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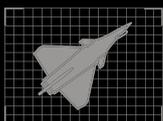
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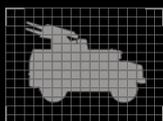
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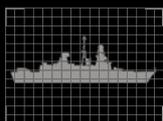
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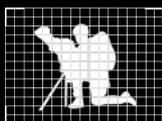
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# Dear visitors, exhibitors, comrades and friends,

As the anticipation mounts and excitement fills the air, I am delighted to extend a heartfelt welcome to Enforce Tac 2024. It is an honor to have you join us as we embark on this journey towards advancing security and cooperation within the realms of law enforcement and defence.

I am filled with immense anticipation for the Enforce Tac 2024 that lies ahead. Alongside my dedicated team, we have spared no effort in curating an experience that surpasses expectations, offering you an unparalleled opportunity to explore, connect, and engage.

**With your visit, you have already made Enforce Tac history together with us:** for the first time, our exhibition will take place over three days – and, how could it be otherwise, in three halls for the first time. With more space and more time, I invite you to immerse yourself in the wealth of premieres, highlights, and innovations that await. From the inaugural Scandinavian-German Defence Symposium to the diverse array of exhibitors spanning our expanded space, there is no shortage of inspiration to be found.

With Norway and Germany maintaining one of the largest partnerships for defence and economic projects in Europe, and the recent inclusion of Sweden and Finland in NATO, the symposium's thematic focus gains added relevance. The collaboration between these nations is integral to strengthening the NATO alliance and addressing common security challenges.

Over the next three days, our program of events promises to ignite meaningful dialogue, foster collaboration, and provide invaluable insights into the ever-evolving landscape of law enforcement and defence.

Whether you are participating in insightful discussions on international procurement processes or engaging meet-and-greets and our major premiere Enforce Tac Village, each moment offers a chance to deepen your understanding and forge lasting connections.

**The special premiere at Enforce Tac 2024 is the Enforce Tac Village**, a realistic outdoor training ground where exhibitor products are presented in various law enforcement and military scenarios. The Enforce Tac team developed the Village along with three strong partners in line with the motto "dynamic.tangible.live". The project team is made up of former and current members of military special forces and police tactical units. Their wealth of experience in special and customized training and expertise in scenario building guarantee a great experience. PRORETA Tactical GmbH is responsible for the infrastructure, while OF Operative Fähigkeiten GmbH and the Airborne Medical Group will oversee the planning and execution of the tactical scenarios. Visitors to Enforce Tac 2024 can look forward to the various scenarios four times a day. The on-site experience will also be live-streamed, allowing the action to be followed inside the exhibitions halls as well.

**As we cast our gaze towards the future, our vision for Enforce Tac is one of growth, relevance, and quality.** Building upon the foundation laid last year, where we underscored the inseparable nature of internal and external security, we are committed to elevating every aspect of our event. From increasing the caliber of our visitors to expanding platforms for qualitative exchange, our aim is to drive this meaningful progress.

As we embark on this journey together, I encourage you to seize every opportunity to engage, collaborate, and inspire. Your presence here today is a testament to your dedication to our shared mission, and I am truly grateful for your participation.

Thank you for being a part of Enforce Tac 2024.

Warm regards,

**Isabelle Teufert**

*Director Enforce Tac*



## Dear readers, dear community,

As publisher of cpmFORUM, I am proud that we are able to be part of the extraordinary success story of ENFORCE TAC with our special edition. We are the official magazine of this trade show.

Our authors have worked hard for you. The "lead story" is an interview with Olaf Lindner. He is President of Federal Police Special Operations Command 11 and knows what he is talking about. Lindner used to be the commander of GSG9, which is now also subordinate to his directorate. He speaks very openly about the challenges of modern special police units – see for yourself from page 6.

Our author André Forkert has taken a detailed look at the equipment used by military special units. From the G95K assault rifle to drones and highly mobile special vehicles, this article starting on page 26 is a "must have" for anyone interested in shooters and gear.

I myself was able to approach a very emotional topic for soldiers. Combat clothing is an essential element of personal equipment. It protects against wet, cold and heat in different climate zones. HEXONIA is taking a very progressive and innovative approach here. I met Managing Director Nils Holm Toverud at the production site in Nettetal. Starting on page 58, we talked about the Zeitenwende, production capacities and cooperation with the armed forces.

As this tour d'horizon shows, the topics are many and varied. But there has always been a diversity of topics in our community. However, the security scenarios have changed dramatically; they are now

tangible and no longer an abstract threat to our way of life. The two wars in Ukraine and at Israel's border region show how different the world might be in the future. On the one hand, the battle of combined arms in the classic sense. There, the fight against a terrorist organization by a regular armed force. We are familiar with these two scenarios. International crisis management and national and alliance defence. The boundaries between these two scenarios are now fading. What they have in common is the emergence of disruptive technologies such as AI, drones and autonomous systems on the digital battlefield. These factors are game changers. They change the dynamics, quality and quantity of weapon systems and command personnel, but also of individual gunnery.

We have tried to address a variety of topics in this magazine. My team has accepted this challenge and, in my opinion, has mastered it well.

I hope you enjoy reading and browsing through the magazine and wish you good discussions and a successful time at ENFORCE TAC.

Yours



**Tobias Ehlke**

*Owner and publisher*



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# 6

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Olaf Lindner, President  
of Federal Police Special  
Operations Command 11



**Interview** with  
PD Dr.-Ing. Dr.-habil.  
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**Interview** with  
Nils Holm Toverud,  
Managing Director at Hexonia GmbH



**The Bundeswehr's  
Handgun Projects**



## Equipment for Special Forces



## Land Mobility for Special Operation Forces



## Trends for Small Arms Shooting Training



## Enforcer – from Light Ammunition to Anti-tank and Air Defence

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Coverimage: NürnbergMesse



## The Sanitätsspezialzug follows the Commando Soldiers directly



# Interview

with Olaf Lindner,  
President of Federal Police  
Special Operations Command 11

Federal Police Special Operations Command 11 in Berlin is home to GSG 9 and all other special forces of the Federal Police, involving a total of six departments (Federal Police Special Forces GSG9, Federal Police Civil Aviation Protection Service, Federal Police Diplomatic Security Service, Federal Police Air Support Group, Federal Police Investigations and Operations Support Office and the Federal Police Explosive Disposal Group) at 40 locations. In addition, there are operational locations worldwide, ensuring the security of German diplomats, among other responsibilities.

**All Federal Police special forces units fall under your command. Can you tell us a bit more about them and their respective areas of responsibility and tasks?**

Our joint mission is to deal with complex threat situations at home and abroad. To do so, we are stationed at more than 40 locations in Germany and abroad in German embassies. We also train pilots and EOD personnel for state and federal police forces.

With the GSG 9, we have one of the most experienced special units in the world in our ranks. With their technical/individual skills and established values, they are ready to counter individual offenders as well as groups fighting against our liberal society. Within the security architecture, they are an executive trump card in operational crisis management for the federal government. Our police flight service also offers an equally broad range of capabilities. In particular, we



Unity, trust and integrity are our guiding values and therefore also mine. We apply them strategically. In other words, they should be inherent in a desirable and aspirational state.

are constantly present in the North and Baltic Sea with our specialisation in police operations at sea, supporting Central Command for Maritime Emergencies in complex damage situations at sea and providing significant SAR (Search and Rescue) services. We also help to counter wildfires and are a sought-after partner in disaster relief and flood response. Thirdly, with our technically versatile experts in operational and investigative support in terms of operational technology and digital forensics, we are constantly active in countering a variety of criminal phenomena and other operational situations. Fourthly, our property and close protection capabilities are in greater demand abroad now than ever before – which infers questions of security-related process organisation. We are also heavily involved in operational cooperation with other personnel protection units, e.g. since 2015 within the international Black Griffin network. Fifthly, our flight security escorts (Air Marshals), are specially trained in close combat, and protect German aircrafts worldwide in order to fend off attacks on civil aviation. In the event of a corresponding threat forecast, we also pay particular attention to individuals and groups. Sixthly, our EOD experts are the decision-makers when it comes to immediate hazard defence measures relating to hazardous substances, providing support with access and breaching technology and securing evidence in the danger zone. Overall, our message is unmistakable: we counter threats to the internal and external security of our country with all available capabilities and competencies.

