project, funded by the European Defence Fund, focuses on building autonomous structures for the evacuation of the injured from the field using uncrewed vehicles and drones. This involves first locating casualties before retrieving them by land or air using autonomous vehicles. It also involves the use of something called "biosignal sensors" which transmit the health status of the injured to the operations centre. In another civilian project, we are working on optimising the interaction between UAVs, UGVs, and operational teams during firefighting operations. In such cases, autonomous air and ground vehicles and various operational teams work alongside one another. Under one scenario, a drone would be deployed to provide information. Then, in the operations centre, the data it collects serves as the basis for decision-making on what course of action needs to be taken – such as whether an unmanned vehicle should be sent to the scene or whether human responders are needed. These responders can then access the information that has already been gathered by the air and ground systems. This helps to ensure that the operational forces arrive at the scene with suitable equipment and the number of personnel needed to resolve the situation. This intelligent interaction means that each module must operate at least partially autonomously, and that the drones or vehicles must be intelligent enough both to navigate independently within a predefined area and perform assigned tasks.

You are the coordinator of the Security and Defence business area at JOANNEUM RESEARCH. What are your responsibilities in that role? My role involves defining extensive and complex tasks in the civilian and military domains through close cooperation with key stakeholders and aligning the existing expertise within the different JOANNEUM RESEARCH institutes. Development topics require the integration of expertise from all institutes, with individual topics calling for specific specialisations. When it comes down to it, security and defence – which comprises military defence, internal security, and civilian and disaster protection – is ultimately a governmental responsibility. In light of that, it

can be a challenge to build and strategically develop a comprehensive competence network with international, national, and regional actors to define future challenges and research priorities. Here, everything hinges on close cooperation with the Ministry of Defence and the Ministry of the Interior. On top of that, implementing research projects also requires a thorough understanding of the national and European funding landscape. Besides national programmes here in Austria such as KIRAS, K-PASS, and FORTE, issued by the Federal Ministry of Finance (BMF), the Horizon Europe Civil Security for Society cluster, the European Defence Fund (EDF), and the European Defence Agency (EDA) are all significant at the European level. Defining military projects requires close coordination with the BMLV, basing them on the defence research strategy to pursue long-term objectives.

What topics does JOANNEUM RESEARCH cover in the field of security and defence? These include technological developments such as assistance systems, partially and fully autonomous ground and air-based systems, cybersecurity, communication, sensor, and simulation technologies, as well as AI-supported image analysis methods and cooperative management approaches with partially and fully autonomous systems. Developing materials, medical wound care, and biosensor-solutions-based vital signs monitoring also play a role. Complex security-related solutions require multidisciplinary approaches as well as the integration of various technologies. One particular challenge, for example, is the partially/fully autonomous evacuation of injured individuals, which is currently being implemented in an international EDF-funded project. Disaster protection and the protection of critical infrastructure are of particular importance. At the national level, the disaster protection departments of the federal provinces are responsible, with close coordination with the BMI and BMLV in disaster situations. The goal is to pool institute-wide competencies and develop innovative assistance, management, and forecasting systems in cooperation with stakeholders.

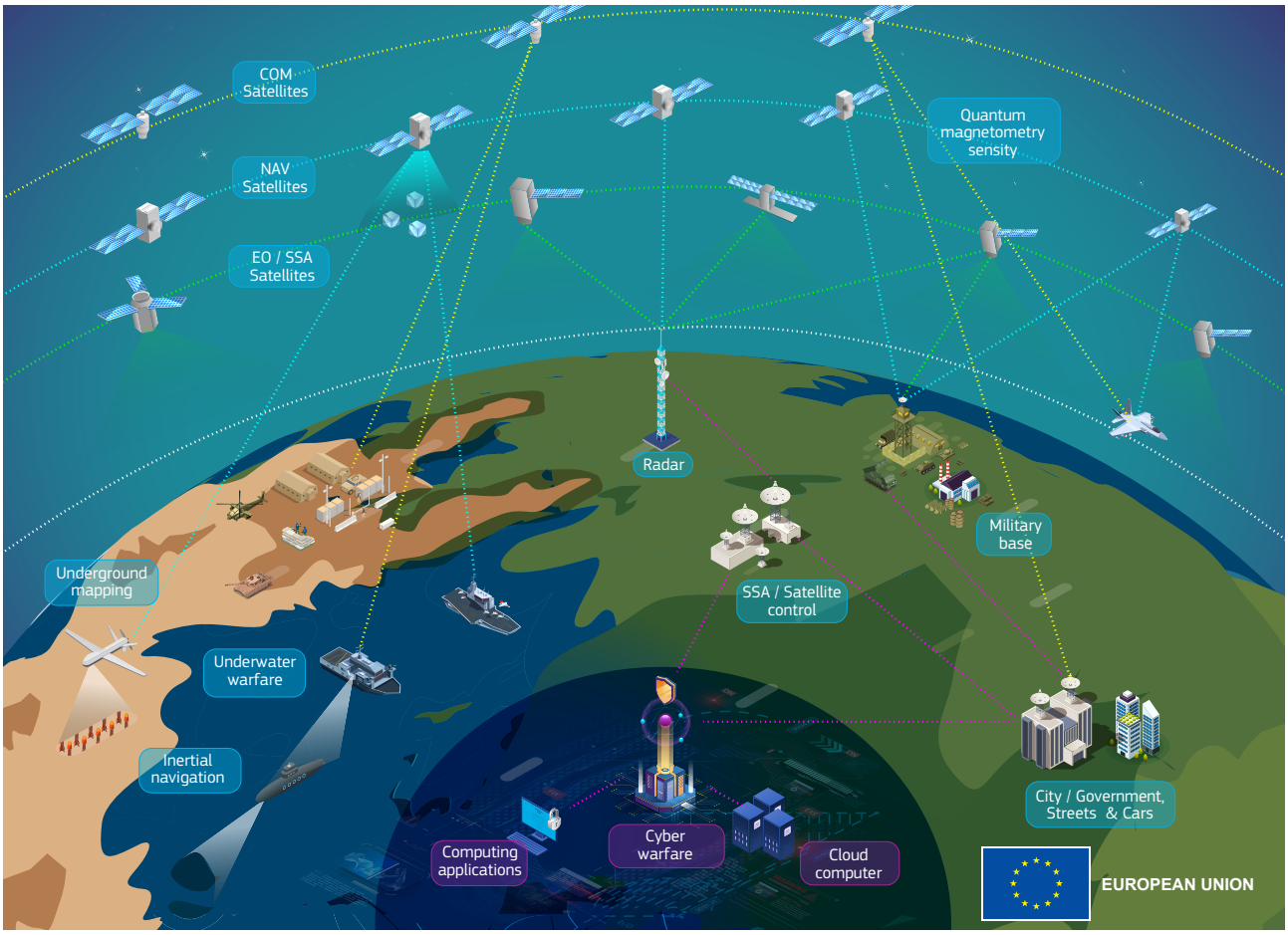
Which topics are set to become increasingly important in future? Artificial intelligence is a cross-cutting theme that plays a role in most areas that are relevant to security and defence research. We're intensively engaging with AI and have already built significant expertise in this area within the company. The ultimate future topic is quantum technology, and we are taking initial steps in this area. Its potential is extremely high – both in the military and civilian security domains. It's not only about quantum cryptography – i.e., communication security – but also extends to security in navigation: through jamming and spoofing, signals can be manipulated, rendering positions based on GPS or Galileo inaccurate, which would make many applications ineffective.

In the "BodyTox" FORTE project, strategies were developed to investigate the toxicity of chemical agents on various organ systems following skin absorption and distribution through the vascular system. This is made possible using body-on-a-chip technology.

PHOTO: BERGMANN

FRIEDRICH TEICHMANN

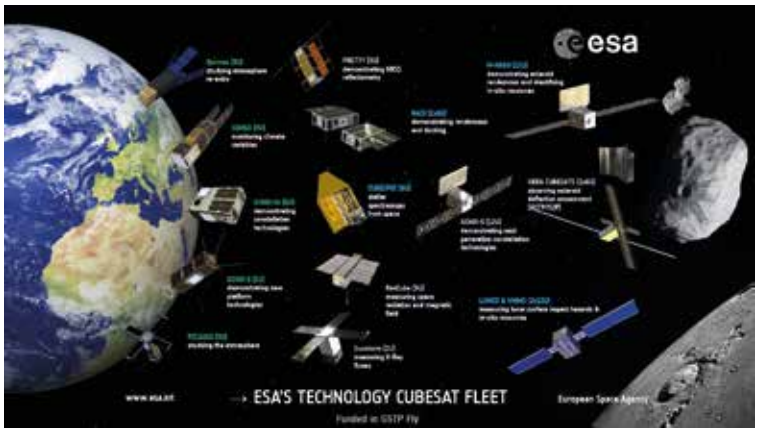
Space technology for security and defence



In 2022, the EU designated space "a new strategic domain" in its Strategic Compass, calling for – and drawing up – an EU Space Strategy for Security and Defence.

