## **Defence Research: Opportunities and Innovations.**

Commemorative brochure on the occasion of the renewal of the cooperation agreement between JOANNEUM RESEARCH and the Ministry of Defence in Graz, 21 September 2018

**Federal Ministry** Defence







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Dear distinguished reader,

In my capacity as Minister of Defence, I am responsible for a task area that can only be accomplished with highly competent support and innovative stateof-the-art technology.

Thus, excellent, forward-looking, ethically prudent and cooperative research and development activities are required in the preliminary stages of fulfilling this military missions. This is precisely the cooperative approach that we want to further advance within the context of national and international, dynamically developing defence research. For this purpose, we need reliable cooperation partners.

During the signing of the first cooperation agreement with JOANNEUM RESEARCH (JR) in 2013, my predecessor boldly claimed that "in choosing JR, we teamed up with a partner from the Champions League of research". In the meantime, we have already established ourselves as a partner of the "reigning European champion". In 2017, Styria reached the peak in Europe as it boasted the best regional research and development rate among 276 EU regions whereby excellent cooperation between industry and science and thus specifically cooperation with our



Mario Kunasek Minister of Defence

valued partner JOANNEUM RESEARCH was the essential reason for this achievement.

Thus, in my function as minister of defence, but also as a Styrian with deep roots in the region, I am especially proud that my department extended the cooperation agreement with one of the most renowned top performers, the, in a sense, reigning "European champion of research" on 21 September 2018.

# **Greeting by the Minister of Defence Mario Kunasek**

On this occasion, I also want to congratulate JOANNEUM RESEARCH to 50 years of excellent research far beyond the borders of the European R&D stronghold of Styria.

The "Silicon Austria Labs" in which JR is also significantly involved provide further excellent possibilities for cooperative partnerships in the area of microelectronics.

For the Austrian Armed Forces, the goal of our continued cooperation with JR is the joint, successful participation in the Champions League of competitive military research, which will primarily be provided within the European context via European defence research. For the time period from 2021 - 2027, a total of  $\in 13$  billion are available through the European Defence Fund, which represents an enormous potential for added value for our national economic location. We should take advantage of this opportunity together.

The required framework conditions have been introduced with the national defence research-funding programme FORTE and a national strategy for the successful participation in European defence research with, by the way, significant involvement from JR. Joint projects, also within the context of FORTE, allow us to assert ourselves among the European competition and constitute a focal point of our cooperation extension with JR.

Thus, I'm quite optimistic to continue our mutually beneficial and flourishing cooperation, an alliance that not only benefits us, but Austria as a whole. Concluding, I want to express my gratitude to JR for its exceedingly appreciative and constructive cooperation over the last five years.

Sincerely,

Mario Kunasek Minister of Defence

In 2018, JOANNEUM RESEARCH celebrated its 50-year anniversary as it continues its successful decades-long cooperation with the Austrian Armed Forces over the last five years within the context of a cooperation agreement. This successful institutionalised cooperation will now be extended by another five years.

Building on this decades-long cooperation in the area of early warning systems as well as in national and international research projects, a five-year cooperation agreement was, for the first time, concluded in 2013, which pursued the goal of achieving an even more intensive cooperation and alleviating the exchange of sensitive data. I am therefore especially delighted that expectations with regard to the intensification of this cooperation have not only been fulfilled but even significantly exceeded.

For this reason, JOANNEUM RESEARCH has also decided to establish the internal competence group Cyber Security and Defence in which the prospective cooperation can be bundled and coordinated to a greater extent. The seven research units MATERIALS, HEALTH, DIGITAL, POLICIES, ROBOTICS, LIFE and COREMED allow JOANNEUM RESEARCH to offer interdisciplinary solution approaches for the Austrian Armed Forces.



Prof. Dr. Wolfgang Pribyl, MBA Chief Executive Officer

In addition to the already existing successful cooperation with the Austrian Armed Forces through research assignments within the context of KIRAS projects of the Austrian Research Promotion Agency (FFG) and projects of the European Defence Agency, European Union and European Space Agency ESA, we also already look forward to new cooperative opportunities in the planned Austrian defence research programme FORTE within the context of the FFG.

## Foreword by Prof. Dr. Wolfgang Pribyl, MBA Chief Executive Officer of JOANNEUM RESEARCH

I also regard it as a special honour that executives of JOANNEUM RESEARCH and I myself have been appointed to the Science Commission of the Austrian Armed Forces as consultants on this committee based on a recommendation from the Armed Forces by the Minister of Defence. This also reflects JR's close connection to the Austrian Armed Forces.

The Austrian Armed Forces are an important strategic partner for the central challenges of the future in the areas of security, information and communication technologies as well as in disaster control.

For JOANNEUM RESEARCH, the extension of the existing cooperation agreement by another five years represents a special milestone with respect to prospective research cooperation with the Austrian Armed Forces. I am convinced that new ideas and specific solution approaches for coping with current and prospective challenges in the area of defence and security policy will emerge from this cooperation and contribute to increased security in Austria and Europe.

Prof. Dr. Wolfgang Pribyl, MBA Chief Executive Officer JOANNEUM RESEARCH

Ladies and gentlemen,

For many years, the Austrian Armed Forces have worked closely with science in the university and non-university sector, fully in line with the ever-increasing international trend toward networking between civilian and military institutions. Successful scientific research cooperation is an essential concept for success, also with respect to the future of the Austrian Armed Forces.

This makes it all the more important to continue the structured cooperation, introduced in 2013 with JOANNEUM RESEARCH as one of the most capable applied research institutes in Austria.

As research director of the MoD, I am especially delighted about todays signing of the continuation of our cooperation agreement. Our cooperation shall continue to be mutually beneficial and contribute to defence research specifically through joint projects within the frame of increased security for Austria and its residents. Thus, on this festive occasion, I also want to take advantage of the opportunity and both thank and recognise all those who have contributed to this successful cooperation as I briefly review our cooperation over the last five years and then state my wishes for the next five. The original goal of the cooperation was to create a common knowledge basis especially in the areas of technology and technology development to promote synergies within the context of cooperation for security and defence-related scientific research between both organisations.

In my assessment, the implementation of this cooperation goal was sustained by mutual respect, openness and appreciation of the respective competences and abilities whose full effect was unfurled within the context of joint projects. The exceedingly satisfactory fulfilment of this target can



General Gerhard Herke Research Director of the Austrian MoD

be measured on the basis of many jointly held events and the present results from 28 jointly concluded projects.

However, in recent years more has happened than merely bringing this cooperation agreement to life. A trusting connection between people beyond organisational borders as well as a mutual understanding or a "sense" for the organisationally related requirements has been established. This is presumably also one of the most valuable prospective factors of success for the fruitful continuation of our cooperation.

Today, the Austrian Armed Forces are facing new challenges and opportunities. One of these opportunities is the ongoing development of national and European defence research in order to support the Armed Forces in the fulfilment of their varied tasks. I see many commonalities and enormous national potential for added value for joint,

## **Foreword General Gerhard Herke**

"Congratulations on 50 years of JOANNEUM RESEARCH and 5 years of successful institutionalised cooperation with the Austrian Armed Forces".

active participation in European defence research. Taking advantage of this opportunity should be the focus of our intensified cooperation over the coming years.

In light of the national defence research programme FORTE and the EU financing instrument of the European Defence Fund, I believe that, in addition to the already existing, ideal personal and technical preconditions of the first cooperation period, a further important framework condition for prospective joint activities has been fulfilled namely the nearly ideal availability of reliable financial resources. My extremely positive cooperation experiences with JOANNEUM RESEARCH as well as the currently exceedingly favourable conditions give me great confidence, but also a sense of great expectation for our joint future.

As commonly said on celebratory occasions: "The table is set and dinner is served." Let us sit down together and contribute to defence research through active participation in order to achieve the best possible mutual benefit and continually intensify our research and development activities.