#### **Which values are important for the special forces of the Federal Police, and which do you personally stand for?**

Unity, trust and integrity are our guiding values and therefore also mine. We apply them strategically. In other words, they should be inherent in a desirable and aspirational state that supports and positively influences our official culture through vitality and tangibility. At the same time, our values are characterised on the one hand by the obligation to behave in accordance with the law and rules and on the other hand by the ability to demand them. They should imply fundamental and permanently anchored guidelines for action. To me this seems more urgent than ever. We can all see the rapid increase in different world views, cultural and religious views in our country. In addition, the number and complexity of dangerous situations is growing at an alarming rate and reducing confidence in those state institutions that guar-

antee security. The more profoundly these political, societal and security-related changes are, the more I believe that the previous traditional communication tools and channels of the security authorities are at risk. Established values offer stability and orientation in this case. Nevertheless, living these values remains a breathing, active process that must be truly supported and lived by leaders. In my opinion, this particularly includes the practice of appreciating employees. Without this, values and their intended impact risk ending up in a credibility crisis. I am also aware that we will not reach every employee in this way: therefore, we set barriers and still offer freedom, especially through our values.

#### **What do you think a leader needs to bring to the table?**

For me, agile leadership is an essential and at the same time critical factor, because it is linked to the alternatives of whether I see opportunities or risks first. In times of crisis, the situation changes quickly. Managers have to adapt to this change. They must be able to develop alternatives and act quickly when circumstances require it. Leaders must also be prepared for uncertainties by maintaining a positive attitude and remaining open to new opportunities. For me, this results in a (leadership) mindset that is characterised by three key competencies. Firstly, I consider communication skills to be the highest discipline for leaders. In times of crisis, open and transparent communication is essential. An authentic and transparent explanation of management decisions is the only way we can provide the basis for their acceptance and effectiveness. Neglecting this means that the required purpose and objectives of leadership actions are lacking. Destructive minority opinions can easily give the impression of a majority opinion. Times of crisis are very stressful for employees. Leaders should be able to feel with them, supporting and encouraging them. Employees should feel their needs and concerns are heard and taken into account. Basically, I am in favour of more altruism, i.e. a management mentality that also encourages and allows innovations in dealing with the situation and rewards the courageous. For me, promoting effective ideas and favouring chances before risk, to begin with, is a key management task. At the moment, we sometimes still need the almost unselfish innovator who is then doomed to success. When things are going well, managers have the capacity to work more on their own area of responsibility, even in times of crisis, rather than having to devote themselves to the extensive control of day-to-day business – in short, looking ahead! Secondly, this requires comprehensive strategic expertise, including a willingness to engage in interdisciplinary teamwork, since only practical

▲ Police Special Forces of the GSG 9 during a tactical training.

◀ Olaf Lindner, President of Federal Police Special Operations Command 11.

Photos: Bundespolizei

implementation involving employees and their operational understanding will enable a constructive strategy culture and develop the desired effectiveness. This cooperation also helps to promote a sense of solidarity and cohesion. Thirdly, I consider the ability to make decisions and take responsibility quickly to be two sides of the same coin. Decisions often have to be made under time pressure, with no time for a detailed analysis. This applies not only to dealing with familiar, well-rehearsed deployment scenarios, but also with less clear-cut situations. A decoupling of decision/non-decision and responsibility leads to a diffusion of responsibility, which in my view causes the basic elements of leadership to slip out of our hands like sand.

### What changes in the terrorist threat situation have there been in recent years?

Allow me at this point to attempt a fundamental categorisation of what is currently happening around us and in the middle of our country. In my opinion, the last ten years we have seen the complexity of social conditions continue to increase, while our systemic control structures reach the limits of their capacity. The reasons for this are three political, social and technological changes, which are occurring simultaneously and becoming increasingly noticeable, as well as being currently negotiated globally. Firstly, the development due to a shift in global political governance and strategic ambitions; secondly, climate change; and thirdly, the digital revolution, which is leading us to change processes of a magnitude similar to the first industrial revolution in the 18th and 19th century. Migration also plays a major role in this process of change. It is with great concern that I personally perceive an increasingly closer correlation between extremism and terrorism, because the omnipresent potential for hatred and violence in our country can no longer be categorised as isolated incidents. A mixed situation now seems to be taking on an offensive character, which can cause extremist – and, as a last resort, terrorist – endeavours to rise sharply at any time. Germany is now a centre for multilateral political and religious conflicts. At the same time, previous categorisations in individual areas of conflict are becoming blurred and less distinct, making extremist and terrorist efforts more confusing. This development must be strategically countered in the long term. The state must further intensify its willingness and ability to act. As Federal Police Special Operations Command 11, we are making our contribution to this.

”

Germany is now a centre for multilateral political and religious conflicts.



### In your view, what are the foreseeable priorities for the strategic development of special forces in the coming years?

From the point of view of the special forces, there is a need for effective federal crisis management. One that integrates omnipresent drivers such as organised crime, cyber terrorism and politically motivated disinformation campaigns. One that includes environmental disasters, wars and other conflicts as well as global – including state-led – refugee movements towards Europe, especially Germany. Basically, the strategic and operational handling of terrorism is also up for discussion; in particular, the threshold for holistic state intervention in time-critical cases of state-directed acts of terrorism on German territory or against its citizens and institutions abroad. This will have massive impact on the readiness of other states to attack and on the quality of our liberal societies. Extremism and terrorism remain permanent adversaries of our political system they can be instrumentalised quickly and at any time. We must always be prepared for this appropriately and have correspondingly flexible responses at the ready.



▲ Federal Police Diplomatic Security Service (Polizeiliche Schutzaufgaben Ausland der Bundespolizei (PSA)) at the entrance of the embassy of Amman, Jordan.

◀ Police Special Forces of the GSG 9 during a fast-roping operation, supported by the Federal Police Air Support Group.

Photos: Bundespolizei

Consequently, the capabilities of special forces and their multilateral interoperability, as well as the specific shortage of specialised personnel and adaptable legislation are also highly influential drivers.

From an analytical perspective, the trend in Germany towards centralisation of national crisis management for integrated security, i.e. internal, external and cyber security is almost irreversible. As a result, the formation of a process-orientated and clearly structured core cell, in the form of a permanent crisis management unit at a high decision-making level, remains a possible option for action. In any case, this organisational element for the crisis management of Germany's integrated security would have the potential to involve many positive assessments – i.e. opportunities – and to strategically counteract risks. We need positive visions of the future to participate in, which will enable a broadly recognised development of further trends and the resulting scenarios, and also include strategic foresight for the special police and military forces.

It is important to clarify the necessary transformation processes for special forces and to learn from other countries. Small-minded thinking exacerbates antiquated thought patterns.

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**What do issues such as cyber-attacks, power outages and attacks on critical infrastructure mean for the deployment, training and equipment of special police forces?**

Our self-image as a Federal Police Special Operations Command is essentially characterised by unconventional thinking and action. To this end, we have a multi-perspective view of national and international situation developments and are constantly adapting our tactics. As a result, we are prepared and ready with our capabilities at all times to show our state and non-state opponents the price they must pay for posing such threats. This is based on the assumption that we are the last line of defence.

**When would GSG9 or one of your units be deployed in a hostage situation abroad? And, since we also have the Special Forces Command (KSK) of the Bundeswehr in addition to GSG9 when it comes to hostage rescue missions, how are the two forces differentiated: who takes on which mission abroad and when?**

In principle, I also believe that in the case of threat situations abroad, whoever can do it, should do it – within the framework of the current law. I don't believe that competition and rivalry alone are the yardstick. An institutionalised pooling and pronounced team capability of all special forces orientations, which is then necessarily reflected in technical-tactical interoperability, seems to me to be the more suitable approach. We should stop setting ourselves apart, since

▼ Robust protection of the embassy and their personal through Federal Police Diplomatic Security Service (Polizeiliche Schutzaufgaben Ausland der Bundespolizei (PSA)).