Space technologies play a pivotal role in security and defence. Satellite communication and navigation, and satellite-based Earth observation are essential technologies and services for modern armed forces. In 2019, NATO recognised space as a distinct operational domain, alongside land, sea, air, and cyberspace. The European Union followed suit in 2023 with its EU Space Strategy for Security and Defence. In Austria, the Federal Ministry for Innovation, Mobility and Infrastructure's (BMIMI) Austrian Space Strategy 2030+ and the Federal Ministry of Defence's (BMLV) Austrian Military Space Strategy 2035+ provide a national framework.

The BMLV set out its clear vision in its military space strategy: "The BMLV/Austrian Armed Forces (ÖBH) is a responsible space actor. By 2035 and beyond, the ÖBH and its partners will operate its own satellite constellations to fulfil assigned tasks and support international cooperation. Accordingly, the BMLV/ÖBH is transitioning from being just a user to a provider of space infrastructure and services."



CREDIT: ESA

The European Space Agency (ESA) is increasingly deploying small CubeSat nanosatellites for in-orbit demonstration (IOD) of miniaturised technologies, small payload-driven missions, and ESA educational activities.

PHOTO: BMLV

Brigadier Friedrich Teichmann, head of the Institute for Military Geospatial Affairs and the ICT & Cybersecurity Centre, plays a key role in advancing the Austrian Armed Forces' space research activities.

Modern conflicts require precise integration of sensors, command units, and weapon systems which together constitute a "reconnaissance, command, and effect network." "New Space" technologies enable cost-effective utilisation of space by offering commercially available standard components. Companies like SpaceX, Blue Origin, and Virgin Galactic are driving developments in this area at pace. One significant advance is the use of CubeSats – standardised small satellites – that also put countries or organisations with only limited space budgets in a position to develop their own space infrastructure. These reduce dependency on commercial space service providers and enhance the autonomy of national defence systems. However, the rapidly increasing number of satellites introduces new challenges, including collision risks and space debris.

From both a technological and operational perspective, the following steps would strengthen the underlying security of Austria's space activities:

Adopting a holistic national approach, particularly through inter-ministerial cooperation, to enable national research and industry to contribute across the entire spectrum of space technologies (from payload to analysis)

Promoting collaboration at the EU level (e.g., through projects by the European Defence Agency) to enhance EU-wide autonomy in critical technologies, reduce risks through cooperation, and pursue joint developments (e.g., for space operations or space situational awareness)

Establishing sovereign control over data flow for all critical space-based communication and information systems (satcom, satnav, and satellite-based Earth observation) to reduce dependency on commercial operators

Developing and implementing one or more cooperative space projects (demonstrators) to prove feasibility, gain experience and insights (lessons identified/lessons learned), and verifying the benefits of providing independent space-based information and communication services

Space – a global security network

Space is no longer simply a domain for scientific exploration or geopolitical prestige projects. In today's world, it is a highly relevant security arena. Satellite communication, Earth observation, and navigation systems form the backbone of critical infrastructure – in both civilian and military contexts. However, increased complexity and connectivity brings more risks.

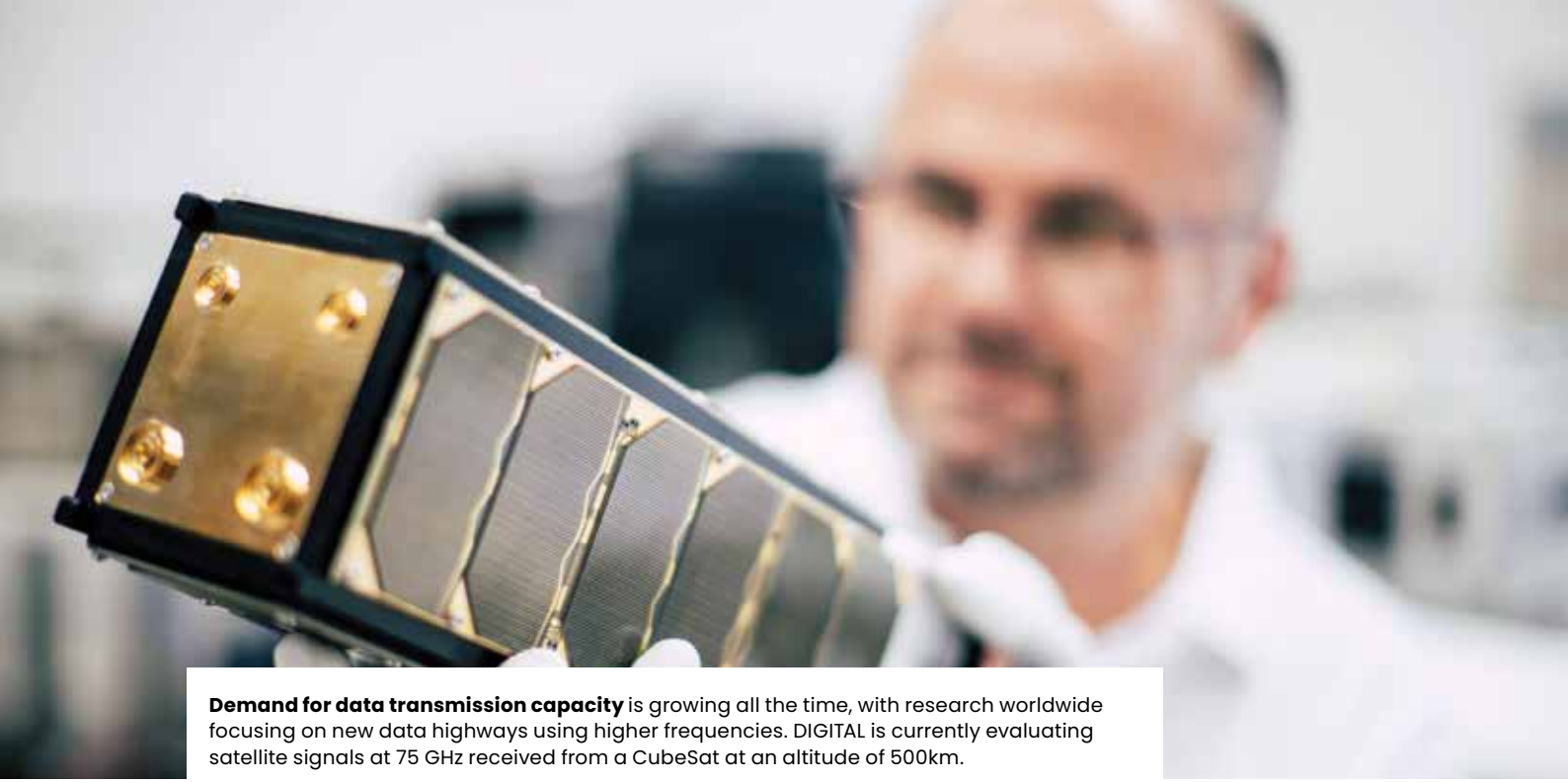
By Elke Zenz

In 1957, the Soviet Union launched Sputnik 1, the world's first satellite, marking a historic milestone in the Cold War. The USA followed in 1962 with Telstar 1, the first operational communication satellite. In the meantime, space technology has advanced rapidly, evolving from a handful of geostationary satellites to mega-constellations of thousands of low Earth orbit small satellites.
To put it in numbers: in 1970, a few hundred satellites were operational; by 2010, this number had risen to around 15,000. And as of early 2025, there are nearly 40,000 active objects orbiting Earth, with platforms like sky.rogue.space providing real-time visualisation of their positions and orbits.

Orbital infrastructure
Satellite services such as skyDSL (Eutelsat) or Starlink (SpaceX) provide continent-wide internet access, including in remote or crisis-affected regions. This creates opportunities while at the same time fuelling increased demand for information security, protection against interception and communication sovereignty. In disaster scenarios or conflict zones, satellite-based communication can be critical for emergency response and coordination.
However, targeted disruptions or attacks on satellites – through threats such as "killer satellites" – are now seen as realistic scenarios. The distinction between civilian and military space applications is also becoming increasingly blurred.