With this in mind, I look forward to continuing on this path together as I express my gratitude for the demon-

strated commitment. For the coming cooperation years, I wish you as well as our various contributing military units continued openness for new areas, successful participation in exciting national and international defence research projects, a few jointly developed innovative and marketable products as well as an appreciative, trusting and fruitful cooperation, all in all I wish you "great success" within the context of our continued cooperation.

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General Gerhard Herke Research Director of the MoD

Applied research stands on two pillars: content-related, technological competence and domain specific knowledge. The cooperation between JOANNEUM RESEARCH and the Austrian Armed Forces in the defence sector provides an excellent environment for such activities. The MoD can rely on JOANNEUM RESEARCH as an internationally oriented research and development partner and, in turn, JOANNEUM RESEARCH benefits from the MoD as a lead customer and partner for innovation and pre-commercial solutions.

Regarding the research activities of the DIGITAL institute, this cooperation dates back even further than the 5-year period of the current cooperation agreement. The development and evolution of the ABC Information System (ABC-IS) is just one example. This expert system has been continuously improved over several generations, the scope of its functionality has been expanded and the technical platform has been transformed. Reconnaissance is one of the major national defence tasks and has therefore always been important alongside modern data management and research into the domain of remote sensing and communication technologies.

A completely new airborne sensor platform has been created based on these competencies that has provided a real-time data channel and ground station for several projects. This solution is perfectly suited for the generation of a comprehensive situational picture in real-time for a wide range of scenarios. These technologies are more relevant than ever before. Interoperability as a research topic has become part of management support systems; sensor platforms have been expanded to include additional modalities, as safe navigation systems play an increasingly important role. Technological achievements in sensor technology and computing power - smaller, lighter, more powerful - enable portability to small aircraft such as drones and vehicles. Multi-modality plays an essential role in many scenarios as a means of optimising operational capabilities. This is particularly relevant for imaging sensors in the visual range, as well as thermal cameras and acoustic sensors for capturing environments. Detecting and locating unmanned flying objects is a relevant specialist area. Information and communication technology is integrated in almost all modern devices, which is why the topic of cyber defence is currently enormously important. This also applies to autonomously driving and flying devices that are built on functional navigation systems to ensure mission success. Satellite signals can be disrupted or false signals can be sent out in order to impede missions. The long-standing experience and internationally recognised competence of the DIGITAL Institute in wave propagation and satellite communication forms the basis for experiments on the resilience of satellite navigationsystems.

## Defence and Security – a Driver for Research Dr. Heinz Mayer (DIGITAL), Wolfgang Polt (POLICIES)

Thus, conducting communication technology experiments in flight are especially important, something the institute can perform using Austrian Armed Forces aircraft within the context of the cooperation agreement.

Increased security awareness in society, politics and industry over the last five years has resulted in the establishment of the internal competence group Cyber Security and Defence at the DIGITAL Institute as DIGITAL demonstrates its increased commitment to research and development in the defence sector.

Looking back, a meanwhile extremely successful cooperation in the form of bilateral projects was started and which was subsequently further reinforced by the start of the KIRAS national research programme while receiving another boost from cooperation within the context of the cooperation agreement.

The national defence research programme FORTE will further increase cooperation. The defence research programme is based on the most recently enacted First Austrian Strategy for Defence Research for whose development the POLICIES Institute provided substantial assistance to the ministry. With its competence in policy and programme development, POLICIES has already supported initiatives in the area of defence and security research in recent years and will continue to contribute to these areas in the future on a national and international level.

The goal of extending the cooperation agreement is not only to further expand the jointly performed research and development work and the practical implementation of selected technologies, but also to support defence and security research with respect to its strategic positioning. JOANNEUM RESEARCH will increasingly integrate the international network and its FTI policy competence in the partnership and continue to build on the competence of the client, development partner and the international network of the MoD.

Providing "security" is a national, transdepartmental core task within the context of national "comprehensive preventative security measures". Analogous to security research, there is a need for the targeted contribution of research and development to addressing pending military challenges with respect to the specific defence-policy area as well as in accordance with European developments in the area of "defence research". This is to be implemented through defence research within the context of implementing the Research, Technology and Innovation (FTI) strategy and according to the current government programme 2017 - 2022 (cf. https://www.bundeskanzleramt. qv.at/documents) as well as through the implementation of strategic government documents such as "Teilstrategie Verteidigungspolitik" [Partial Strategy Defence Policy].

### EU - Initiative for defence research

In the "European Defence Action Plan (EDAP)", published on 30 November 2016, the European

Commission (EC) suggested the establishment of the "European Defence Fund (EDF)" and thus created the basis for defence research as a new "track" within the next EU budget. The EDF is to support the entire range from research to development and procurement, which is, on the one hand, to be implemented with a "research window" via the "European Defence Research Programme (EDRP)" and, on the other hand, with a "capability window" via the "European Defence Industrial Development Programme (EDIDP)". From 2021, € 13 billion are envisaged for the EDF in the next EU budget (multi-annual financial framework, MFF 2021 – 2027), € 4.1 billion for research (100% funded) and € 8.9 billion for development and procurement measures (20 – 80% funded).

In preparation for the establishment of defence research with an independent EDRP in the next MFF from 2021, the EC launched the "Preparatory Action on Defence Research (PADR)" on 7 June 2017 with a total budget of  $\notin$  90 million. The First Call for the work

# Developments and Potential of Defence Research

Director at the Federal Ministry of Defence Alexander Warnicki

programme 2017 ( $\notin$  25 Mio.) has already been issued while the Call 2018 ( $\notin$  40 Mio.) is still ongoing.

This EU initiative for defence research opens up wholly new development perspectives for the Austrian research and technology location with high potential in a thus far rather underdeveloped topical area.

A strategy was developed in 2018 in a national initiative under the leadership of the Ministry of Defence (MoD) and with significant contribution from the POLICIES Institute of JOANNEUM RESEARCH. The strategy lays out how Austria is to handle the EU initiative and utilise the resulting potential.

As a parallel, the MoD has commissioned the potential analysis of the relevant EU programme for the economic, research and technology location. The strategy is to establish a common national understanding of the EU initiative and provide a basis for the creation of suitable national framework conditions in Austria. The strategy was enacted on 22 August at the Council of Ministers and thus forms a binding national basis and the guideline for all players involved with this topic.

## Establishment of the national defence research programme "FORTE"

Defence research should also manifest itself in the national research-funding landscape according to European developments in the area of "defence research". The defence research programme enacted from 2018 should, among other things, also contribute to supporting the structure of national defence research and innovation competences. The establishment of the defence research programme "FORTE" (research and technology) expands the national research-funding portfolio and creates a new format for cooperation with relevant research institutes and commercial enterprises. The content of defence research is complementary to many competences that exist in the civilian/ national area so as to avoid duplication. The owner of the defence research programme is the Ministry of Transport, Innovation and Technology (BMVIT) and the Ministry of Defence (MoD) is responsible with respect to content/thematic design supports those national research endeavours that – complementary to the funding programme for national security research KIRAS – are necessary for the fulfilment of a purely military task portfolio.

For the targeted further development of the Austrian Armed Forces, FORTE will especially focus on timely and adequate research-supported contributions in the most urgent military defence research topics – such as cyber defence, management information systems or robotics (also with international participation).

FORTE positions the MoD and the Austrian Armed Forces as industry partners for research, innovation and technological development and reinforces national defence research competences so that national research institutions and economic partners can also successfully participate in the international competition for defence research (EU research programmes) and generate further national added value. After the assurance of all required framework conditions, FORTE, in accordance with the Research and Technology Funding Act will be handled as a national funding programme via the Austrian Research Promotion Agency (FFG). The First Call for FORTE is already planned for the fourth quarter of 2018 with an operational programme volume of  $\notin$  5 Mio.