Photos: Bundespolizei

this can only be to the detriment of our joint effectiveness. It also unnecessarily increases interfaces and overlaps and, as a result, reduces the necessary ability to respond to the variety of threat situations that originate abroad. It also favours diffusion of responsibility.

**Whether it's industry or the authorities, there is a shortage of personnel everywhere. What is Federal Police Directorate 11 doing to generate a sufficient number of suitable personnel? Or more importantly, what makes working for you an attractive career choice for young people?**

Our commitment to recruiting personnel is high. However, we sometimes lack the necessary efficiency and sustainability, which certainly also has to do with the appropriate localisation of personnel responsibility and decision-making authority in the right place. We have simply not yet achieved the necessary speed and adaptability. I think there is still a lot of small-scale thinking, individual careers are linked to the question "why should it be better/faster for them than for me?"

We do not achieve long-term retention of highly qualified personnel through monetary means alone. I prefer a reliable presentation of career prospects, combined with flexible employment contracts and career development models, even beyond rigid service periods and age limits. This is the nucleus for long-term, trusting cooperation, in which the social meaningfulness of our task first comes to fruition. A comprehensible strategic orientation can be very helpful here.

**Mr. Lindner, thank you very much for this interview.**

*The interview was conducted by André Forkert*





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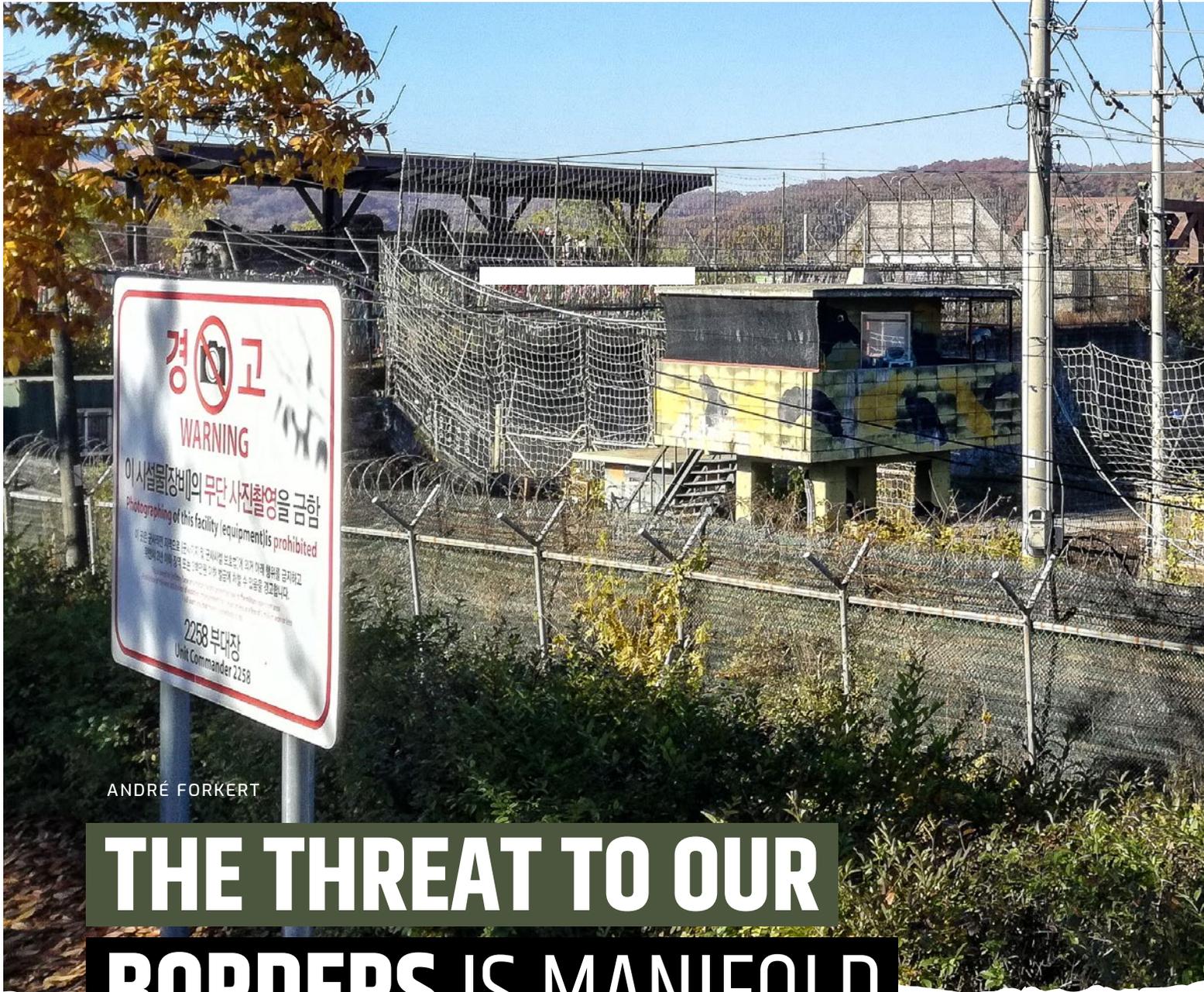
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ANDRÉ FORKERT

# THE THREAT TO OUR BORDERS IS MANIFOLD

Determining the "best" guarded borders can be subjective and dependent on various factors, including the specific goals of border security, the geopolitical context, and the resources available to the respective countries. However, some borders are known for their stringent security measures.

These four border areas are probably known as the best guarded in the world: North & South Korea, India & Pakistan, Israel with all its neighbors – but especially with the Gaza Strip and West Bank – and the border between the USA and Mexico. The Korean Demilitarized Zone (DMZ) is one of the most heavily guarded borders in the world, with heavy military presence on both sides. Also the Line of Control (LoC) in Kashmir – between India and Pakistan – is heavily militarized, with both countries deploying significant military forces. Due to the ongoing Israeli-Palestinian conflict, the borders were heavily guarded, with a combination of physical barriers, surveillance,

and military presence, until the terrorist attack by the terrorist organization HAMAS on 7 October 2023. The US-Mexico border has seen increased security measures, including physical barriers, surveillance technology, and border patrol agents. From Europe’s and NATO’s perspective, the borders between the Baltic states and Russia, or the border between Poland and Belarus, have also become much more prominent since the Russian invasion of Ukraine. Not only to prevent Russia from crossing, but also because refugees are being smuggled across these borders to destabilize Europe.

▲ What looks so idyllic here is one of the most dangerous borders in the world: a view of North Korea from South Korea.

► Although outlawed in parts of the world, minefields still protect a large number of borders today. Here between North Korea and South Korea.

Photos: AF



## DIFFERENT THREATS AND CHALLENGES

As for challenges and threats to border security, they can vary widely. From a European perspective one of the main challenges currently is the illegal immigration at the inner and outer borders. People attempting to cross borders without proper authorization pose a significant challenge, economically, with a terrorist and destabilizing mean. Another threat is smuggling, the illicit movement of goods, drugs, weapons, and even people across borders is a major concern. Terrorism can be a vulnerable point for the movement of terrorists and the trafficking of weapons across the (green) borders. Part of that challenge can be cyber security threats. In an increasingly digital world, securing borders also involves protecting against cyber threats targeting critical infrastructure and information systems. Political disputes and conflicts between neighboring countries can escalate border security concerns and raise geopolitical tensions, which in the end leads to a war and destabilization of a whole region.

Regarding technical security tools for border security, several technologies are employed. Surveillance systems can include a variety of sensors (and effectors): day and night cameras, drones, and other monitoring devices to keep a watchful eye on border areas. These could be acoustic sensors that detect people or vehicles, or even shot detection systems, seismic detectors, ground surveillance radars or doppler radars and other sensor technologies help detect movement in restricted areas. These sensors



can be fixed installations or mobile ones. Depending on the size of the area, maybe both ways are necessary to ensure unpredictability. Drones provide aerial surveillance and can cover large areas efficiently. Or can help to identify the threat, if one of the other sensors trigger an alarm. Also satellite technology aids in monitoring and mapping border areas, but they are more expensive and often not a live feed. One of the most common possibilities are physical barriers such as walls and fences to impede unauthorized crossings, the US-Mexico border or Israel-Gaza are some of the best known. As known from Korea or the former German-German border minefields (often outlawed today) and automatic firing systems can be part of the fortifications.