Cyberthreats from space
As reliance on satellite services grows, so does vulnerability to cyberattacks targeting both satellites and their ground infrastructure. On 24 February 2022, an attack on Viasat's KA-SAT satellite network showed just how vulnerable even the most modern systems can be: Ukrainian military communications were interrupted and around 30,000 modems across Europe affected, including control systems for wind turbines in Germany (2022 Viasat Incident Report). Incidents like these highlight the critical need for robust cyberdefence strategies in space. Threats range from GPS spoofing and jamming to targeted hacking attempts on satellites or ground control stations.

JOANNEUM RESEARCH Security research with a space dimension
JOANNEUM RESEARCH has been actively engaged in satellite-based communication and navigation solutions since 1978, initially as the Institute for Applied Systems Technology. Its focus includes using higher frequency bands, optimising modulation and coding, integrating artificial intelligence into signal processing and experimental validation through real satellite connections.
Reconnaissance tasks with high security significance are supported by existing satellite systems such as the EU's Sentinel satellites and smaller CubeSats. JOANNEUM RESEARCH is developing an AI-based service concept for military imagery intelligence (IMINT) the EDF's IntSen² project. The goal is to facilitate automated, continuous monitoring of large areas using high-resolution Sentinel image data for efficient detection and analysis of critical objects.
Notable projects include Alphasat Q/V band at Graz's Hilmwarte observatory, the minisatellite W-Cube, and mobile satellite communication systems.



Demand for data transmission capacity is growing all the time, with research worldwide focusing on new data highways using higher frequencies. DIGITAL is currently evaluating satellite signals at 75 GHz received from a CubeSat at an altitude of 500km.

PHOTOS: BERGMANN

The IRIS² Project

To underpin Europe's technological independence, the EU launched the IRIS² (Infrastructure for Resilience, Interconnectivity and Security by Satellite) programme. This planned megaconstellation of approximately 300 satellites in multi-orbit configuration aims to serve both civilian and military purposes, providing resilient communication channels for authorities, emergency services, and critical infrastructure, independent of non-European providers.

Security is increasingly the focus these days – as evident through participation in projects like Austria's KIRAS security research programme.

Demand for data transmission capacity is growing all the time, with research worldwide focusing on new data highways using higher frequencies. DIGITAL is currently evaluating satellite signals at 75 GHz received from a CubeSat at an altitude of 500km.
The increasing commercialisation of space presents both challenges and opportunities for the European space industry.
JOANNEUM RESEARCH positions itself as a bridge between science, industry, and public institutions to actively shape technological progress in this field.

Space is no longer an isolated domain – it is an integral part of security for critical infrastructure. For Europe and Austria, this means technological sovereignty, reliable partnerships, and innovation-driven research – all of which are essential to reduce geopolitical dependencies and enhance resilience against modern threats.

Business area Space

Coordinator **Michael Schmidt,**
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For many years, we have been developing and implementing satellite communications systems featuring innovative technologies and solutions, as well as precise satellite navigation systems and space robotics. We also specialise in Earth observation using remote sensing technologies, and environmental monitoring.

LISTENING OUT FOR UNWANTED VISITORS

Martin Blass, a researcher at DIGITAL's Intelligent Acoustic Solutions group, is working on the development of innovative acoustic drone detection technology. An approach that plays a crucial role in both civilian and military applications.

By Elke Zenz

The JR-IcoDome32 3D microphone array – developed under the MMCUAS and BARAKUDA projects – is designed for stationary and mobile operations for drone localisation. Optimised for harsh environments it has a geodesic form and is particularly robust thanks to its lightweight aluminium and plastic (10kg) construction. Comprising 32 calibrated microphones, it achieves precise localisation with an angular error of less than 5°. Commercial multicopter drones can be tracked up to 500 metres, depending on type and environment.

PHOTO: BERGMANN

PHOTOS: JOANNEUM RESEARCH/RAISER

The USKIT project is exploring ways of integrating acoustic and LiDAR sensors on a cooperative drone to detect unauthorised drones in the air. To do this, single microphones and small microphone arrays are mounted on a carbon rod, with self-generated noise suppressed through audio signal processing and AI-based models used for drone detection. A Blickfeld Qb2-3D LiDAR sensor scans the drone's field of view up to 100 metres in the direction of flight.

"Our acoustic drone detection enables us to identify unmanned aerial objects that are in the airspace without authorisation," explains Martin Blass. Microphone arrays capture sound from various directions, and runtime differences between sensor signals pinpoint the sound's origin. "It's like listening intently in a specific direction while at the same time filtering out background noise," Blass adds.

Trained with acoustic data from drone flights to help it reliably recognise typical sound patterns, machine learning continuously improves the system. "The more data we collect, the more accurate our technology becomes," Blass adds.

One recent breakthrough is a hemispherical 3D microphone array that is able to localise drones in the air with greater accuracy than conventional arrays. This enables better tracking in complex environments and significantly enhanced object identification. It captures better elevation angles than 2D arrays and can even be used as a mobile technology mounted on vehicles.

There is a diverse range of potential applications, too: protecting large events, political gatherings, or airports from unauthorised drones, particularly to safeguard critical infrastructure, as drones weighing over 500 grams (that require a permit to fly in Austria) can cause significant damage.

And in military applications, the system can be used to complement existing sensor networks for detecting aerial objects. Contrary to radar systems, which actively emit waves that make them detectable, acoustic detection operates passively – a major advantage in security-critical scenarios.

A look at the future reveals a number of highly promising developments: planned research projects focus on distributed acoustic sensor nodes to extend detection range. Compact MEMS-based microphone arrays will operate directly where they are needed – "on the edge" – with minimal energy consumption, made increasingly efficient through advances in deep learning.

FIT FOR **DUTY?**

Extreme operational conditions call for peak physical performance, whether in military operations, firefighting, or high-risk professions. As part of the RT-VitalMonitor project, a team at DIGITAL is developing a wearable monitoring system that measures vital signs in real time and is able to provide early warnings of overexertion.

By Elke Zenz

Anna Weber studied Software Engineering and Management at Graz University of Technology. She works at JOANNEUM RESEARCH's Institute for Digital Technologies (DIGITAL) as a data analysis and multisensor assistance systems expert, as well as a project manager for numerous national and EU research projects in a wide range of areas including security and defence.

PHOTO: BERGMANN

Although Anna Weber has since moved to the Digital Twin Lab, she will continue to work on the RT-Vital-Monitor project, conducted in collaboration with the Austrian Armed Forces (ÖBH), until year-end. Part of the preceding research project, she is bringing her expertise to bear when it comes to measuring soldiers' physical resilience. Weber explains real-time vital data measurement: "Sensors are integrated directly into textiles – an undershirt or sports bra – and capture data such as ECG metrics, heart rate, heart rate variability, respiratory rate, and skin and core body temperature. These parameters are critical for assessing the physical condition of personnel as they provide insights into fatigue, stress and potential health risks. This enables preventive measures to be taken for individuals who exhibit signs of being in a critical condition." One remarkable feature of the technology is that it facilitates non-invasive measurement of a person's core temperature This is achieved thanks to a heat flux sensor from Swiss company greenTEG. "We achieve an accuracy of ±0.2°C, making it comparable to invasive methods." GNSS positioning and accelerometers also enable movement pattern analysis.

More accurate measurement than smartwatches

But how does this differ from smartwatches, the lifestyle gadgets worn by many? "The key difference lies in sensor placement and the method of measurement," Weber explains. "While watches often use indirect light reflection, we measure the heart's electrical impulses directly using a single-channel ECG. This ensures far greater accuracy, especially during intense activity," the software developer explains. The system integrates seamlessly into uniforms and is washable. "For professions where watches or wristbands are impractical, this represents a major advantage," she adds.

PHOTOS: BERGMANN

A textile sensor solution integrated into smart shirts or smart bras enables precise capture of physiological data without restricting the wearer's freedom of movement.

Training and decision-making support

In addition to monitoring individual soldiers, RT-VitalMonitor can also support commanders' decision-making. "The goal is a system that displays the real-time stress levels of individual soldiers or groups," says Thomas Hölzl, sports science expert at the Austrian Armed Forces. "Commanders can use this to make tactical decisions, identifying the best-suited group or individual for a particular task." The system also enables more precise training management. Continuous feedback teaches soldiers to optimise intensity – in situations such as endurance exercises," he confirms.

Development challenges

However, developing a reliable system for dynamic operational scenarios poses unique challenges. "We had to develop adaptive algorithms that not only capture physiological parameters but adjust to different scenarios, too," Weber explains. Transmitting and processing large data volumes was another hurdle. "Our algorithms filter out noise, ensuring reliable analysis even in extreme conditions, which include motion artefacts from intense activity, or environmental factors that can influence sensor data, such as heat or humidity."