### **Brief summary**

Overall and in light of the abovementioned briefly outlined developments for all research units of JOANNEUM RESEARCH, an enormous potential for prospective cooperation with the MoD is envisaged within the context of defence research.



From left to right: Dr. Heinz Mayer (JR), Director at the Federal Ministry of Defence Alexander Warnicki, Brig. Klemens Hofmeister, Brig. Gerhard Herke (all with MoD), Prof. Dr. Wolfgang Pribyl (JR), Col. Hans Starlinger (MoD), Erwin Kubista (JR) Photo: JR

### derStandard.at > Wissenschaft > Welt

### Bundesheer und Joanneum Research kooperieren in der Forschung

7 September 2013 16:42

### Schwerpunkte sind unter anderem Cyber-Sicherheit und Gefahrenerkennung

Graz/Wien - Die steirische Forschungsgesellschaft Joanneum Research und das Österreichische Bundesheer werden die nächsten fünf Jahre eine Forschungskooperation unterhalten. "Exzellente Forschung kann nur in Zusammenarbeit mit den Anwendern, deren Wissensstand, Kompetenz und Ansehen erfolgreich funktionieren", so Wolfgang Pribyl, Geschäftsführer der Joanneum Research Forschungsgesellschaft mbH.

Die künftige Zusammenarbeit betrifft innovative Entwicklungen in den Bereichen Cyber-Sicherheit, Sensorik zur besseren Erkennung von Gefahren und Fortschritte bei der Informations- und Kommunikationstechnologie sowie im militärischen Gesundheitswesen. Hier soll durch die Anwendung moderner bioanalytischer Methoden und durch den Einsatz von Nanotechnologie die Früherkennung von neuen Krankheitserregern verbessert werden. Diese Erkenntnisse sollen dann sowohl dem öffentlichen als auch dem militärischen Gesundheitswesen zur Verfügung gestellt werden.

Bei der bisherigen erfolgreichen Kooperation wurden luftgestützte Erkundungs- und Warnsysteme für einen wirksamen Katastrophenschutz entwickelt. Diese kamen nicht nur bei Tests, sondern bereits in der Praxis erfolgreich zum Einsatz, so etwa beim Hochwasser 2013, bei Waldbränden 2012 oder auch bei militärischen Übungen. Ein anderes Projekt wurde zur Erhöhung des Schutzes von Soldaten im Auslandseinsatz durchgeführt. Durch elektronische Maßnahmen könne man nun geplante Sprengstoffanschläge auf Konvois oder große Menschenansammlungen rechtzeitig erkennen, warnen und durch geeignete Roboter verhindern. (APA derStandard.at, 7. 9. 2013)

Source: derStandardOnline\_Bundesheer und Joanneum Research kooperieren in der Forschung



### Verteidigungsforschung als Milliarden-Markt

Im Rahmen des Buropäischen Verteidigungsfonds toll künitlig ein Potenzial von jahrloch über Eint Mid. Buro kunvier werden, um Buropas Vestichgungstallegiketen zu stätken Das betres glecchzeitlig enorme wirterhältliche und technologische Chancen für den Wirterhalts- um finnwaronzeitlich

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Source: Austria innovativ: Verteidigungsforschung als Milliardenmarkt

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Source: Fazit: Steirische Forschungspower für das Bundesheer.

## Bundesheer setzt auf steirische Forscher

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Kooperation mit Joanneum Research soll das Heer fit für technologische Zukunft machen.

GRAZ, WIEN. Für Sinzelprojekte rem technologische Entwickhat das Bundesheer bereits er-lungen, die die Sicherheit der folgreich auf die Forscher des Austro-Soldaten bei Auslandssteirischen Joanneum Research (JR) gesetzt. Jetzt soll die Zu-reits umgesetzt wurden etwa sammenarbeit vertieft und sys- elektronische Maßnahmen, mit sammenarbeit vertielt und sys-tematisient werden. Verteile denne großantes Sprengsstoffan-gungsminister Gertald Klug un-terzeichnete gesterm mit IR-Ge-schemengen frühzeitig er-schaftsführer Wolfgang Pribyl einen Kooperationsvertrag, der Karsstrophenmanagement soll eines Konperatikozvertus, der Kriststopkennansgenart sollt vorsch ist z081 stehn viel. vorsch ist z081 stehn viel. Verschangesbediung des Her-Drackungesbediung des Her-bange von des reditischen faper Wissen der stehtischen faper Projektes ab. stage frügt. Stein erweitigen auf der stehn vorschangen erweitigen auf der stehn vorschangen derungen zu lächteren. Im För-eingebreiche Konperburg derungen zu lächteren. Im För-eingebreiche Konperburg vorschangen zu lächteren.

Source: Kleine Zeituna: "Bundesheer setzt auf steirische Forschuna"

# Ministry of Defence and JOANNEUM RESEARCH: Press Review

### "AeroChannel": Bundesheer unterstützt Forschungsprojekt von Joanneum Research

Algon im Ennodal, 20. Februar 2015 - Im Auftrag der Buropäischen Weitnaumogenisatien (ESA), föhren Wissenschafterinnen und Wissenschaftler von der Grazer kanneum Research-Ferschungseinrichtung im Kooperation mit dem Deutschen Zinstrum für Luft- und Raumfahr sewie der Universität Vigo aus Spanien im Zuge des Projektes "AeroChanne" Messuneen in Obterreich durch.

Satellitenkommunikation

Ziel des Protektes ist es, die Empfangsqualität von breitbandigen i Sateillerkommunikationssignalen (z.B. für die Bereitstellung eines Hochgeschwindigkelbsintenzugangs für Plagpassagiere) im Plug zu webesem. Dazu wurden und werden mit Unterstützung durch das Daterreichliche Bundesheer verschiedere Flugezperimente und Messungen von Boden zus an verschiedenen Standorten in Osterreich durchgeführt.

Messflüge unter winterlichen Bedingungen

Von 12, bis 39, Februar wurden, ausgehend von Filegenhnit Fala-Fernbrugg in Algen im Ennstal, mit Unterstützung durch einen Helikopter des Durdsheiners entmals bei schneiebedeckter Landschaft ausgedeinte Messfläge durchgeführt. Im Spätsommer 2014 erfolgten Missungen unter sommerlichen Bedingungen. Venkret gehet se bei den derzeitigen Experimenton und Messungen darum, Erkenstnisse und Vergleichswerte Geer die Auswirkung der Schneilige bei der Rafekoln von Satellitensigneien im Rig zu geniment "sagt: Thomas Jost vom Forscherteram.

Hubschrauber und Flächenflugzeuge im Einsatz

Bei der Durchführung dieser Experimente wird das internationale Forschertem von Bundesherer daurch unterstlötzt, dass Briegerische Kapasitien und unftahrittechnische Expentise bereitgestellt werden. Bisher erfolgten Meschlüge mit dem Flüchenflugzeug Flütus Norter PC-6 und dem Hubschnuber Alberter 112. zwästlicher Flüge und Messungen werden noch mit dem Transportflugzeug C-130 "Hercules" und dem Mehrzwechnübschruber 5-70 "Bisk Hand" anforder bein Sch

ist is wegen möglichst gune Vergleichbarkeit wichtig, dass alle vier Flugzeugtsgen, an denen die Messungen durchgeführt werden, von einem Betreiber gehandhabt werden. Für das Forscherteam von Joanneum. Research war es daher klar, "dass derantig komptexe und herzusfördernde Aufgabenstaltungen im Berrich Flugerscher und bechnischer Ubterstützung nur durch die Flugikompetenz des Österreichischen Bundesheers erfolgreich umgesetzt werden könne".