All these sensors and effectors should be combined into one integrated system. Biometric Technology like fingerprints, facial recognition, and other biometric tools are used to iden-

▲ Hensoldt SPEXER 600 multi-mission, X-Band ground-based surveillance radar. The low weight of the unit allows it to be installed on buildings or masts with no requirement for specialist mounting arrangements or access. UAVs can be detected at distances of up to 9 km, people from up to 8.2 km. Photo: Hensoldt

► The FLIR Systems LTV-X Light Tactical Vehicle (LTV) is a hardened tactical reconnaissance vehicle. The kit can theoretically be used on any 4x4 with a flatbed. It is based on the Polaris MRZE, with a TacFLIR 280-HD multispectral ISR turret and the Ranger R6SS (solid state) ground surveillance radar as sensors. The LTV-X also includes a C2 system for full sensor control, utilization and dissemination of real-time imagery and target information. The C2 system can track over 500 targets simultaneously. The 12" mast can be folded for maneuvering, which takes around 80 seconds. The integration of drones is also possible, e.g. Flir PD-100 BLACK HORNET PRS. Laser rangefinders, laser pointers and laser illuminators (NIR) are also available as options. The Ranger R6SS ground surveillance radar (FMCW X-Band) can detect people and vehicles up to a distance of 15 kilometers. Photo: US Gov

tify individuals crossing borders. Also seamless communication between border enforcement agencies is crucial for an effective response. And advanced analytics help process vast amounts of data to identify patterns and anomalies that could indicate security threats. Effective border security often involves a combination of these tools and technologies tailored to the specific challenges and geography of the border in question.

But as seen at the border of Poland and Belarus or at the 7th October 2023 in Israel, an effective Quick Reaction Force (QRF) is necessary in order to be able to react quickly and effectively to recognized threats. This applies from apprehending illegal migrants to combating terrorists, smugglers or drug traffickers.

But none of this is worth anything if the political will is lacking, the will and the ability of the security forces to effectively protect a border and to respond to threats with all legal power. Threats and persons can be detected and even apprehended, but there must be more consequences for the actors than just a warning. Deterrence is a very important aspect of border security.

### **COLLABORATIVE APPROACH AND POLITICAL WILL**

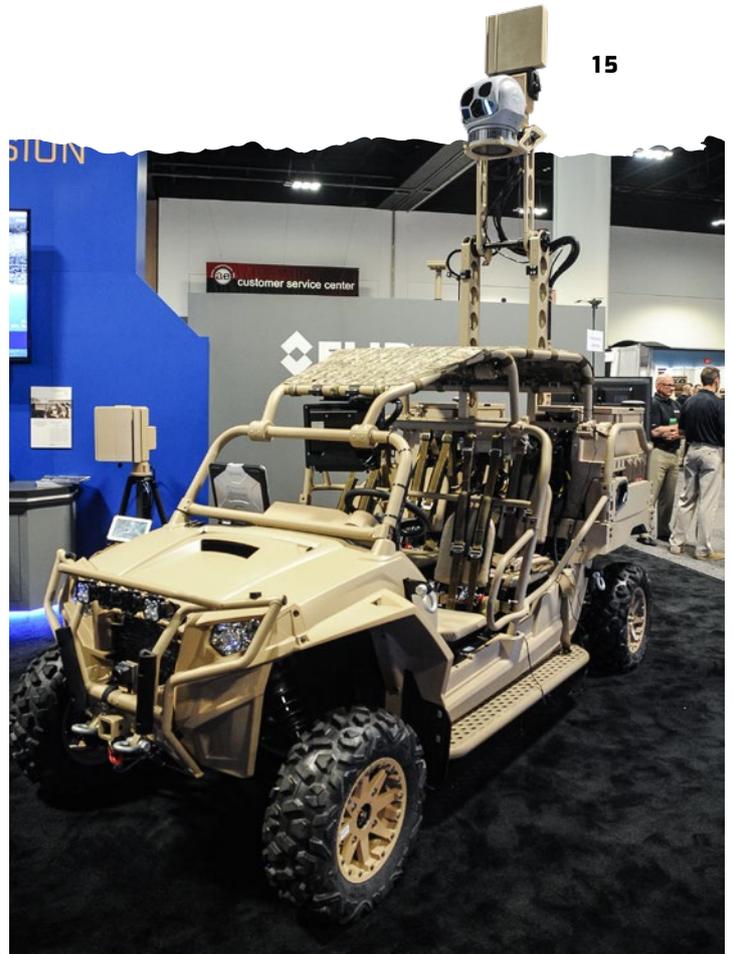
The European Union (EU) has been working on a collaborative approach to border security for some time now. Particularly in response to challenges such as irregular migration and terrorism. However, the change of national governments, their political will and orientation as well as the required unanimity of the Union hinder the effectiveness of the measures.

While not all EU countries are part of the Schengen Area, which allows for passport-free travel within participating countries, the area's members (should) work collectively on external border control to ensure the security of the zone. But if the effective controls at the external borders fail,

then the system literally opens the door to illegal activities within the Union.

The European Border and Coast Guard Agency, commonly known as Frontex, plays a crucial role in coordinating border management among EU member states. It conducts joint operations, deploys border guards, and provides technical assistance to protect the external borders. The European Border Surveillance System (EUROSUR) is a mechanism that enables member states to share information and coordinate responses to border-related issues, including irregular migration and cross-border crime. Part of this is an enhanced information exchange among member states and improving intelligence-sharing capabilities to address security threats. The Common European Asylum System (CEAS) have been made to establish a common approach to asylum and refugee policies, addressing issues related to migration. But as we can see, it is not a good tool to protect the EU and national borders.

It's important to note that border security measures are dynamic and subject to change based on emerging challenges and policy developments. But the threats change faster than the political will and the capabilities of the border security agencies can adapt to them. It's like the rabbit and hedgehog race. In the end, the more intelligent and flexible player wins.



## EVERYTHING UNDER CONTROL

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# Interview

with Senior Technical Director  
PD Dr.-Ing. Dr.-habil.

**Jens Holtmannspötter,**

Head of the Materials, Engineering,  
Structures & Digitalization Division (200)  
at the Bundeswehr Research Institute for  
Materials, Fuels and Lubricants (WIWeB)  
in Erding, Bavaria

**Dr. Holtmannspötter, your division is responsible for the "Soldier System". What are the main current characteristics of protection?**

On the one hand, the topic of protection is characterised by the fact that it fulfils its function and enables soldiers to perform at a high level without significantly impairing them in their tasks. Of course, more protection is always better, especially with the modern materials we have available. However, it is also a constant cat-and-mouse game. On the one hand, we improve the materials, the protective systems and structures, while others optimise their weapons. As a result, the weight quickly reaches the limits of what can be expected of the soldiers. This becomes particularly apparent during operations, as the protective systems can be a hindrance. So, we have to weigh things up, because as soon as we restrict the soldiers' mobility too much, this also contradicts protection. They are then unable to react quickly enough. It is therefore important to improve existing protection systems, but this is not easy.

Financial resources naturally also play a role, since high-quality materials are expensive and sensitive. Particular care must be taken with brittle ceramics. In addition, there are many requirements, and the logistical supply capability

also plays a role. Protection systems can be personalised by customising them, for example, using modern manufacturing technologies such as 3D printing. Even ballistic quality ceramics are now possible. However, these customized prints are then only suitable for a specific soldier. Technologically, we are already far advanced in this field, but it is difficult to predict what will actually be used in the future. Our task is to research and build knowledge in this important field, in order to be able to advise the Ministry of Defence and other departments and set the course for the future. Time is an important factor in our considerations. In my opinion, it is unrealistic to assume that we will make enormous progress in a short time, but we must nevertheless keep at it, as we are obliged to provide every soldier with the best possible protection.

**What are the most important projects here?**

With our "Soldier System" innovation laboratory, we are treading a revolutionary path. Our goal is to maximise technological support for soldiers in the context of digitalization. The term "Soldier System" means that we have to take a systemic approach. A simple example: you can develop socks and shoes separately, but ideally the components should be matched to each other. This is especially true for complex military equipment. Protective components must be suitable for seamless combination with other equipment without one interfering with another. Today, the focus is primarily on functional integration, not on the accumulation of bulky individual components. Ideally, soldiers should hardly notice they are wearing technology on their bodies. This should be the goal of new developments.