On top of that come individual factors such as personal heat tolerance and stress resilience, which also play a role in stress modelling. "While we can determine maximum heart rate individually, other parameters are based on scientific findings and averages," Hölzl notes. While not yet fully addressed, psychological stress factors could be considered in future developments, he adds.

Diverse applications

Originally designed for military use, the technology also has civilian applications. Firefighters and ambulance services could benefit from individual stress monitoring to detect potential health risks at an early stage. Opportunities also exist in occupational and telemedicine, where continuous monitoring of at-risk patients is a possibility. Acceptance varies according to the specific context. "Tests showed that soldiers from different units respond differently to the smart shirt," Hölzl reports. While some find continuous monitoring helpful, challenges arise in specific scenarios, such as when wearing additional protective gear. In roles where physical demands are high – such as light infantry – the shirt has been largely well-received.

Looking to the future

Anna Weber: "Besides individual stress monitoring, the data will also be used for training and exercise scenarios going forward." The next step: integration into existing command systems to enable data-driven decisions on deployment times and stress limits.

The research project vividly demonstrates how smart sensor technology is in a position to enhance performance and safety in demanding professions. Further development is needed in consultation with the Austrian Armed Forces before the technology can transition into volume production.

Fire!

By Elke Zenz

How AI-Based robotics supports emergency responders in disaster situations

Wildfires are increasing globally, causing significant economic and ecological damage every year. In Europe alone, up to 500,000 hectares of forest are consumed by flames each year. And in the USA, the January 2025 Los Angeles wildfires – including the 69km² Palisades Fire and the 42km² Eaton Fire – destroyed approximately 160km² or 16,000 hectares of land. Over 16,200 buildings were destroyed or damaged. Given this dramatic trend, intensive research is underway into innovative technologies that are designed to provide more effective support for emergency responders. At DIGITAL, a promising approach is being developed: the use of AI-based robotics.

Autonomous systems in wildfire emergency response

Markus Bergen and his team are developing assistance systems for emergency responders under the KIRAS KI-SecAssist project. Here, unmanned aerial vehicles (UAVs) and unmanned ground vehicles (UGVs) equipped with multisensor technology are used to generate near-real-time situational awareness. As multitasking systems, the AI-supported technology they use can detect fires early, map affected areas, and assist with evacuations. Markus Bergen, Senior Researcher at DIGITAL, explains: "Autonomous drones provide real-time information on casualties, fire areas, smouldering embers, and gas levels. This helps establish a comprehensive picture of the situation for first responders, enabling targeted and efficient operations." The interplay of drones and unmanned ground vehicles – which are able to independently enter hazardous areas – is particularly valuable. They can also deliver water and critical supplies autonomously, supporting response teams in transporting casualties from danger zones. "Autonomous vehicles could significantly increase evacuation capacity while reducing risks for responders," Bergen adds.

PHOTO: BERG-MANN

Markus Bergen specialises in photogrammetric image processing, geoinformation services, and multisensor systems. He has worked at DIGITAL in the Remote Sensing and Geoinformation research group since October 2023. His current security and defence focus involves providing comprehensive situational awareness through mobile platforms (UxVs), wearable sensors, geodata analysis, and sensor fusion.

Networking and cooperative task management

The researchers are also working on a system that prioritises tasks and optimises the coordination of autonomous systems. "This cooperative task management relies on the use of autonomous aerial and ground vehicles," explains Alexander Almer, Coordinator of the Security and Defence business area at JOANNEUM RESEARCH. "In one application, autonomous drones can detect fires, transmit data to the command centre, and direct autonomous vehicles to the site to support firefighting or casualty recovery."

In time-critical situations, this technology enables faster decision-making, significantly enhancing responders' effectiveness. "The interaction between humans and machines is optimised to better assess and combat dangers more quickly," Almer confirms.

Progress thanks to European collaboration

JOANNEUM RESEARCH is advancing autonomous systems through its participation in several international projects. Funded by the European Defence Fund, one example involves testing UAVs and UGVs for casualty evacuation. "The autonomous systems are designed to independently identify danger zones, locate casualties, and transport them safely," Almer notes.

Thanks to these innovative developments, combating wildfires and similar disasters could become safer and more efficient in the future. The combination of AI, sensor technology, and autonomous vehicles can make a decisive contribution to protecting people and nature.

JOANNEUM RESEARCH

RETHINKING HEALING

ForceRepair

Innovative treatment for chronic wounds

Chronic wounds significantly impair quality of life for many patients. As part of the EU's ForceRepair project, JOANNEUM RESEARCH COREMED – working alongside 13 partners – is developing a novel therapy in the form of a 3D-printed wound dressing that uses mechanical stimulation to activate the body's natural healing processes. The core component is a smart carrier system that combines innovative biocompatible technologies with pro-regenerative agents. This promotes cell regeneration while controlling bacterial infections and inflammation. The system facilitates individually tailored treatment approaches, improving long-term wound healing.

JOANNEUM RESEARCH COREMED
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Funded by the European Union

RUDOLF ZAUNER

Defence through focused collaboration

PHOTO: BMLV

Brigadier Rudolf Zauner heads the Federal Ministry of Defence's Department of Science, Research and Development.

In 2013, a cooperation agreement focusing on security and defence was signed with JOANNEUM RESEARCH for the first time. Following a successful, wide-ranging initial collaboration defined by trust, this agreement was extended in 2018 and 2023. The aim is to provide mutual support in developing and participating in national and EU research programmes. Regular exchanges on technology and technological developments have created a pivotal link from fundamental research to product development for security and defence applications. The scale of the cooperation between JOANNEUM RESEARCH (JR) and the Federal Ministry of Defence (BMLV) now sees it rank third, behind TU Graz and AIT.

Defence research is impacted by multiple factors including the current geopolitical situation, the pace of environmental changes, and rapid technological advancements, which introduce complex and destabilising threats, generating potential and real dangers. Consequently, the Austrian Armed Forces (ÖBH) must continuously develop new capabilities and enhance existing ones to ensure operational readiness in service of the country. Future defence capability ultimately depends on having innovative technologies available in a timely and effective manner. Finalised in 2024 with JR's contribution, the BMLV's Defence Research Strategy 2032+ charts the course for this to happen.

Effective defence research for the technology-driven modernisation of the ÖBH is only achievable through partnership with civilian research institutions and industry, and clearly focused cooperation at the European level. Aligned to a time horizon of 2040, it requires an interdisciplinary and broadly themed approach. Like all successful research, it is predicated on favourable conditions, including excellent personnel, suitable infrastructure that is aligned with climate goals and the availability of sufficient funding. Defence research, as a response to pervasive threats, needs to be viewed as an investment in the future.

For projects under the FORTE defence research programme and European-level initiatives in areas such as autonomous driving, robotics, satellite reconnaissance, AI, space technologies, drone defence, and capabilities to detect improvised explosive devices, well-established and intensive cooperation between the ministry and JR is a win-win situation. Two examples of our extensive collaboration with JR spring to mind here: in the long-standing VitalMonitor project, JR's technical expertise was combined with the BMLV's military-specific sports science expertise to develop a Human Performance Monitoring System. This system aims to enhance soldiers' performance during training and serve as a tool for supporting decision-making during operations. The LEO2VLEO project is exploring the feasibility of rapidly manoeuvring satellites between low Earth orbit (LEO) and very low Earth orbit (VLEO). This is relevant for Austria and the EU in terms of space situational awareness, Earth observation/remote sensing, GNSS/navigation warfare, and communication applications.

While it is impossible to predict when, how, or in what form threats will emerge, it is certain that cooperative defence research leaves us significantly better prepared for future challenges, benefiting Austria and its population.

Hera mission.

Europe playing its part in planetary defence

Asteroids pose a genuine threat to the Earth. To gain deeper insights into measures designed to avert potential collisions, the European Space Agency (ESA) launched the Hera mission. The Hera spacecraft will investigate the outcomes of the Double Asteroid Redirection Test (DART) experiment – the first-ever controlled collision between a probe and an asteroid. Piluca Caballo Perucha and Gerhard Paar of the DIGITAL Institute's Space Robotics and Instruments team are playing a central role in data evaluation and processing, in particular the 2D and 3D analysis of data collected by the instruments on board Hera.

By Renate Buchgraber

The influence of the DART mission

On 28 September 2022, NASA's DART probe collided with an asteroid moon called Dimorphos, in order to alter its orbit around the parent asteroid, Didymos. Even with a diameter of 160 metres, Dimorphos would be large enough to destroy a city the size of Vienna if it hit Earth. Analysis carried out after the DART impact showed that Dimorphos's orbit had been shortened by 33 minutes. "This proved that a kinetic impact can change an asteroid's orbit," says Piluca Caballo Perucha. Now, the Hera probe is due to examine the long-term effects of the collision, supplying detailed data on the asteroid's structure, composition and gravitation.