### Erfolgreiche Zusammenarbeit

Diptomingenieur Tanja Peternann ist als wissenschaftliche Mitarbeiterin von Joanneum Research im Rahmen des Projektes "AeroChannel" am Standort Agen im Einstät als mittlingender Openster in der "Abuette" III im Einsatz. Zur Unterstützung durch das Bundesheer sept sie "In der Vergangenhat gab es bereis öffers eine sehr erfolgreiche Zusannenanziet mit dem Osterneichischen Bundesheer. Die excellent ausgebildeten Nicten beharrschen alle für um sehren offenste sie aler anspruchavollan Ragmanöver bestens: Zusätzlich werden wir von den Technikem bei affen Einderlichen für die Luffahrbauftigkerung bestens überten."

Source: www.bundesheer.at: "Bundesheer unterstützt Forschungsprojekt von JOANNEUM RESEARCH"

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# Hightech beim Heer

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Source: Austria Innovativ: Hightech beim Heer





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Date	Event title
15.10.2013	Research Market Day of the MoD 2013, Vienna
12.03.2014	Future Conference 2014, Graz
14.06.2014	MoD Exhibition (Open Day), Innsbruck
15.01.2015	3. Cooperation Meeting, JOANNEUM RESEARCH – MoD
11.03.2015	Future Conference 2015, Graz
28.04.2015	Research Market Day of the MoD 2015, Vienna
06.05.2015	Civil Protection Forum, Brussels
27.08.2015	AIRWATCH Alpbach
10.09.2015	Air Challenge Styria 2015, Kapfenberg
22.10.2015	MoD Exhibition – Heldenplatz
03.11.2015	ICT Security Conference 2015, St. Pölten
16.12.2015	4. Cooperation Meeting, JOANNEUM RESEARCH – MoD
09.03.2016	Future Conference 2016, Graz
07.04.2016	Strategic Leadership Course, MoD

Date	Event title
01.09.2016	Airpower 2016, Zeltweg
07.09.2016	Research Market Day 2016, Wiener Neustadt
04.10.2016	Austria Showcase "Defense, Aerospace & Security 2016", Washington
11.10.2016	ICT Security Conference 2016 of the AAF, St. Johann im Pongau
21.11.2016	5. Cooperation Meeting, JOANNEUM RESEARCH – MoD, Graz
01.03.2017	Future Conference 2017, Graz
22.05.2017	Public Day of the AAF, Military Training Area Seetal Alps
07.09.2017	Research Market Day of the MoD 2017, Wiener Neustadt
26.09.2017	ICT Security Conference 2017, Villach
31.10.2017	6. Cooperation Meeting, JOANNEUM RESEARCH – MoD
07.11.2017	KIRAS Symposium, Vienna
07.03.2018	Future Conference 2018, Graz
25.06.2018	Austrian European Security Research Innovation Days, Vienna

# Ministry of Defence and JOANNEUM RESEARCH: Common Presence



Photos: JOANNEUM RESEARCH



Photos: JOANNEUM RESEARCH

# Ministry of Defence and JOANNEUM RESEARCH: Common Presence



Photos: JOANNEUM RESEARCH

# **Overview of Research Cooperation**

Project	Volume
Commissioned by the MoD:	<sup>9</sup> 1.8 Mio. Euro
Projects funded by the European Defence Agency (EDA):	0.25 Mio. Euro "In-kind" contribution by the MoD
National funding:	5.2 Mio. Euro
Commissions European Space Agency (ESA):	0.75 Mio. Euro
Total within the context of cooperation	8.0 Mio. Euro

The cooperation MoD/JR enables the development of leading-edge technologies and provides a basis for a range of applications in military and civil areas.

## **Project Overview**

Project acronym	Project title	Contracting/Funding entity
CAIDA – Preliminary study	Critical Austrian infrastructure dependency analysis	Contracting entity MoD
Tactical Network Mapping	A network analysis tool for enhancing cyber defence capabilities	Contracting entity MoD
Tactical 3D-Mapping	Photogrammetric terrestrial "Tactical 3D-Mapping"	Contracting entity MoD
ABC-IS	Technical information system for ABC hazard systems	Contracting entity MoD
IOR – Validation	Validation according to ICT aspects of the study "Integrated Operations Research"	Contracting entity MoD
SEMI-MUNIT	Automation and optimisation of munition logistics with innovative identification technologies	Contracting entity MoD
AUDio	Acoustic UAV detection	Contracting entity MoD
DEBASTI	Research study for the analysis of technical communications detection procedures of spread spectrum control and telemetry signals for UAVs	Contracting entity MoD
Austrian Strategy Development for EU Defence Research	Austrian strategy development for EU defence research	Contracting entity MoD
NISS	Usage and maintenance control system	Contracting entity MoD
RadMon & RiskSite	Radiation monitoring and hazard assessment for at-risk operations	Contracting entity MoD
Energy Harvesting	Study for the examination of energy forms available in the field	AAF within the context of the programme "Combat Equipment for Dismoun- ted Soldier" (CEDS) of the European Defence Agency (EDA)
INTERPRETER	Realisation of civil-military interoperability at the semantic data level	FFG programme KIRAS Partner MoD
QuOIMA	Situational information for the usage of any open, unstructured information sources	FFG programme KIRAS Partner MoD
MONITOR	Flexible real-time-proximal multi-sensor monitoring and short-term prognosis for the examina- tion of security management for large-scale events	FFG programme KIRAS Partner MoD

Project acronym	Project title	Contracting/Funding entity
3F-MS	Multi-Level "ForestFireFighting Management System" for optimised deployment management of ground and air forces in forest fire situations	FFG programme KIRAS Partner MoD
WatchDog	Mobile communications and multi-sensor solution for security and risk management in open areas and in object protection	FFG programme KIRAS Partner MoD
Aid4Floods	Comprehensive and rapid provision of information for efficient disaster and emergency management	FFG programme ASAP Partner MoD
EVES	Evaluation system for the optimisation of evacuation scenarios and intervention strategies of deployment forces	FFG programme KIRAS Partner MoD
TACTIC	Creating awareness for Galileo PRS at critical infrastructures	FFG programme ASAP Partner MoD
Be-Aware	Threat analysis based on GNSS interference susceptibility in Austria	FFG programme KIRAS Partner MoD
EVIVA	Air-supported observation and analysis system for event protection and crisis situations with video-based behavioural analysis	FFG programme KIRAS Partner MoD
HUMAN+	Real time situational imaging for efficient migration management for ensuring humanitarian security	FFG programme KIRAS Partner MoD
FLASHBANG	Examination of the acoustic effect of flashbang grenades	FFG programme KIRAS Partner MoD
EN MASSE	Deployment system for large-scale events with multi-sensors, crowd flow analysis for real time situational visualisation and short-term prognosis	FFG programme KIRAS Partner MoD
AIRWATCH	National integration for assistance deployments in disaster control	FFG programme KIRAS Partner MoD
ARGUS-Flex	Multimodal air-supported sensor platform and innovative analysis and geo-management solutions for support in disaster management	FFG programme KIRAS Partner MoD
SILBOS	Measures for ensuring airspace security for authorities and organisations with security tasks	FFG programme KIRAS Partner MoD
AMBOS	Defence against unmanned flying objects for authorities and organisations with security tasks	FFG programme KIRAS Partner MoD
AeroChannel	Aeronautical satellite communications channel software	European Space Agency (ESA) Partner MoD

## **CAIDA** Critical Austrian Infrastructure Dependency Analysis

Both the military and civilian society utterly depend on Austria's critical infrastructure. Strong interdependencies exist between critical infrastructures. Ascertaining and depicting these dependencies is in the highest interest of the Austrian Armed Forces. For example, telecommunications is naturally dependent on a functioning energy infrastructure whereas the latter is in turn required for the control of energy flows as well as for energy supply and grid stability of remote measurements and controls and thus again dependent on telecommunications infrastructure. Many concepts, which all share the same statistical approach have been and are being developed for depicting these dependencies. In this preliminary study commissioned by the Austrian Armed Forces, the results of deliberations are presented for acquiring necessary data for extracting these dependencies via a dynamic system, limited to the domains of telecommunications and energy. This report, on the one hand, shows which communication protocols and protocol fields must be analysed and which models are suitable for processing data and depicting dependencies and, on the other hand, also presents a concept based on necessary local collectors and central aggregation including secure and anonymous or pseudonymised data transmission.