The "Soldier System" innovation laboratory aims not only to continuously develop existing systems, but also to improve the usability of the systems. It includes research

**Goal:** The best  
protection  
for all soldiers

### Zukünftige Soldatensysteme / Smart Textiles

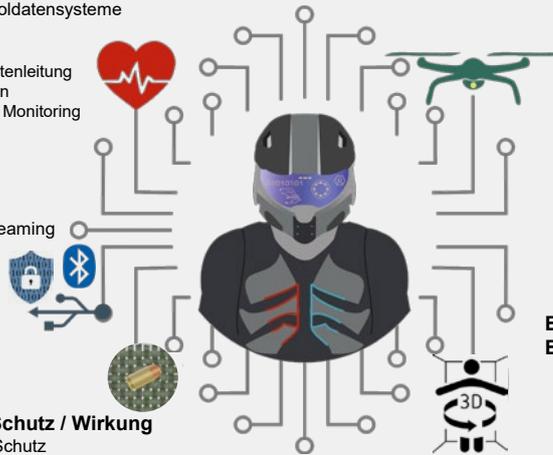
- Verbesserung der Soldatensysteme
- Smart Textiles
  - Heizen / Kühlen
  - Textile Strom / Datenleitung
  - Sensoren / Aktoren
  - Biophysikalisches Monitoring

### Schnittstellen/Visualisierung

- Mensch-Maschine Interface + Teaming
- Kommunikation
- Interoperabilität
- Visualisierung AR / VR / MR
- Big Data / AI / KI / IoT

### Individueller Schutz / Wirkung

- Ballistischer Schutz
- Tarnen / Täuschen
- Verbesserung Wirkmittel (Smart Weapons)



### Systeme zur Unterstützung

- UxV (UGVs, UAVs, ...)
- Elektronische Lastesel
- Schwarmverhalten
- Exoskelette

### Ergonomie & Digitalisierung der Bekleidung & Ausrüstung

- Ergonomische Gestaltung der Bekleidung & Ausrüstung
- Weiteentwicklung Simulationsmethoden
- 3D Scannen von Personen
- Personalisierung der Ausrüstung

in the fields of materials and ergonomics, especially the optimisation of textiles. On the one hand, it is about the continuous improvement of existing systems. On the other hand, we need to think about how things might possibly be completely redesigned, i.e. allowing for disruptive changes. An example of this is the personalisation of body armour systems for female soldiers. This approach is based on the fact that there are often ergonomic problems. It therefore makes sense to design different sizes and customised, i.e. printed, protective plates.



### What are the advantages and disadvantages?

At the beginning of personalisation of equipment for soldiers the process is complex and costly. However, as the number of personalised pieces increases, the effort and costs should decrease considerably. In addition, logistics could be simplified, as there is no need to store numerous different sizes. Protection is produced as needed, for example during the initial medical examination, recruitment or when physical changes occur during service.

The development of new materials is crucial to ensure customised protection with quality on par with the previous system. Radical new developments require thorough investigation and demonstration with our troops in order to discuss the future with decision-makers.

We are pursuing similar approaches in the field of clothing. Digital clothes fitting has been successfully prototyped with a trial group of 50 persons. Instead of going to the Bundeswehr in civilian clothes and being clothed later, recruits can scan themselves beforehand with an app. Computer algorithms then determine the appropriate clothing sizes after the 3D scan, so their clothes are already ready in their locker when they arrive at the barracks. The possibility of direct communication with the clothing service provider via an app also enables quick exchange options.

These innovative approaches result in significant improvements and considerable potential for all involved. With digital clothes fitting, the number of logistical distribution centres can be reduced in favour of central warehouses, which is

▲ Soldier System – thematic fields.

Graphic: WlWeB

◀ Senior Technical Director PD Dr.-Ing. Dr.-habil. Jens Holtmannspötter.

Photo: Bundeswehr / Jara Kürschner

◀ 3D body scanner: for measuring people as a prerequisite for faster provision of suitable uniforms.

Photo: AF



attractive for in-house companies such as Bundeswehr Bekleidungsmanagement (BwBM) GmbH. This opens up radically new avenues, but they cannot be realised by an industry partner alone. Targeted research is necessary.

The challenge is not the procurement or production of 100 or 200 vests or helmets, but of much larger quantities – tens of thousands. Decisions between client and contractor must be well-considered to ensure a smooth transition.

### You have already mentioned modern materials several times. What do you mean by that?

Various materials are well suited to protect soldiers while carrying out their missions, e.g. a helmet made of aramid-reinforced plastic or ultra-high molecular weight polyethylene. Composite structures with integrated ceramic materials are also common in protective systems. The use of composite materials and combinations of materials is well-established, with each material having advantages and disadvantages. Some are lighter, others absorb bullets or shrapnel more effectively or are more resistant to angular bombardment. The choice depends on various factors, such as penetration depth, especially in the helmet area.

▲ Example of modern technology in a soldier system – here a combat vest. Clips can be used to supply power to a wide variety of peripheral devices or to connect them to each other and, as these capabilities are already incorporated into the textiles, without dangling cables. Moreover, such a system increases the flexibility of possible configurations.

► Personalised, ergonomically manufactured protective plate dummies. However, there are a number of things to consider when manufacturing them. For example, the special shape may cause ricochets towards the head, which would be a disadvantage.

Photos: AF

No single ideal material exists, which makes research in this area challenging. It is necessary to focus not only on a specific type of material, but to consider overall developments. An example of this is the fundamental difference between ceramics and polymers with extremely long molecular chains. In addition, not every company has access to knowledge of how to produce these materials. Monopolistic constellations and products that can only be manufactured by foreign companies lead to discussions at other levels. In such cases, a sovereign country has to consider how it wants to position itself.

### How is cooperation with industry? Do you research together or in parallel?

It is crucial that we maintain close dialogue and regular exchange with the industry. WIWeB is active as a funding agency within the framework of defence research & technology and is responsible for targeted research and technology development. We fund joint defence technology studies with industry, usually contributing our own workshare.

Our approach involves not only commissioning specific research services, but also integrating our own work. This usually leads to more comprehensive gains in competence. By involving our own researchers in projects and conducting parts of the research ourselves, we gain much better access to information and knowledge. We are also able to identify the challenges and aspects that are often left out in final reports. Our claim is to work scientifically and to present topics objectively, independently of economic interests. In doing so, we work closely with the Bundeswehr universities and often cooperate with highly qualified scientists who use specialised topics for their doctorates – at a very high level, which is essential.



**You said at the beginning that the WIWeB is a ministerial research institution. What distinguishes it from other research institutions?**

Ministerial research institutions are geared towards conducting ministry-specific research in their field. In our case, we concentrate on materials and supplies as well as the soldier system. This research is usually application-oriented but can occasionally include basic research. Our aim is often to prepare for upcoming developments in order to provide the necessary judgement and advisory capability for the ministry and decision makers. Ultimately, we provide information and insights that enable informed opinion-forming and decision-making.

Despite successful cooperation with industry, the Bundeswehr has proven that it retains its own expertise. A special characteristic of ministerial research is that it addresses topics with a considerable lead time – technologies that may not become relevant for another 15 or 20 years. Our orientation enables us to follow longer-term developments.

In addition, there are highly specialised topics that are not attractive or economically viable for industry to cover. In such cases, the Bundeswehr has to close knowledge gaps and build up its own expertise, as is done here in Erding in the area of materials and supplies.

**What is the hottest current development in protective materials?**

Currently there are no ground-breaking developments in the world of materials that fundamentally change the status quo. Nevertheless, numerous smaller improvements can be seen. These are mainly about optimising manufacturing processes in order to reduce costs through improved geometries, thus providing higher-quality protective equipment.

**Apart from equipment price and volume, a frequent criticism is the length of time required to reach deployment. What is the reason for that?**

Our focus is to provide the soldiers only with defence-related products that they can rely on and that meet the established requirements. For larger orders in the current package of measures for personal protective equipment, protective systems and clothing must be available in large quantities and fit precisely – a reliability the taxpayer rightly expects.