Hera mission in 2D and 3D

Piluca Caballo Perucha and Gerhard Paar from the DIGITAL Institute are making a vital contribution to the Hera mission. In collaboration with research institution VRVis, they are developing specialised software tools designed to analyse the collected data. This will enable them to create a detailed 2D and 3D visualisation of the surface composition and material properties of Dimorphos and Didymos. As the JOANNEUM RESEARCH experts point out, the PRo3D-GIS platform will allow them to search the mission data interactively and perform precise scientific analysis.

"The end product of our work is the PRo3D-GIS tool, which supports the interactive visualisation and analysis of instrument data and processing outcomes in a consistent context in terms of space and time. PRo3D-GIS integrates the Hera instrument data in a database that contains all of the data, metadata and derived products recorded during the mission. These include Hera's position along its trajectory, the projection of sensor data onto the surface, as well as 3D models, some of which were created using DIGITAL-designed software. The other layers of information include textures, gradient maps, albedo maps, annotations and multispectral maps," explains Gerhard Paar, who has specialised in image processing software for space applications, as well as the planetary science subsequently founded on it, for more than 30 years. As a key partner, this contribution to the Hera mission will enable the Space team to publish joint papers with their Hera counterparts, and participate in future ESA missions, including the Ramses mission to study the asteroid Apophis. Measuring 375 metres in diameter,

PHOTO: FIEDLER

Geodesy expert Piluca Caballo Perucha has been conducting research into industrial measurement technology, sensors and robotics for over 20 years.

PHOTO: FIEDLER

Gerhard Paar is a highly regarded expert in image processing software for space-related applications. He has been involved in numerous NASA projects.

Apophis will pass within around 31,750km of Earth on 13 April 2029, travelling at a speed of 7.4km/second. "The 3D-GIS functionality and the necessary data interfaces are helping to expand our Mars exploration and 3D tunnel mapping portfolio," Paar adds.

A voyage through the solar system

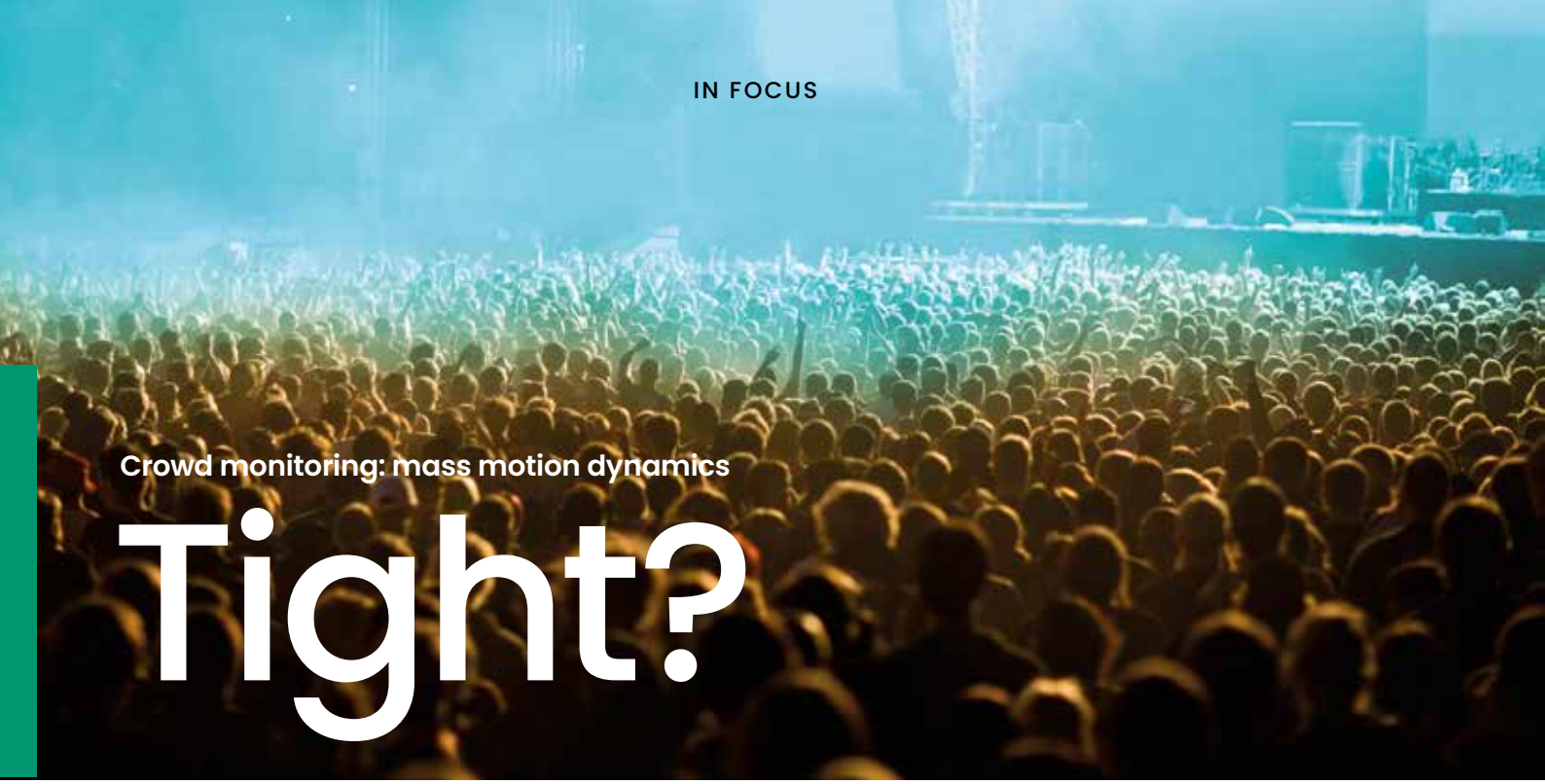
Launched from Cape Canaveral on 7 October 2024, Hera is currently in what is known as the cruise phase. It completed a successful swingby of Mars – which was designed to shorten the journey to Dimorphos – on 12 March 2025. In the process, the probe also surveyed important regions of Deimos, collecting an unprecedented array of images of the Martian moon. As Gerhard Paar comments: "We'll have to wait and see whether this will help to refine the surface model for Deimos. The data will be input into our tools in the next few weeks for testing purposes in preparation for the approach to the Didymos system in 2026, and to support analysis of the data from Mars's moon Phobos. At virtually the same time, we initiated recordings from Mars's atmosphere using the Mastcam and Mastcam-Z on the Mars rovers Curiosity and Perseverance. Together with the images from the Hera probe, these recordings could facilitate types of analysis of the martian atmosphere that have only very rarely been possible in this form."

When Hera reaches the Didymos system in late 2026, it will deploy two CubeSats – Milani and Juventas – to carry out follow-up investigations. "I'm especially excited about the analysis of the crater structure on Dimorphos that was created by the DART impact," says Piluca Caballo Perucha, who lived in Spain before moving to JOANNEUM RESEARCH to write her master's thesis on geodesy almost 25 years ago.

The next phase of the mission – the gradual approach to Dimorphos – will use PRo3D-GIS as the key platform for 3D recording and visualisation of a range of different instrument data, laying the foundations for achievement of the project's scientific goals. These include measuring Dimorphos's gravitational field, studying its external and internal structure – which may have been changed by the DART collision – and analysing the surface's physical, morphological, optical, thermal and chemical properties. The aim is also to map the global composition, carry out detailed measurement of the features of the crater and other effects of the DART impact, and characterise the dust clouds surrounding the binary asteroid system.

Looking to the future

The findings will be critically important for future planetary defence strategies, and will also deliver valuable insights into the make-up of asteroids. A major milestone in international space research, the project shows how modern technology can help to protect Earth against potential threats from the cosmos.



Crowd monitoring: mass motion dynamics

Tight?

PHOTO: iSTOCK

Whether it's music festivals, major sporting events or demonstrations: gaining a precise overview of the size of a crowd, the mood and the dynamics behind developing situations is an important security factor. The DIGITAL Institute has been trialling a tool designed to produce real-time snapshots of any given situation.

By Petra Mravlak

As part of the MUSIG project, researchers from the DIGITAL Institute and their partners examined innovative approaches to the analysis of flow movements and social media, in order to arrive at more efficient safety and management strategies for large-scale events and emergency situations. Applying multimodal data sources, including social media and mobile communications data, makes it possible to build up a comprehensive picture of a situation in real time. This also enables emergency service personnel to respond quickly to changes.