## *Runtime:* 16.12.2016 – 30.09.2017

### MoD unit:



## **Tactical Network Mapping**

A network analysis tool for enhancing cyber defence capabilities

Development of a network mapping tool for rapid and comprehensive ascertainment and preparation of information for non-cooperating dynamic networks.

The prototype of Tactical Network Mapping (TNM), developed from projects on behalf of the Ministry of Defence is a tool for supporting security audits of IT networks and network devices and thus of great significance for agencies of the Austrian Armed Forces responsible for ICT security. It allows for the integration of configurable analysis modules in simple adaptable processes and combines results of automated black-box analysis processes in the form of a lucid network graphic whereas especially endangered components are emphasised. Direct comparisons between network scans at various times or two overlapping areas of a network are possible.

*Runtime:* 13.12.2016 – 13.12.2019

*MoD unit:* Science, Research and Development Division

![](_page_27_Picture_0.jpeg)

## **Tactical 3D-Mapping** Photogrammetric terrestrial "Tactical 3D-Mapping"

New methods and techniques for the performance of military tasks and support within the course of assistance services in the Austrian Armed Forces require, among other things, up-to-date geo-information for the preparation, training, execution and review of deployments. In the context of this project. the term "tactical mapping" designates a solution for the mobile, rapid and multi-sensor ascertainment of target objects or areas and consequential requirements-oriented utilisation of geo-oriented data. The approach of mobile camera-based terrestrial tactical mapping ensures rapid on-site availability of the system as well as practical deployment in various terrains. High relative precision, currentness and rapid and target-group oriented data distribution are essential factors of successful management support. Prompt and efficient target recording is needed for the acquisition, documentation and provision of current, necessary geographic data and analyses. In addition to recording via a stereo camera system with integrated GNSS (Global Navigation Satellite System) positioning solution, developments include attached modules for the practical recording itself, time-spatial data storage, data access and user-oriented product generation, visualisation or forwarding from the force provider to the existing systems of requesting consumers. A prototype of a mobile, multi-sensor mast solution as well as associated modules for the recording and consequential evaluation of critical infrastructure objects have been conceptualised and developed. The practical deployment of the prototype indicates further research requirements and provides the basis for future developments.

Runtime: 01.11.2017 – 31.10.2018 MoD unit: Institute of Military Geography

![](_page_29_Figure_0.jpeg)

## **ABC-IS** Technical information system for ABC hazardous situations

ABC-IS is a technical information system for determining hazardous situations resulting from threats and incidences in the atomic, biological and chemical (ABC) sector. The system is used for threats caused by the release of hazardous substances based on military or civilian incidents at home or abroad, triggered by weapons effect, sabotage, accidents or operational malfunctions. It is used nationwide as well as for missions abroad while integrating various data sources (contingents, weather services, sensors) and utilising internal, digital military communication paths for the data network of the Control and Evaluation Centre (MAZ). ABC-IS provides management bodies of the respective command levels with current information from the ABC sector as the basis for situational assessment, decision-making and the issuance of orders.

*Runtime:* Project series since 1995

*MoD unit:* Operational Applications Section

## **IOR – Validation**

## Validation according to ICT aspects of the study "Integrated Operations Research"

The goal of this study is to analyse existing operation research instruments and procedures with respect to integrated operation research concepts - models methods and requirements for the implementation in supporting IT applications for relevant requesting consumers within the Austrian Armed Forces. The status quo – both civilian and military – is to be defined and documented as well as studied with respect to application options within the context of military deployment support at a strategic, operational and tactical level in order to derive basics for concept and model development of a military information modelling system for Integrated Operations Research (IOR). This forms the basis for international, multi-national and nationally integrated deployment management support within the context of a software-supported integrated deployment management while taking the joint application landscape of various requesting consumers into account with respect to comprehensive pooling & sharing systematics adapted for IOR models.

The result, which is quality-assured by the competence group Cyber Security and Defence of JOAN-NEUM RESEARCH in the form of a scientific peer review, ultimately provides a concept for a military information modelling system whereas deployment possibilities but also limits and interfaces are identified especially with respect to prospective synergy effects related to force-space-time within the context of deployment support.

Runtime: 31.08.2017 – 30.09.2018 MoD unit: Science, Research and Development Division

## **SEMI-MUNIT**

# Automation and optimisation of munition logistics with innovative identification technologies

The goal of the project is to examine the questions to what extent automated tracking or management of munition inventories can be performed within the context of autonomous or semi-autonomous transport systems and to what extent manual transaction in the field can be integrated in the automated system as well as how to evaluate directly associated matters such as human-machine interaction, security of used protocols, traceability of transactions and reliability of used technology for exacerbated conditions (weather. moisture, dirt, hazardous substances,...). Based on RFID (Radio-Frequency Identification), a theoretical concept has been developed in order to hierarchically depict the observed levels of container - pallet - munition crate - individual packaging, save the required information in a compact and secure manner on RFID tags, detect errors in the transaction as guickly as possible and send back the information in a fully automated manner to a superior database or perform the comparison. Functional prototypes have been implemented for concept validation in order to depict the deployment scenarios "munition storage" (programming of RFID tags from the database),

"basic supply point or supply point goods" (handling transaction) and additional demonstrations of special functionalities (such as handling of restricted munitions, detection of the movement direction for pass-by transports, detection of opened munition boxes) in a real test and evaluate these on-site at the munition storage.

## *Runtime:* 10.04.2017 – 31.05.2018

### MoD unit:

![](_page_33_Picture_0.jpeg)

## **Acoustic UAV-Detektion – AUDio**

For some time, it has been possible to commercially acquire and operate unmanned air vehicles (UAV) in various price and weight classes. UAVs represent a special military danger since even private persons without extensive expertise can use these devices as a means of attack. Presently, classic securing and monitoring methods cannot sufficiently detect this new type of threat from the air. The goal of the project was to examine to what extent acoustic detection methods for UAVs can be prospectively used by the Austrian Armed Forces and which physical limits exist for current procedures. UAVs with various drive technologies and designs were selected, and test flights were performed at military airports in Austria. Acoustic signatures of UAVs were recorded under various conditions (distances, weather, ground characteristics) in extensive measurement campaigns.

These data provide the basis for the further analysis of acoustic signals with the goal of developing a military detection and defence system for UAVs.

*Runtime:* 01.02.2017 – 31.12.2017

### MoD unit:

## DEBASTI

## Research study for the analysis of technical communications detection procedures of spread spectrum control and telemetry signals for UAVs

Many efforts and projects are currently under way with the goal of defining and developing suitable defence mechanisms for drones (UAVs). Especially incidents involving commercial drones clearly show that this topic is relevant both with respect to civilian interests as well as for the military sector. The Austrian Armed Forces are consistently enhancing their capacities for warding off dangers caused by drones. The substantial increase in the number of used, commercially available UAVs and the associated conflicts – whether due to incidents in civilian air traffic or through the targeted disruption of privacy or even of critical infrastructure – make it necessary to create countermeasures in order to protect private and public spaces.

Jamming or spoofing technologies provide specific defensive measures that can, on the one hand, disrupt radio signals with broadband static and thus impede the connection between sender and recipient or, on the other hand, change control signals in order to affect a targeted misguidance due to false position and time

information. Even quite affordable UAV models can be controlled with GNSS (Global Navigation Satellite System).