Protecting soldiers requires extensive testing that cannot be accelerated unless one accepts a high degree of risk, which we do not. Material development spans years or decades rather than a few weeks. It is critical to ensure that protective structures, especially bonded composites, maintain their performance throughout their service life, regardless of external influences.



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Climatic testing of equipment involving different materials takes time and cannot be accelerated at will. Defects in equipment could have a negative impact on soldiers, so we place great emphasis on thorough testing procedures.

We want to equip soldiers in the best possible way and therefore constantly test new materials and developments. However, this has its limits, as soldiers expect their equipment to be further developed. Defects in equipment can lead to negative reactions among soldiers, which is why the highest testing standards and safety must be ensured.

**You said that the equipment must also be tested. Can you explain that in concrete terms?**

In procurement contracts, test and acceptance inspections are common components. In the case of defence technology products, the Bundeswehr usually takes random samples or requests samples during quality inspection to ensure the supplied products meet the original requirements. In doing so, the Bundeswehr mainly uses its own resources in the Bundeswehr Technical Centres and Bundeswehr Research Institutes. If necessary, it also draws on external expertise.

▲ Blue Gun pistol for training purposes from the 3D printer. In December 2017, a container with a 3D printer was provided by WIWeB in Mazar-e-Sharif.

Photo: AF

An example of this is the conduct of bullet tests by an official proof house (Beschussamt) during the acceptance of helmets in personal protective equipment. Based on test results, a Bundeswehr Research Institute such as the WIWeB can examine material behaviour in detail, especially if there are conspicuous features. Investigations can be carried out using methods such as micro-CT or scanning electron microscopy to understand the material and structural behaviour. Simulations of the firing process and material behaviour also help to analyse why certain helmets perform better or worse in tests.

The contracts, including the tests, are not drawn up by WIWeB, but by the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw). Tests are carried out by qualified institutes or test centres commissioned by the BAAINBw. External partners, such as the Fraunhofer institutes or the proof houses for verification, can also contribute test results. The testing is carried out using various methods to ensure the products meet the agreed quality standards.

**In the past, the classic steel helmet's main function was to protect against impact and shrapnel. What must a helmet be able to do today?**

A helmet still has to fulfil basic protective functions and, among other things, protect soldiers as best as possible from bullets. Currently, additional functionalities, such as night vision devices, hearing protection and means of communication, are enabled via add-on parts. Therefore, we now speak of helmet systems. The increasing requirements show that separate developments with subsequent connection are not always optimal. Our approach is to integrate systemic thinking.

A future helmet system must offer far more than impact and shrapnel protection – from hearing protection to communication to the visualisation of situation images with technologies such as augmented or mixed reality. It is crucial to consider how these technologies can best be made available to soldiers for their missions. Practical testing and dialogue with future users, the soldiers themselves, play a decisive role in identifying useful additions or further developments. Such practical experiences complement the previous planning considerably, which is why a continuous exchange in the early phases of development and research with the soldiers is necessary.

**Dr. Holtmannspötter, thank you very much for this interview.**

*The interview was conducted by Rainer Krug*

# THERMAL INSULATION FOR OPTIMAL BODY CLIMATE



**For successful missions, reliable equipment is a basic requirement. Clothes in particular take center stage. For an optimal body climate, effective thermal insulation in base and mid-layer clothing is essential for effective protection in cold climates.**

Woolpower's materials and products were developed in collaboration between military, medical personnel, and clothing physiologists over 40 years ago. The aim was to create a system of base- and mid-layer clothing for a wide range of deployment requirements, focusing primarily on covering the following performance parameters:

- Maintenance of an optimal body climate – regardless of external temperatures and the level of activity during deployment
- Washable at 60 degrees Celsius for antibacterial protection
- Comfortable clothes even after extended periods of use

The result was Woolpower's unique material, Ullfrotté Original. It has merino wool for optimal heat insulation, moisture management and comfort and a part of synthetic fibres for increased durability. It uses circular knitting to avoid unnecessary seams, enhance durability and prevent uncomfortable pressure points and friction.

▲ Christian Stjärnered, Head of Tactical-Woolpower HQ Sweden (l.), and Jesper Rodig, CEO Scandic Outdoor GmbH (r.).

► "The decision to build a new factory was made already 2019. This is an investment for the future and to meet the increasing need for high quality, functional and sustainable products on a global market", says Christian Stjärnered, Head of Tactical-Woolpower HQ Sweden.

Photos: Scandic Outdoor GmbH

Woolpower's functional and cold protection clothing has proven itself over many years in diverse fields of application within authorities, industries, and much more. Satisfied users include, among others:

- Mountain Rescue
- NCU – Nordic Combat System (Sweden, Finland, Norway & Denmark)
- BDCS – Belgium Defense Combat System
- Bundeswehr – German Army
- Various state police forces of Germany
- USAF
- US Navy
- NATO Forces

Since the start, Woolpower has produced clothes in our own factory located in Östersund, Sweden. By the end of 2022, our new facility became operational, where over 240 employees oversee all production stages – from knitting to sewing – under one roof.

Our goal is to craft durable products manufactured under responsible and sustainable conditions. Our clothing is timeless, functional, and of exceptionally high quality, steering clear of any disposable mentality.

The resources we use, how we employ them, as well as their purpose demand responsibility toward the environment, people, and animals. We consistently strive for enhancements to ensure our production has the least possible impact on the environment.

Woolpower proves that it is possible to be a leading textile company while keeping the entire production in Sweden, enabling responsible and caring actions toward the world.

ANDRÉ FORKERT

# EU-PROJECT ACHILE PROJECT – Development of the next dismounted Soldier System Generation

In June 2023 the European Commission has awarded a € 40 million grant to the ACHILE (Augmented Capability for High end solDiErs) consortium to develop innovative solutions for next-generation dismounted soldier systems in Europe. ACHILE is one of the main projects of the European Defence Fund 2021.

ACHILE is aimed at bringing a breakthrough transformation for soldier systems, through an open architecture developed for the Preparatory Action Plan on Defence Research (PADR). It will seek to demonstrate enhanced interchangeable capabilities improving all areas of dismounted combat: survivability, sustainability, mobility, localization and navigation, perception and situational awareness, lethality/smart engagement and communication.

ACHILE will develop specific capabilities in four main areas: Soldier Core and Soldier Extension to address capabilities at soldier level, and Team Core and Team Extension to address squad and networking capabilities, as well as robotics and weapon interaction at team level.

#### ACHILE will result in:

- Better protection for soldiers, with lighter equipment and improved ergonomics, a modular approach and optimized Size, Weight And Power (SWAP) capability up to the system level.
- Enhanced soldier performance, in particular for visual and sound perception, and individual situational awareness.
- Augmented team capabilities through network connectivity, shared situational awareness, and coordination with all other units on the battlefield.



▲ EU Flag.