The system was trialled at Vienna's Danube Island Festival. It has one key advantage compared to conventional crowd monitoring systems: integrating a range of different data sources means that more precise overviews can be generated, which significantly enhances event safety. The technology also supports crisis management activities thanks to rapid analysis of crowds and their movements. The analysis is based on data from optical and thermal cameras, mobile communications, as well as location data from social media, all of which are evaluated using artificial intelligence. This allows for tracking of the number of people, the speed they are moving at and crowd density. Besides the specific analysis of movements, other types of information are also extracted from social media – in particular the emotions of people on site, which provides the basis for assessing mood and dynamic changes in the topics people are talking about.

When it comes to projects like this, data protection is a particularly important factor. And with this in mind, compliance with data protection regulations is monitored by an ethics board. Data protection officers were closely involved in the project in order to ensure safeguarding of personal data.

The project findings and the resulting technologies have helped to pinpoint important focuses for future research, as well as practical applications in the fields of event management and public safety. Funded by the Austrian Research Promotion Agency (FFG), the MUSIG project is part of the Austrian KIRAS security research programme.

Evacuation under extreme conditions

By Elke Zenz

The foldable tent is ideal for use in transport aircraft such as the C-130 Hercules.

PHOTOS: JOANNEUM RESEARCH

Evacuating people from disaster zones poses both logistical and medical challenges – especially if individuals have been affected by contamination or are carrying highly infectious diseases. In situations where evacuees are transported by air, in a worst case scenario contamination can spread throughout the plane's interior. Protecting the crew, ground staff and other passengers is just as critical as ensuring that an aircraft remains operational. Conventional solutions usually take the form of sealed boxes, or isolation pods that have to be ventilated and require complex filtration systems. However, an alternative that is permeable, flexible and, at the same time, secure is not available anywhere in the world.

Now, researchers from JOANNEUM RESEARCH, working alongside partners from Germany and Austria on the DEKO-AirTrans project, have come up with the answer. The aim was to develop a mobile, permeable interior tent solution for transport aircraft like the C-130 Hercules. Designed around a standard multifunctional pallet, the set-up allows contaminated individuals to be transported safely without the contaminant spreading to the aircraft's interior. Integrated sensors continuously monitor the individual's vital signs, as well as environmental conditions inside the tent. This means that medical decisions can be taken in real time via a telemedicine interface. The stand-out feature is the material used, which combines breathability with protection against chemical, biological, radiological, and nuclear (CBRN) substances. This will not only make air evacuations safer, but also more practical and energy efficient – and it represents a milestone for Austria's armed forces as well as international humanitarian missions.

The practical interior tent can be used to transport contaminated individuals and removes the need to fully decontaminate the inside of the aircraft afterwards.

Emerging talent

PHOTOS: BERGMANN

IT specialist **FLORIAN HAID is a member of the Remote Sensing and Geoinformation research group at DIGITAL, the JOANNEUM RESEARCH** institute specialising in digital technologies.

What is your research focused on?
I work in security research. We develop software solutions for the management and visualisation of various types of data, including vital sign data for emergency responders and soldiers, as well as aerial images taken by drones. This makes it possible to provide an overview of an ongoing situation, protect members of the emergency services, and generate decision-making tools for managers and commanders. Whether it's for the fire service or the military – knowing exactly what's happening on the ground, and keeping an eye on the current status of emergency services personnel, is critical for taking action at the right time.

What is the wider context of this research?
The research we do is part of the Remote Sensing unit, which focuses on recording and analysing environmental data using different types of sensors. We also use drones with highly specialised camera systems that are precisely calibrated to accurately capture objects and changes in a particular area. So we can monitor both the location and status of emergency services staff, and also carry out AI-supported analysis, for example to detect people or vehicles. On top of that, we work with satellite images in order to evaluate environmental changes. The combination of these technologies enables us to generate valuable knowledge that is extremely useful for the emergency services, public authorities and decision-makers.

How did you get into your current profession?
When I started my computer science degree, the idea of going into research hadn't even crossed my mind. Through my brother, I organised an internship at JOANNEUM RESEARCH – and right from the outset I was fascinated by all of the exciting research topics. I wrote my bachelor's and master's theses at JOANNEUM RESEARCH, and I've been part of the Remote Sensing and Geoinformation research team for more than five years.

Building a research group, together

JOANNEUM RESEARCH is growing. With around 300 employees, Virtual Vehicle (ViF) is Europe's largest research centre for the development of virtual vehicles. Following JOANNEUM RESEARCH's acquisition of a 50.1% stake in the business at the end of last year, a research group with a strong international profile is now taking shape.

PHOTOS: VIF

ViF is based at TU Graz's Campus Inffeldgasse.

PHOTO: VIF/WACHMANN

ViF's research is centred on the integration of numeric simulations and virtual validation in the automotive and railway industries. The goal is to make mobility in tomorrow's world safer, more efficient and more sustainable than ever before.

ViF Managing Director Jost Bernasch and JR Managing Director Heinz Mayer have big plans aimed at further raising the site's visibility. The two organisations are already cooperating on a number of international projects and have appeared jointly at events including MotionExpo and the JOANNEUM RESEARCH Forum.

This kind of investment represents a unique strategic opportunity for both companies, and for the location as a research hub. It will allow for the exploitation of synergies and significantly enhance the site's domestic and international profile in the research landscape. Carried out in collaboration with business and industry, research and innovation in digital and green mobility will be strengthened considerably, giving a major boost to Styria's competitiveness as a business and research location. ViF and JR have already teamed up on a number of different activities, including a joint presentation at MotionExpo 2025 and at the JOANNEUM RESEARCH Forum, where discussions focused on the future of mobility (see page 36).

Field research high in the sky

Field work at the model airfield in Stocking.
Martin Blass, Ana Gregorac, Michael Huber and Lukas Reinisch from the DIGITAL Institute are teaching drones how to hear, with the aim of enabling them to identify other airborne drones acoustically. At the initial test flight, a drone fitted with an omnidirectional microphone flew high into the air to record the sound patterns of other aerial vehicles. The data are now being used to train an AI.

Why is this so important?
Smart drones like this can be deployed to protect critical infrastructure more effectively. Turn to page 14 to find out more about the acoustic detection of drones.

PHOTOS: JOANNEUM RESEARCH/RAISER

HANNA WILHELMER

Cybersecurity through innovation

PHOTO: FEDERAL CHANCELLERY

Hanna Wilhelmer is the project manager for Austria's National Cybersecurity Coordination Centre (NCC-AT), which is currently being set up in the Federal Chancellery.

When it comes to cybersecurity, security considerations play an overriding role. This is important – but it does not take sufficient account of the potential of the economy and society. Austria – and the Styrian hub in particular – can offer excellence in the research, technology and innovation landscape. The Austrian Strategy for Cybersecurity 2021 aims to bridge this gap, defining cybersecurity as a whole-of-government issue. Alongside strict security goals, the strategy also defines research, technology and development, as well as business as key target audiences for national cybersecurity policies.

A core public-private partnership, the Cybersecurity Platform is designed to support information sharing between these target audiences and play a part in promoting cooperation. At the EU level, it is backed up by the Network of National Coordination Centres, which focuses on promoting the development of innovative cybersecurity solutions in partnership with the European Cybersecurity Competence Centre (ECCC). Austria's national office – the NCC-AT – has been set up over the past few years in collaboration with the Austrian Research Promotion Agency.

In recent years, the EU has been taking action aimed at promoting strategic autonomy in key areas including cybersecurity, as well as reducing dependencies and enhancing the competitiveness of European products.

In cybersecurity terms, the focus has shifted towards industrial policy by means of targeted support programmes. In addition to the European Defence Fund (EDF) and the well-established Horizon Europe security research programme, more than EUR 1 billion has been earmarked for the development and launch of innovative cybersecurity solutions between 2021 and 2027. For the period to 2027, the Digital Europe Programme is placing an emphasis on artificial intelligence, post-quantum cryptography and innovative solutions that are designed to enhance cybersecurity. Funding is aimed exclusively at European ideas and, to a minor extent, at the intersection between civil and military applications in the form of dual-use developments.

The EU's budget priorities from 2028 onwards will be drawn up by the end of this year. And the topics of competitiveness and innovation, as well as security and defence can be expected to play an even more significant part.

GERALD HESZTERA

Security in a dynamic environment: challenges and solutions

PHOTO: GERD PACHAUER

Gerald Hesztera is head of the Department for Strategy, Security Policy and Coordination at the Austrian Federal Ministry of the Interior (BMI). He is also a recognised media and communication expert.