The study performed by JOANNEUM RESEARCH shows special approaches for the detection of signals transmitted with the spread spectrum method.

*Runtime:* 01.10.2017 – 31.05.2018

### MoD unit:
# Austrian strategy development for EU defence research

The "Austrian strategy for EU defence research" was developed on behalf of the Ministry of Defence under the leadership of JOANNEUM RESEARCH and eutema GmbH within the context of a process that lasted almost a year.

The national strategy principally takes existing strengths, weaknesses, opportunities and challenges into account for the purpose of achieving security, technology and economic-policy goals. Austria's active participation in EU defence research builds up and expands technological competences that take current challenges, existing capability gaps as well as new conflict and threat images into account and also contribute to creating necessary military capabilities both in Austria and the EU. Moreover, the strategy supports economic and technological-policy goals and creates suitable preconditions for Austrian firms and research institutes for successful participation in prospective tenders within the context of the EDF. The Austrian strategy for EU defence research was enacted on 22 August 2018 within the context of a Ministerial Council.



#### Runtime:

29.06.2017 - 31.12.2017

#### MoD unit:

Science, Research and Development Division

Photo: Austrian Armed Forces

Fish

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### **NISS** Usage and maintenance control system

The Austrian Armed Forces (AAF) require a usage and maintenance control system for the optimal utilisation of its infrastructure, which, on the one hand, maximises the availability of infrastructure objects and, on the other hand, optimises the utilisation of associated maintenance systems. A mathematical model is created that takes all framework conditions into account, This model was provided as a functional expert version with which test runs for typical infrastructure object classes can be performed. In further consequence, this model can be added to a technical software solution for which JOANNEUM RESEARCH has created requirement specifications.

Observed objects (e.g. aircraft, special vehicles, etc.) require maintenance measures in order to maintain operational readiness. These measures must be scheduled and performed according to specific intervals; however, it must also be possible to perform maintenance unexpectedly in case of sudden unscheduled events. Depending on the triggering criteria, various maintenance types are performed. Each of these maintenance events occupies resources for varying periods of time such as workshops (in the broader sense), personnel, devices, etc., which are only available to a limited extent. Among other things, methods from the area of predictive maintenance were used within the context of this project and will continue to be used for deployment and maintenance planning. Strict security provisions must be observed for the analysis of highly sensitive data.

#### Runtime:

28.11.2014 - 03.12.2015

#### MoD unit:

Communications and Information Systems & Cyber Defence Command

Photo: Austrian Armed Forces

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## RadMon & RiskSite

#### Radiation monitoring and hazard assessment for at-risk operations

Disasters such as the Chernobyl incident on 26 April 1986 occur rarely, but often have devastating consequences. Measures for the prevention of such disasters are to be further developed and options for timely responsiveness improved in order to cope with existing hazard situations. Austria has extensive experience in this area. A-detection contingent of the AAF are deployed on military premises as swell as within the course of assistance deployments for the ascertainment of radioactive contamination in case of a radiological emergency situation. These contingents report their results to the ABC Information System (ABC-IS) with which ABC defence specialists support commanders in regard to situational evaluation and the issuance of orders.

The project also allows for the usage of measurement data from the Austrian radiation early warning system for the situational assessment. Moreover, measurement results of the detection contingent of the AAF can also be made available to civilian authorities.

*Runtime:* 16.10.2017 – 30.06.2018

*MoD unit:* Science, Research and Development Division



## **Energy Harvesting**

Study for the usage examination of energy forms available in the field

The need for mobile electrical energy is a result of the many, by now almost fundamental needs of modern society. This requirement is especially relevant in the military sector as there are fewer options to procure or charge batteries in the field. The study "Energy Harvesting" was performed within the course of the EDA programme "Combat Equipment for Dismounted Soldier" (CEDS) in which energy forms that are available in the field were examined. The framework conditions of military deployments are taken into account. The application of solar cells on helmets and clothing seems to be an obvious choice, but is actually not very effective in case of deployment in climate conditions with little sunshine. Systems that follow body movements are burdensome for users, which is why knee generators or similar designs are not taken into account. Ultimately, the experiment tested prototypes with three suitable systems. The "shoe-embedded harvester" is based on a special shoe sole with piezo effect. The more effective "tube generator" is a cylinder with coil and movable magnet integrated in the backpack. However, the most effective device is the thermoelectric cooker with which a field cooker can be modified with minimal additional weight in order to, e.g., charge mobile phones. The experiments were enabled and substantially supported since energy harvesting possibilities are of great interest to the Austrian Armed Forces.

## *Runtime:* 09.01.2014 – 31.12.2016

#### MoD unit:

Science, Research and Development Division

## INTERPRETER

#### Realisation of civil-military interoperability at the semantic data level

In connection with the current state of research. INTERPRETER demonstrates a completely automated data exchange between civilian and military (management) information systems by means of state-ofthe-art software design methods and thus ensures the semantic integrity of the same. The modular structure of INTERPRETER further ensures generic system expandability, which is regarded as a basic precondition for sustained usability. Moreover, the project develops and evaluates an expanded concept of IT-supported integration of affected population groups in the process of crisis and disaster management whereby the current trend for more citizen participation is taken into account. The competence group Cyber Security and Defence of JOANNEUM RESEARCH DIGITAL focusses on the integration of the ABC Information System of the Austrian Armed Forces within the INTERPRETER interoperability platform. The resulting INTERPRETER architecture is implemented as proof-of-concept, which is evaluated with respect to acceptance and efficiency in the subsequent evaluation phase both with requesting consumers and

the population. This is the reason why INTERPTER constitutes an important milestone in the development of civilian-military interoperability and will provide an indispensable contribution in the coming years to crisis and disaster management in Austria.

Runtime: 01.01.2017 – 31.12.2018 MoD unit: Operational Applications Section

## QuOIMA

#### Situational information for the usage of any open, unstructured information sources

Freely accessible sources of information – specifically social media such as Twitter, Facebook or YouTube – allow the The Austrian Armed Forces and other deployment organisations to derive information in order to establish a more realistic risk assessment with respect to crisis and disaster management. The combination of news from traditional sources and social media allows for the procurement or securing of information, which would not be available in this quality and quantity via conventional paths.

The methods developed in QuOIMA (for the most part automated) for the analysis of texts, images and videos from social media allow the MoD to detect trends and structures of a crisis or disaster situation more quickly and effectively than is currently possible with available situational information.

Methods were realised in QuOIMA in order to reduce to a manageable extent the enormous volume of information available in a disaster situation via social and traditional media. These methods were integrated in the media mining system and evaluated by the MoD. Information is automatically grouped through clustering procedures according to time, location and event. This gives operators the ability to view the enormous volume of material and also offers wholly new possibilities for searching, filtering and visualisation.

Runtime: 01.11.2012 – 31.10.2014 MoD unit: National Defence Academy



Photos: JOANNEUM RESEARCH/Austrian Armed Forces

## MONITOR

# Flexible real-time-proximal multi-sensor monitoring and short-term prognosis for the examination of security management for large-scale events

The growing trend toward planned but also spontaneous events with large crowds provides new challenges for civilian security management. The project MONITOR pursues the synergistic deployment of air-supported and terrestrial recording systems as well as flexible multi-sensor networks in order to create current and comprehensive situational images. Pursued developments should provide targeted observations regarding the movement behaviour of crowds and short-term prognoses while adhering to data protection regulations in order to detect critical situations such as excessive crowd densities, the formation of traffic congestion, etc. in advance and support necessary security or even evacuation measures. Moreover, archiving functionalities for all measured and analysed data are developed in a geo-data pool for documentation and review purposes.