Photo: pexels.com – Viktorya Sergeeva

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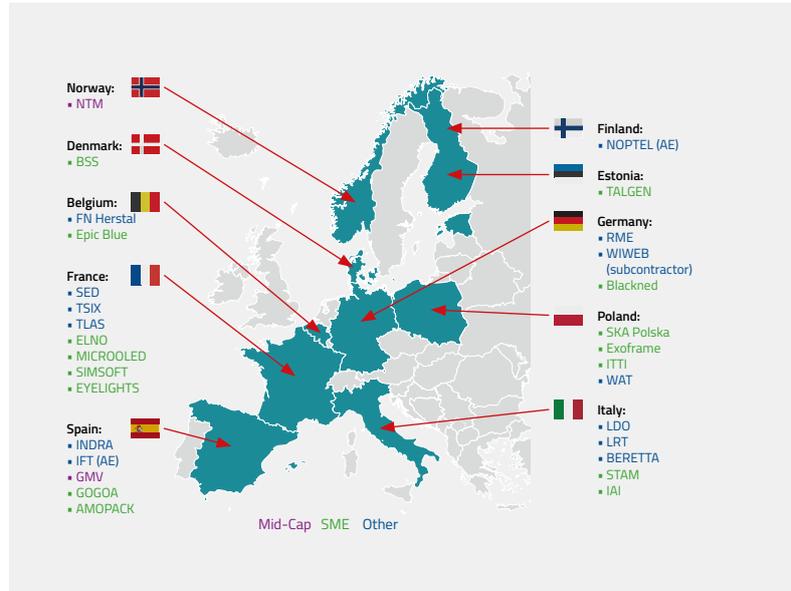
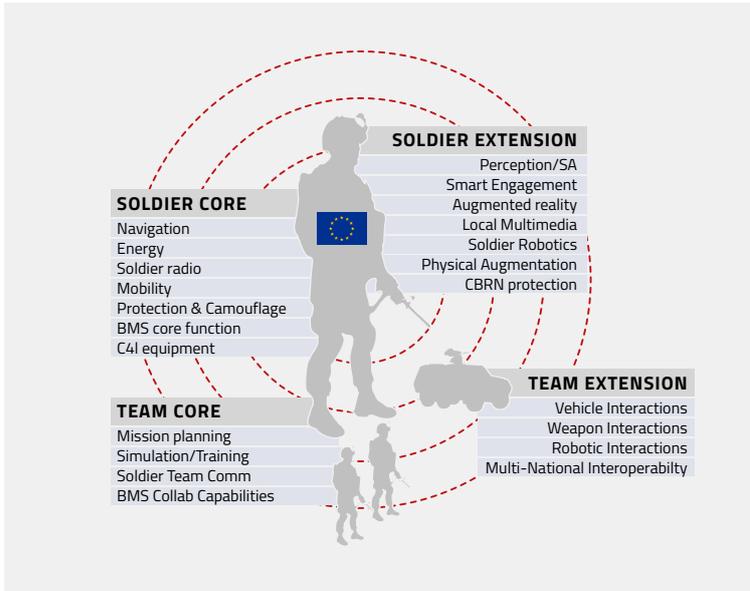
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Safran Electronics & Defense from France is leading the consortium of 30 partners – with close support from Rheinmetall Electronics GmbH (Germany), for technical coordination, Indra Sistemas SA (Spain), and Leonardo S.p.A. (Italy). From June 2023 on, and for the next four years, the consortium will:

- Study and deliver harmonized concepts of operations, and harmonized user and system requirements at European level.
- Develop the standardized open soldier system architecture prefigured with GOSSRA (Generic Open Soldier System Reference Architecture).
- Design advanced soldier system and enhanced capability suites, and evaluate them through technological demonstrators and proofs of concept, including innovative navigation units, head-up displays for augmented reality, weapon sights, and exoskeletons.
- Design networking capabilities and evaluate them through large-scale demonstrations with Battlefield Management Systems (BMS) and communication systems.
- Evaluate full-size demonstrators and prototypes in representative conditions and large-scale demonstrations.

ACHILE encompasses entities from nine EU countries and one associated country (Norway). This consortium covers the full soldier system value chain with a wide range of small and medium-size enterprises, mid-caps, research institutes, universities, and large groups.

Safran Electronics & Defense will coordinate the ACHILE project, supported by the core team, to meet the technical and contractual commitments signed between the European Commission and all involved entities. Through the ACHILE project, the consortium will improve harmonization of standards proposed to member states and thus contribute significantly to European cooperation. Other partners include Elno, FN Herstal, Thales, Simsoft Industries, Blackned, Bionic System Solution, Beretta, SKA Polska and NFM, just to name a few.

- ▲ ACHILE will develop specific capabilities in four main areas (l.).
  - ▲ Participants of the EU ACHILE-Project (r.).
- Graphics: EU

▼ Due to more and more necessary systems and the need for protection soldiers need to carry extending weight. One of the aims of ACHILE Project is to reduce this weight.

Photo: Bundeswehr / Tom Twardy



# PROTECT WHAT'S NEXT

## ADVANCING RADIATION SAFETY. EMPOWERING PROGRESS.

From R&D labs, to critical nuclear facilities, and on the front lines, we provide proven radiation safety technologies that operate at the highest levels of precision, and deliver trusted expertise that empowers our customers to solve problems and enable breakthrough innovation.

Mirion brings together unrivaled expertise in radiation safety with an unmatched range of reliably precise technologies. We partner with our customers to build solutions that fundamentally change what's possible in science, industry and medicine – empowering innovations which have the power to improve lives today and better the human condition for the future.

## MIRION CBRNE PRODUCTS

Military and CBRNE applications have evolved to create a need for enhanced radiological detection equipment used by armed forces. Based on long-term experience and cooperation with customers, Mirion Technologies constantly improves and extends its range of military products, providing new solutions and innovative technologies against new threats to protect global defense forces.

## TACTICAL DOSIMETER / SOR- DOSIMETER

The SOR device is an electronic dosimeter with alarming and direct screen readout, designed to be seamlessly worn. The SOR dosimeter is part of the dosimetry system for contactless field readers and software, to monitor the dose of personnel, tactical decisions, and health protection for operations other than war, and medical records. It's specially designed for military forces and their missions.

## DETECTION AND IDENTIFICATION

Mirion Technologies provides a variety of equipment to detect and identify radiation.



**SPIR-Ident Mobile Platform:** Detector boxes with NaI (TI) crystals of different sizes, GM detector for high gamma dose rate measurements, and optionally BZnS based neutron detectors with the associated electronics.

**SPIR-ACE™:** The SPIR-Ace unit is a versatile Radio Isotope Identification Device (RIID) addressing all applications requiring efficient detection and identification of radiological threats in security applications, including civil defense, border security and customs.

**SPIR-Pack™:** The Mirion SPIR-Pack backpack is ideal for all applications requiring the efficient detection and identification of radiological and nuclear threats.

**SPIR-Explorer™:** The SPIR-Explorer sensor is a lightweight radiation detector designed to be mounted on a UAV/Drone or UGV/Robot for a wide range of applications where radiation detection, measurement, and nuclide identification is needed.

**AccuRad™:** A discreet yet robust gamma radiation detecting PRD designed for law enforcement, fire rescue, and other emergency responders to detect and interdict nuclear and radioactive materials. It also provides dose measurement and alarming capabilities for event response.

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ANDRÉ FORKERT

# EQUIPMENT FOR SPECIAL FORCES





In the domain Wirkung (Effect), the procurement of the G95K light assault rifle for special forces has largely been completed. However, the 40 mm sub-mounted grenade launcher is still missing. Here, the German Kommando Spezialkräfte (KSK; Special Forces Command) is still in the procurement phase. Even though this is already well advanced. As this component was not procured as part of the overall system, it is still missing and will only be delivered after a considerable delay. This approach is being taken primarily to minimise the procurement risk or for budgetary reasons. Until this is finalised, the special forces will now have to compensate for this shortfall by using the G36 with the 40 mm x 46 AG36 grenade launcher or the HK69A1 grenade pistol.

All pistols in the special forces (HK P30, HK P8C and P9A1 (Glock)) will be replaced by the "P14 Special Forces Pistol System". A corresponding invitation to tender was issued at the beginning of 2023. A total of around 6,500 pistols in the basic weapon and compact weapon variants are to be procured.

The G210 short-range sniper rifle project emerged from the G26 short-range sniper rifle project for special forces/field troops, which has been interrupted several times. Around 500 semi-automatic rifles are to be procured. The tender was issued on 20 February 2023, taking up the system concept and considering night vision and ammunition at the same time. The Schmidt & Bender 5-20 x 50 PM II Ultra Short has been selected as the optic. As this is a real sniper weapon, the KSK attaches great importance to the topic of (sniper) ammunition. The calibre should be 7.62 mm, but the classic NATO cartridge 7.62 mm x 51 is not specified. A precision cartridge is required. Therefore, it will probably be an open tip (hollow point bullet). Hollow-point bullets offer first-class accuracy with a long gun. The G210 is also referred to as a "DMR rifle deluxe", i.e. with sniper quality. DMR stands for Designated Marksman Rifle. The semi-automatic rifle is designed to engage fast-moving targets at ranges of 600 to 800 metres. This is particularly relevant with regard to national and alliance defence, as it allows more targets to be engaged more quickly than it would be possible with a bolt-action rifle. In terms of ammunition, this means that the Bundeswehr is (re)introducing precision cartridges. This is because the armed forces no longer actually have them. The Bundeswehr, like many other armies, has been using ammunition from the civilian market. With corresponding restrictions, of course. In the area of tracer or hard-core bullets, corresponding in-house developments even have to be driven forward or restarted.