Maintaining the high level of public security in Austria is becoming an increasingly complex challenge. Threats such as organised crime, extremism and terrorism are constantly evolving. In addition, technological advances are giving rise to new threats that affect government institutions, businesses and citizens alike. The growing dependence on digital systems in our society, as well as the digitalisation of critical infrastructure – including energy and transport networks – are bringing additional risks that need to be addressed. Cybercrime and state-sponsored attacks have made protecting digital systems a core consideration for security agencies. These shifts are creating a complex landscape that demands continuous adaptation and development of the BMI's capabilities.

Deepening its collaboration with research organisations is a key priority for the Ministry. And this is why the BMI is placing greater emphasis on collaboration with the scientific community by way of partnerships with Austrian research institutes, which deliver in-depth analyses, cutting-edge technologies and innovative approaches to tackling crime. Research can identify trends at an early stage and help to counteract emerging threats. Close links between science, business and public institutions promote knowledge transfer as well as training for much-needed specialists. In a world that is becoming more complex by the day, fostering national and EU-wide scientific expertise is hugely important – not just for security, but also for our country's competitiveness and resilience.

In view of these factors, the BMI recently signed an agreement with JOANNEUM RESEARCH, building on their long-running, successful collaboration on various security research projects. One current example is the KIRAS-funded NoiseSens project, where a measuring device is being developed that will enable the police to collect legally admissible evidence of vehicles exceeding noise limits at car tuning events.

PHOTO: iSTOCK

Flood risks

Focus on insurance and flood prevention

The most recent floods in Austria caused significant damage and reignited the debate surrounding insurance coverage. Finance expert and LIFE Director Franz Prettenthaler believes that insurers frequently provide insufficient protection against flood damage. In many cases, the maximum insurance payout is between EUR 5,000 and EUR 10,000, because the potential losses for insurance companies are too high and serious damage is virtually uninsurable. As a result, many households depend on government support (from disaster relief funds), but this could lead to problems in the long run. Austria's insurance industry is faced with the challenge of developing suitable solutions for the growing number of natural disasters. The Austrian Insurance Association (VVO) puts the total cost of flood damage as high as EUR 700m.

In light of these developments, Prettenthaler underlines the need to depoliticise the idea of compensation for flood damage and introduce a legal entitlement to defined support payments. He suggests following Switzerland's lead and setting up insurance pools, which help to spread substantial losses between private-sector insurers more effectively. This could also involve partial government subsidies for insurance premiums. "A combination of the public sector and private insurers is the only possible solution," says Prettenthaler. Alongside discussions on insurance solutions, strengthening preventive measures will also be crucial. These include extending flood protection systems, sustainable land use, and raising awareness of flood risks among the population. The combination of insurance coverage and prevention is the only way to effectively minimise the impact of flooding in Austria in future.

PHOTO: BERGMANN

Interview
with Franz Prettenthaler

Director of LIFE – Institute for Climate, Energy Systems and Society

What lessons can we learn from the severe flooding in summer 2024?

That the topic of heavy rains caused by climate change is now a reality. And that this is a high-impact, highly damaging process in itself, because only part of the enormous damage was caused by fluvial flooding from the Danube and its tributaries, while the rest was brought about by pluvial flooding, or surface water flooding, as a result of massive rainfall in a very short period of time.

Wasn't this foreseeable?

In theory, yes: every additional degree of warming translates into a 7% increase in the water absorption capacity of the air, but rainfall per hour rose by twice as much due to new circulation patterns. By the way, people can check the impact of flooding on their property by visiting hora.gv.at.

What needs to be done?

At the moment, we're cooperating with the University of Lausanne to develop an insurance solution for pluvial flooding like this. Also, the government and private-sector insurers need to finally join forces, because neither will be able to deal with the increasing damage caused by natural disasters on their own.

Award-winning

PHOTO: SFG/LUNGHAMMER

Innovation prize for JOANNEUM RESEARCH: Provincial Councillor for Business and Research Willibald Ehrenhöfer, Wolfgang Waldhauser, Jürgen Lackner, Paul Hartmann, Heinz Mayer and Christoph Ludwig (SFG)

Styrian Innovation Award / Houska Prize

Pair of awards for plasma coating

With the atmospheric plasma coating developed by the MATERIALS Institute in Niklasdorf, wood and other bio-based materials can be coated with conductive structures, water-repellent surfaces or adhesion-enhancing interlayers. JOANNEUM RESEARCH picked up two awards for its refinement of the technology: the Province of Styria's Innovation Award in the "Sustainability: R&D institutions" category, as well as second place in the Houska Prize, in the "Non-University Research" category.

"We believe that innovation is all about the sustainable transformation of existing materials by applying groundbreaking technologies, and combining natural aesthetics with smart functions in the process," according to project manager Jürgen Lackner, who carries out basic research and process optimisation along with his team at the Niklasdorf site.

"The level of innovation achieved by a research company is determined by the excellence of its employees, who work to address current economic and social challenges and are integrated into an agile network formed by business and science, as well as by world-class infrastructure," Managing Director Heinz Mayer adds. "As an application-driven research company, we are also in a position to offer targeted, made-to-measure solutions for business and industry at the site." Presented in six categories, the Styrian Innovation Award is the Province of Styria's official business prize. Awarded annually by the B&C Private Foundation, the Houska Prize is presented in recognition of pioneering research projects.

Distinguished service awards for JR employees

PHOTO: FRANKL

Roswitha Katter and Herwig Proske with their awards from the Province of Styria

Long-serving employees Roswitha Katter and Herwig Proske were presented with the Province of Styria's distinguished service award for employees of provincial government companies. With JR Managing Director Heinz Mayer and works council member Ferdinand Golja in attendance, the service medals – a mark of the province's gratitude and recognition – were presented by Governor Mario Kunasek and former Provincial Councillor Barbara Eibinger-Miedl. Herwig Proske joined JOANNEUM RESEARCH in 1986. He started out in the environmental geology unit, where he focused on mapping and risk analysis. Proske specialises in the application of remote sensing data for the analysis and modelling of geological hazards, taking into account climate-related changes. Roswitha Katter began her career at the Institute of Environmental Research in 1986. She went on to work in the Department of Research Planning, Technology Consulting and Project Management, as well as the Strategic Planning Department. She also has excellent connections within the research landscape in her role as the liaison for the European Commission. Katter has been in charge of the Research Programmes and Coordination staff function since 2023.

Outstanding product
Rollout for AKUT tunnel monitoring system in Italy

PHOTOS: BERGMANN

AKUT is now also serving as the "ears" of tunnels in Italy, allowing for immediate incident responses.

Microphones and AI enable the AKUT acoustic tunnel monitoring system to identify incidents or other critical events in road tunnels in under a second. The system recently entered operation for the first time, in a motorway tunnel in Italy – on a section of the motorway in Lombardy operated by Autostrada Pedemontana Lombarda. There are several tunnels on the company's network, including the 1,300m Gorla tunnel. Another new AKUT user is road operator Milano Serravalle – Milano Tangenziali S.p.A., which has also commissioned the system for three further tunnels. The sounds that typically occur in tunnel operations are produced by the engines, rolling motion and flow of vehicles passing through the tunnel. Any anomalies in these sounds – for example, the noise from vehicles colliding – are picked up in real time by the microphones installed in the tunnel, so response measures can be initiated straight away. Managed by the DIGITAL Institute, the AKUT tunnel monitoring system is also currently in use in around 50 tunnels in Austria and the Czech Republic.

News

Visit www.joanneum.at for all of the latest JOANNEUM RESEARCH news and events

The future of mobility, part one: automotive

Automotive industry trends and challenges

The speakers at the JOANNEUM RESEARCH Forum, held in Graz on 25 February 2025, looked at the future of the automotive industry from a range of different perspectives. The discussion topics included transport, energy storage, software and artificial intelligence, as well as life cycle assessment.

PHOTO: JOANNEUM RESEARCH/KUBISTA

Heinz Mayer with speakers Stefan Koller (VARTA), Robert Fischer (AVL), Jost Bernasch (Virtual Vehicle) and Gerfried Jungmeier (LIFE)

PHOTO: BERGMANN

Basic research pays off

On 27 November 2024, the Austrian Institute of Economic Research (WIFO), the Institute for Advanced Studies (IHS) and JOANNEUM RESEARCH's POLICIES Institute presented a study which showed that basic research can pay dividends quickly and extensively. Conducted for the first time in Austria, the study on the impact of basic research financed by the Austrian Science Fund (FWF) arrived at two surprising conclusions: firstly, the financed projects had a far quicker impact on the economy and society than was previously assumed, and secondly, all of the investments made through the FWF generate returns for the federal budget in a short space of time. These outcomes have a particularly positive effect on the economy. The crossover of basic research findings into applied research while, at the same time, practical needs fuel basic research, gives rise to dynamic reciprocal effects. This speeds up progress, as well as enabling efficient responses to challenges.