*Runtime:* 01.11.2014 – 31.10.2017 *MoD unit:* 

National Defence Academy

Diagram: JOANNEUM RESEARCH Austrian Armed Forces

Ground Segmen

Airborne Segment

Ite

TETR

Realtime comme

## **3F-MS**

#### Multi-level "ForestFireFighting Management System" for optimised deployment management of ground and air forces in forest fire situations

The optimisation of immediate forest fire fighting measures is an important national and international topic due to the dramatic increase in forest fires in Europe in order to better protect human lives and resources, but also in order to keep the environmental impact of forest fires to a minimum. A solution for optimised deployment management based on an innovative, real-time-proximal situational image acquisition and a role and scenario-focussed, high-performance management solution is pursued within the context of the project 3F-MS. Moreover, the development of simulation-based decision-making support and impact evaluation modules as well as innovative developments for areal monitoring of affected forest fire areas after fires have been extinguished are being pursued. A further essential goal is the international networking of the project 3F-MS by means of integrating international cooperation partners and workshops.

*Runtime:* 01.11.2015 – 31.10.2018 *MoD unit:* 

Institute of Military Geography



Diagramm: JOANNEUM RESEARCH

## WatchDog

## Mobile communications and multi-sensor solutions for security and risk management in open areas and in object protection

Dynamically changing security situations as well as the demand for efficiency increase for personnel resources elevate the requirements for deployment forces and security services as dramatically demonstrated by events in the most recent past. The key to optimised deployment management and successfully coping with various hazard situations is an innovative, permanent (24/7), time-optimised situational assessment. A development concept for mobile communications and multi-sensor solutions for security and risk management in open areas and in object protection is being developed, tested and evaluated within the context of WatchDog. Thus, the goal is the development of an energy and communication-independent multi-sensor system for focussed security scenarios, optimised deployment management and support of time-critical decision-making processes in order to successfully cope with various hazard situations.

*Runtime:* 01.12.2016 – 30.11.2019

#### MoD unit:

Armaments and Defence Technology Agency (ADTA)

Photo: Austrian Armed Forces

## **Aid4Floods**

#### Comprehensive and rapid provision of information for efficient disaster and emergency management

Comprehensive mapping services that rely on satellite and aerial image data are to be developed for the support of authorities for disaster and crisis management. Rapid availability of SAR, optical and thermal imaging data as well as products and information that are tailored to specific user requirements are to be provided at various scale levels whereas the main focus is on hydrological natural disasters. Quick data processing as well as innovative functionalities for information extraction are the essential goals of these services. Complementarity and integration with existing initiatives such as the European Copernicus (former GMES) Emergency Management Service or the Austrian "National Crisis and Disaster Management SKKM 2020" are also being pursued.

*Runtime:* 01.10.2014 – 31.01.2017

*MoD unit:* Institute of Military Geography



## **EVES**

## Evaluation system for the optimisation of evacuation scenarios and intervention strategies of deployment forces

The project EVES is developing a new generation of evaluation systems for the assessment of guidance systems and security elements as well as evaluation and fire safety plans based on innovative sensor technologies for human factor analyses. Field studies examine the behaviour of groups of persons in evacuation situations. For the first time, study results provide quantitative measurement parameters with respect to the behaviour and information acquisition in real-time-proximal deployments, which are channelled into the development of a significantly improved simulation model for the evacuation of persons. Technical solution approaches as well as alternative evacuation scenarios can be objectively and efficiently evaluated with a thus far unattained level of realism. The results specifically provide support for planning and training measures and ensure the highest possible degree of security. Requesting consumers, security technology providers and end users receive innovative evaluation options for the security infrastructure as well as for fire safety and evacuation planning.

Runtime: 01.01.2013 – 30.04.2015 MoD unit: National Defence Academy



### **TACTIC** Creating awareness for Galileo PRS at critical infrastructures

The project is to create awareness for the vulnerability of global satellite navigation systems (GNSS) and emphasise the advantages of Galileo Public Regulated Service (PRS). Any user can derive precise position and time data via global satellite navigation systems. There are many GNSS applications whose malfunction or targeted disruption could produce devastating consequences both for the Austrian Armed Forces as well as in the civilian sector. Satellite signals received on earth are very weak due to the enormous distance between satellites and receivers. The system can therefore be disrupted relatively easily through simple interference signals (jamming). With the right expertise, freely available signal specifications can also be used to generate and send out false signals in order to deliberately falsify derived position and time data (spoofing).

Experiments and demonstrations have already been performed at the military training area in the Seetal Alps in order to demonstrate the hazards of jamming and spoofing and increase awareness for this type of threat. Examinations are planned for analysing the advantages of encrypted PRS for which a GNSS receiver is concurrently supplied with signals similar to PRS and attacked by means of jamming or spoofing. The project results are both interesting and beneficial

*Runtime:* 01.04.2016 – 30.12.2018

*MoD unit:* Institute of Military Geography



## **Be-Aware**

#### Threat analysis based on GNSS interference susceptibility in Austria

Global satellite navigation systems (GNSS) are used in varied form for position, navigation and time determinations. Nowadays, GNSS is used in highly critical infrastructures such as for time-synchronisation of financial transactions, in communication networks, electricity girds, aviation, etc. as well as in organisations such as the Austrian Armed Forces. GNSS signals can be disrupted relatively easily through cyber attacks (e.g. jamming or spoofing) due to their weak signal strength.

The goal of the project is to create an extensive overview of critical GNSS infrastructure in Austria including threatened elements in the AAF and Ministry of the Interior. Individual critical infrastructures must be examined in the greatest possible detail in order to establish further precautions for endangered infrastructure. An initial preliminary threat catalogue is created for Austria in which each recorded infrastructure is entered with the respective threat assessment based on collected information for threat situations (possible consequences, assessment of the expected occurrence probability and damage intensity). Operators of critical infrastructure are given the ability to decide by means of the threat analysis whether measures for improving GNSS security should be implemented.

Runtime: 01.01.2018 – 30.06.2019 MoD unit: Institute of Military Geography

Photo: Austrian Armen Forces

## **EVIVA**

## Air-supported observation and analysis system for event protection and crisis situations with video-based behavioural analysis

The project EVIVA develops security technologies for event management with large crowds. For the first time, the technology developed in EVIVA provides comprehensive observations of the movement behaviour of crowds and thus advanced detection of critical situations (congestion, increased crowd density, initial signs of panic behaviour, etc.).

On the one hand, behavioural observation can be used for the prevention of crisis situations in order to allow security forces to intervene in group dynamics in timely fashion. On the other hand, panic behaviour can be prevented in already existing crisis situations due to early identification of hazardous zones and timely intervention by security forces.

The project EVIVA conceptualises, develops and validates relevant system components for the stated purpose for air-supported observation and analysis of crowd flow dynamics by means of optical and thermal data as well as an associated innovative management and guidance system that makes it possible to integrate air-supported observation with terrestrial security

infrastructure. The innovative features of the project are the usage of air-supported sensor technology, the development of complex algorithms for the evaluation of optical and thermal data for the evaluation of crowd flow movement patterns, automatic video positioning as well as the structure of the integrated management centre.

*Runtime:* 01.10.2014 – 31.01.2017 *MoD unit:* National Defence Academy



## HUMAN+

#### Real time situational imaging for efficient migration management for ensuring humanitarian security

The purpose of HUMAN+ is to ensure humanitarian security and improve preparation for migration waves while concurrently taking legal, ethical and sociological framework conditions into account. The described project approach aims at the usage of social media and its integration with established methods of remote sensing for the creation of integrative real time situational images and short-term prognoses. Deployment forces are better prepared for migration waves and can make comprehensively informed and targeted decisions due to the generated situational image in real time. The scientific and technical goals of HUMAN+ include three areas:

 Migration movements: Detection and prediction of migratory movements, identification of migration focal points as well as comprehensive observation of ethical, legal and social aspects

- Creation of situational images: Creation of a real-time-proximal situational images, real-time-proximal data analyses (social media and image data), creation of short-term prognoses
- Information and decision-making support: User group-dependent, interactive informational visualisation, (semi-) automated quality controls, assurance of interoperability by means of a laboratory-proximal experimental setup and training scenario.