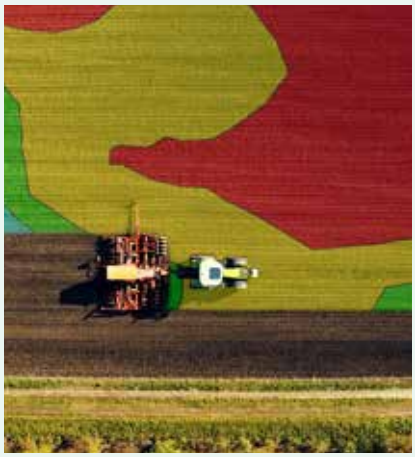


PHOTO: MASCHINENRING

AI-based management zone maps can be generated using the new soil mapping tool.

Digitalising agriculture with AI

Thanks to an innovative AI-based soil mapping tool, services provider Maschinenring, the Province of Styria and JOANNEUM RESEARCH are setting new standards in resource-conserving agriculture. State-of-the-art technology enables farmers to use up to 20% less seed, while also reducing nitrogen fertilisation by as much as 9% and diesel consumption by 15%. Hermann Katz, head of the Data Analysis and Statistical Modelling research group at the POLICIES Institute, and his team have played a significant part in developing the groundbreaking tool. The project was presented at a press conference with Provincial Councillor Simone Schmiedbauer, Maschinenring Styria project partners Sepp Wumbauer, Mario Hütter and Markus Pichler, and JR project manager Hermann Katz (POLICIES).

BMI and JR extend cooperation

On 15 January 2025, the Austrian Interior Ministry (BMI) and JOANNEUM RESEARCH signed a cooperation agreement that will extend and strengthen their long-standing and highly successful partnership. Collaboration on a number of joint projects, primarily in the field of security research, underlines the outstanding success of their collaboration to date.

PHOTO: BMI/TUMA

From left to right: Paul Fasching, Gerald Hesztera, Karl Srnec (all BMI), Heinz Mayer, Alexander Almer (both JR), Karl Hutter (BMI), Matthias Rüther, Helmut Wiedenhofer (both JR) and Christian Kunstmann (BMI)

PHOTO: OLIVER WOLF

The schedule included networking opportunities, as well as B2B meetings and discussions.

Health Tech Hub Styria 2025

Healthtech game changers: held across two days at the Medical University of Graz, Health Tech Hub (HTH) Styria 2025 focused on the latest and most exciting developments in the world of health technology.

"Digital solutions, robotics and regenerative medicine – three important trends for the future – are having a significant impact on healthtech and bringing about fundamental changes in healthcare," explained JR Managing Director Heinz Mayer at the opening of the event. JOANNEUM RESEARCH is making vital contributions in all of these areas through its research expertise – from innovative digital applications that support personalised medicine to robotics-based technologies and new regenerative-medicine approaches. Among the JR members attending the interactive healthtech event were Silvia Russegger (DIGITAL), Franz Feichtner (HEALTH), Michael Ploder (POLICIES) and Lars-Peter Kamolz (COREMED).

Micro heart pumps for babies

Developed under the EU's M.ERA.NET research network programme, the KIDmicroBLOODpump – a miniaturised centrifugal pump – is a groundbreaking and highly promising project. The aim is to facilitate minimally invasive procedures, and to make the design of the POLVAD artificial heart even more flexible – for young patients in particular. Researchers from MATERIALS are involved in the project.

Every year, around 40,000 children are born with heart defects worldwide. Many of them suffer life-threatening complications. Conventional artificial hearts are often too large and carry the risk of blood clots, as blood is unable to flow properly. This is where the KIDmicroBLOODpump comes in: at half the size of an adult's little finger, it can be implanted through a small vascular opening, without the need for invasive surgery. The form of the device has been specially optimised. It is produced on a 3D printer before a surface coating is added.

PHOTO: JOANNEUM RESEARCH/RAISER

The technology was partially developed in Niklasdorf: thin, flexible physical vapour deposition (PVD) layers – which are produced by coating materials such as polyurethane and titanium alloys with layers of diamond-like carbon – have significantly enhanced the artificial heart's haemocompatibility. This improves blood flow while also minimising the risk of blood clots.

Any questions?

If you are looking for a reliable partner for your research project or would like to find out more about our technologies, please contact our institutes directly.

Info

Headquartered in Graz, JOANNEUM RESEARCH provides innovation and technology services in the field of applied research. Working as a research company on behalf of various federal provinces and regions in Austria, our expertise shapes the development of our modern society and economy – sustainably, and always with a focus on people. A multidisciplinary team working in flexible structures that foster innovation, we always live up to the highest social and scientific standards.

As a research institute backed by the public sector, JOANNEUM RESEARCH plays a key role in identifying and generating solutions for challenges facing society, including climate change, energy supply, digital transformation, mobility, civil and military security, and social change.

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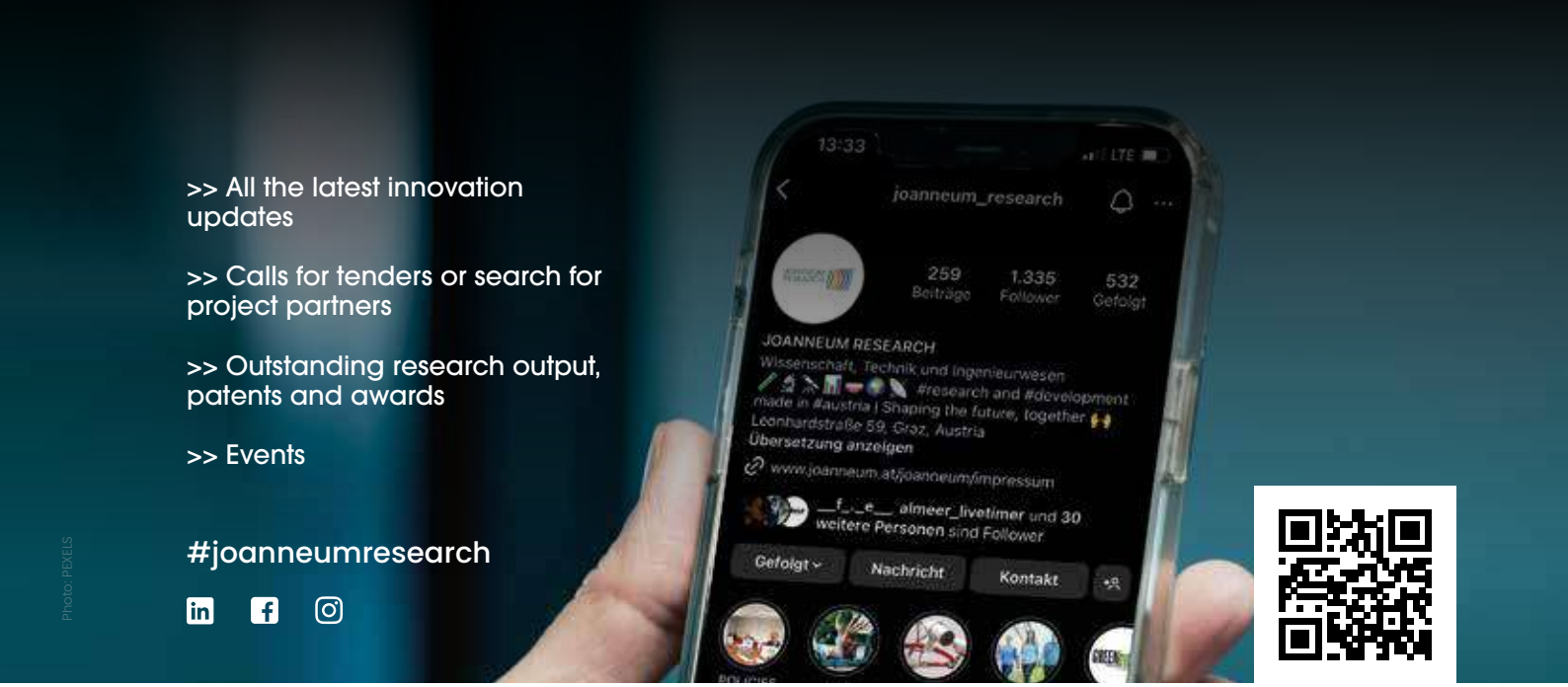

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