*Runtime:* 01.03.2018 – 29.02.2020 *MoD unit:* 

Institute of Military Geography



## **FLASHBANG**

#### Examination of the acoustic effect of flashbang grenades

Development and testing of non-lethal weapons (NLW) have already been advanced since the late 1960s. However, the public only became broadly aware of NLW around 1990. Since then, a trend towards new forms of NLW can be observed, which opens up new possibilities for military and security forces with respect to the fulfilment of their tasks.

Today, the military has adapted its approach as it aims to cause as little collateral damage as possible due to the call for proportionality. Non-lethal weapons – as suggested by the name – do not have a fatal impact when used correctly and can provide assistance in this area. Presently, the specific effects of so-called flashbang grenades have not been sufficiently investigated. It is often difficult for special deployment forces on site to perform a quick and precise proportionality assessment or discrimination. The goal of the study was to examine the acoustic effect of flashbang grenades outdoors and indoors and further create the basis for a military-suitable simulation tool that allows special deployment forces to assess the acoustic effect of flashbang grenades on humans prior to usage.

## *Runtime:* 01.09.2015 – 30.04.2018

#### MoD unit:

Science, Research and Development Division



Images: JOANNEUM RESEARCH

## **EN MASSE**

#### Deployment system for large-scale events with multi-sensors Crowd flow analysis for real time situational visualisation and short-term prognosis

Time and again, humans are at risk at mass events as during the incident at Bergisel (Innsbruck) on 4 December 1999 or the Love Parade on 24 July 2010, events that even resulted in fatalities. Tradic incidents frequently occur at large-scale events despite extensive prior planning of security concepts and governmental regulations for maximum crowd sizes. Often the reason for this is a lack of precise information about current crowd sizes, crowd density and spatial distribution on the event premises. In practice. so-called "lookout" stewards predominantly determine compliance of certain areas since reliable and automatic ascertainment of pedestrian flows still have not been satisfactorily resolved in event management. Information passed on to the situation centre often arrives too late in order for security forces to react appropriately. Thus, reliable and current information in real time about the situation is indispensable for ensuring security at large-scale events.

A flexibly adjustable and deployable crowd monitoring system was developed with EN MASSE, a system that acquires and lucidly displays extensive information for the assessment of critical situations at large-scale events while supporting event monitoring for increased security.

*Runtime:* 01.10.2011 – 31.01.2014 *MoD unit:* 

National Defence Academy



Images: JOANNEUM RESEARCH/Austrian Armed Forces

## AIRWATCH

#### National integration for assistance deployments in disaster control

Based on the results of the KIRIAS project PUKIN, AIRWATCH develops a flexible air-supported recording and monitoring system that supports various security-relevant deployment scenarios. These can be found, on the one hand, in disaster control and, on the other, in assistance and security deployments of the Austrian Armed Forces. A new multi-sensor platform is integrated in the DA 42 MPP of the company Diamond Aircraft Industries as well as in the aircraft type Pilatus of the Austrian Armed Forces within the sense of a multi-functional platform. According to specific requirements of requesting consumers, data acquisition, data communication and data processing procedures are developed with advanced information extraction. The innovative core is the role-oriented deployment image with integrated management and decision-making support system according to the principles of National Crisis and Disaster Management (SKKM).

*Runtime:* 01.01.2012 – 30.09.2014 *MoD unit:* 

Institute of Military Geography



## **ARGUS-Flex**

## Multimodal air-supported sensor platform and innovative analysis and geo-management solutions for support in disaster management

In the commissioned project, the air-supported, compact multi-modal system ARGUS-Flex for the large -scale recording of high-quality optical and thermal imaging data on various platforms (helicopter, ultralight airplane, UAV) is being developed for the support of risk and disaster management. In addition to rapid and flexible system readiness, the essential content consists of scientific developments with respect to quality optimisation of multi-sensor data as well as innovative data processing and data analysis methods. Deployment-optimised management modules and procedures are developed based on social-scientific examinations of efficient integration in tactical deployment management in national and international deployments.

*Runtime:* 01.11.2018 – 31.10.2020

*MoD unit:* Institute of Military Geography



Images: JOANNEUM RESEARCH
## **SILBOS**

# Measures for ensuring airspace security for authorities and organisations with security tasks

The rapid development of small unmanned aviation systems drives the exponential growth in the commercial sector and represents an asymmetrical threat situation and potential means of attack against the background of inefficient defensive measures. In light of increasing changes in security-policy threat situations, the adaptation of threat scenarios and the inclusion of unmanned aviation system as potential means of attack are becoming increasingly important.

Technological, legal and ethical challenges have been assessed based on insights from the G7 Summit in 2015 and the Bilderberg Meeting in 2015 at which public requesting consumers were partially involved. The overarching goal of this project is the holistic observation of threats due to unmanned aviation systems as potential means of attack from a technological, ethical and legal perspective. From a technological point of view, the focus is on the situational interpretation and comprehension of the threat from the air due to the deployment of artificial intelligence as the basis for semi-autonomous tools for decision-making support as well as measures for situational-dependent intervention based on scenarios relevant to authorities.

#### Runtime:

01.06.2018 - 31.05.2020

#### MoD unit:

Armaments and Defence Technology Agency (ADTA)

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## AMBOS

# Defence against unmanned flying objects for authorities and organisations with security tasks

Unmanned aircraft can be commercially acquired in various price and weight categories with basic functions such as waypoint navigation or programmable digital outputs. Thus, an attacker already has all functionalities for a potential assault at his disposal, which is why these devices represent a potential disturbance factor. From a security-policy perspective, the adaptation of changing threat scenarios is crucially important in order to maintain supply security for vital goods and services in and for Austria. Presently, the protection of critical infrastructure varies according to the individual threat potential. Research and industry have not sufficiently addressed this problem specifically in the civilian sector, which is why only insufficient research results are available. Superior goals of the project: Development and evaluation of technology components, specifically methods and procedures for electronic optics, acoustics and communication technology for detection and protection against potential threats from the air based on proportionate means of intervention as well as the merging of various sensor modalities for ensuring robust and reliable sensor technology.

Runtime: 01.12.2016 – 30.11.2018 MoD unit:

Air Force Command



Images: JOANNEUM RESEARCH/Austrian Armed Forces

### **AeroChannel**

### Aeronautical satellite communications channel software

The reception of satellite signals on aircraft can be influenced by the structure of the aircraft itself as well as by reflections from the ground. Software models are being developed in order to better plan respective satellite connections that take these effects into account, JOANNEUM RESEARCH won the bid for the tender of the European Space Agency ESA for this topic and manages a consortium with the German Aerospace Centre and the University of Vigo in Spain. Even the most careful model calculations require experimental verification, which was provided through flight measurements within the context of the project AeroChannel. A large and small fixedwing airplane (C130 Hercules and Pilatus PC-6 Turbo Porter) as well as a large and small helicopter (S-70 Black Hawk and Alouette III) were used. The enormous competence and excellent team spirit of the Austrian Armed Forces made these successful experiments possible. The exact performance of the measurement flights was only possible due to the extremely high competence of the pilots of the Austrian Armed Forces. In turn, this cooperation with the Austrian Armed Forces provided a detailed and up-to-date insight into the possibilities and limits of satellite connections on aircraft, which is especially of interest in the military sector. The measurement series were evaluated in detail and delivered prominent illustrative results such as strong reflections at the water surface of Lake Neusiedl. A presentation at the renowned international conference (EuCAP 2018) received the "Best Paper Award in Propagation".

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#### MoD unit:

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