The "special silenced special forces weapon" (Sonderwaffe Schallgedämpft Spezialkräfte) is currently being tendered. A total of up to 988 rifles are to be procured. The semi-automatic weapon should be able to engage soft and protected targets at



a range of up to 200 metres. The weapon is to be used by both the KSK and the naval special forces KSM (Kommando Spezialkräfte der Marine). One of the requirements is therefore the "over-the-beach" capability. The "over-the-beach" capability is

a design feature of firearms that enables them to be fired even though they have just been in the water. The approved calibres are .300 BLK AAC Blackout (7.62 mm x 35) and 7.62 mm x 39 (calibre of the AK 47). According to well-informed sources, weapons in both calibres are offered for the tender. The semi-automatic must be able to be used with both a silencer (subsonic) and a signature silencer (supersonic). In addition to the weapon, the complete system also includes accessories (silencers and signature suppressors, sights and magazines) and ammunition (soft core, supersonic and subsonic). For the KSM, a main maritime optic is added. This must be submersible to a depth of 24 metres.

The 40 mm multiple launcher still needs to be addressed. A tender is to be issued with a time delay. A long time ago, the KSK once had the 40 mm Milkor MGL (Multiple Grenade Launcher). However, this was not only very heavy, but has long been out of use. The aim now is to procure a product



▲ New KSK reconnaissance system FALKE by Quantum Systems VECTOR drone.

Photo: Quantum Systems

▲ Pistols such as the Walther PDP Compact – OR- and SR-ready – are candidates for the P14 Special Forces Pistol System. Here the PDP has a PDT (Performance Duty Trigger) and an Aimpoint reflex sight. Walther is offering the PDP pistol in a Compact and Full Size. Features of the pistol are a magazine funnel, a tetrahedron design and non-abrasive Performance Duty Texture grip with an optimized grip angle. The weapons can be operated from both sides and offer a choice of two triggers. They can also be offered with a direct cut for a low line of sight.

Photo: AF



that is available on the market, including aiming aids. The new multiple launcher can also fire medium velocity (MV) cartridges and thus also have a longer range effect and utilise capabilities such as ground or air burst. There are several current suppliers available on the market, for example the HYDRA launcher from Rheinmetall, the Milkor Supersix Multi-Range Grenade Launcher (MRGL) and others. In comparison, the AG36 sub-mounted device or the grenade launcher can only fire low-velocity (LV) cartridges.

## DRONES

At the end of September 2023, it was announced that the KSK would be introducing the VECTOR drone from Quantum Systems as the FALKE reconnaissance system (Ferngeführtes Aufklärungssystem, Luftgestützt, Kurze Entfernung; English: remote-controlled reconnaissance system, airborne, short range). The Vector reconnaissance drone, which is capable of vertical take-off and landing, will provide the KSK with a market-ready tactical reconnaissance system that is optimised for its operational spectrum and meets the requirements in terms of range, flight time and sensor capability.

Vector enables precise reconnaissance over a distance of up to 30 kilometres with a flight duration of up to three hours. The integrated RAPTOR combined sensor is equipped with an optical and an infrared camera and can be used day and night, in all climate zones and under challenging environmental conditions. This drone has already been delivered to the Ukrainian armed forces.

The command now has a second reconnaissance system in addition to the AR100-H MIKADO (micro reconnaissance drone) modular drone system from Airrobot GmbH & Co. KG (part of the Nordic Unmanned Group). The latest version AR100-H MIKADO was procured in 2022 as a replacement for its predecessor AR100-B. The AR100-H system is a foldable, small drone with a modular design.

All relevant components can be replaced in a few simple steps and without the use of tools. It is a flexible, lightweight and low-noise drone system that can be used for reconnaissance day and night and in all weather conditions. The Special Forces Command also uses the Black Hornet PD-100 nano-drone from FLIR Systems. This helicopter-like drone weighs just 18 grams, has a flight time of 25 minutes and a range of up to 1,500 metres.

However, there is not only a need for reconnaissance equipment, but also in the area of unmanned aerial vehicle (UAV) effectors and drone defence. For the latter, the SMASH X4 fire control system was procured from the Israeli manufacturer Smart Shooter for small arms as an infantry counter-UAV system. This system is used for close and close-range combat and is used in the KSK on the G27. Jammers or other commercially available roof-mounted solutions, which are mounted on a 4x4 vehicle or quad bike and then offer effective ranges of several kilometres, will be added later.

What is still completely lacking is the effector sector, i.e. drones with active effectors or loitering ammunition. A look at Ukraine shows that around 10,000 UAVs are used/lost there



every month. These are reconnaissance vehicles, loitering ammunition or "repurposed" civilian DJI-type drones with active effectors (e.g. hand grenades, etc.). In the case of national and alliance defence (LV/BV), the special forces, but also the normal armed forces, would not be able to fight with the quantities currently procured. Replenishment would have to take place quickly and en masse. So far, drones have been regarded as non-expendable supplies, but they are not. On the contrary, Ukraine shows that they are mass-expandable supplies. But this is now to be remedied. A workshop was held in February 2023 to draw up a corresponding project plan. However, this must now also be implemented. A drone task force has also been set up at the level of the German Federal Ministry of Defence (BMVg). The aim is to quickly procure market-available systems in the field of effector drones and loitering ammunition. With regard to Ukraine, it appears that the turnaround has not yet arrived in all areas and in procurement. Not even for the Special Forces. We are still thinking and procuring as we did in peacetime. Especially when it comes to authorising the use of drones and loitering ammunition. Civilian regulations – such as airspace regulations or authorisations for civilian airspace – are standing in the way.

▲ KSK with some of its Land Vehicles – AGF SERVAL, LL UTV and Quad Grizzly 450 EPS – some of them have to be replaced.  
Photo: KSK

► The SOV3-MM2 will change from an interim solution to a second available system to offer more flexibility to KSK.  
Photo: CPS

Another issue is the so-called cargo drones for the remote supply of deployed forces. And that over several hundred kilometres. These drones must have autonomous or semi-autonomous properties for this purpose. And this has to be supported by artificial intelligence (AI). The cargo drones should be seen as a supplement or replacement for the self-steering cargo glider system (SLG Sys). This is because once Special Forces or airborne forces have been deployed and started their missions on the ground, a follow-up supply must be provided after a few days at the latest. This follow-up supply can include weapons, ammunition, food and water, spare parts or adaptive protection for vehicles. Transport helicopters with external loads or door loads from fixed-wing aircraft can be used for this purpose. Depending on the type, the transport helicopters are limited in range or payload.

The door drop may be too inaccurate, or the aircraft may not be able to enter the area of operation at all, as the enemy air defence prevents this, keyword: Anti-Access Area Denial (A2AD). In order to ensure a supply nevertheless, self-steering cargo glider systems (SLG Sys) can be used. They supply the troop units with material at a distance, even small, detached units. However, the Bundeswehr has not made any progress on the SLG Sys project for almost 15 years now. Here too, concerns and technical authorisation regulations stand in the way. Germany is standing in its own way and is not meeting the requirements of the battlefield. A turning point looks different. Other nations have been using such systems for their Special Forces for years now.

The topic of AI (Artificial Intelligence) will be relevant in all areas in the future. It is not just about processing and analysing mass data, but also about controlling autonomous and semi-autonomous processes. Thanks to AI, decision-making processes or the sensor-to-shooter cycle will become significantly faster. Therefore, the area of AI is definitely worth working on. Thanks to AI, the speed with which procedures and processes can be designed today can be significantly increased. This means that decisions can be made more quickly – if necessary still by a human. These are prepared in advance by stored algorithms. Without AI, the user is too slow and can no longer keep up with the functional chain of command, reconnaissance and enemy action. Here too, Ukraine shows that what used to take half an hour can now be realised in just a few minutes.

### LAND VEHICLES

The reconnaissance/combat vehicle (AGF; Aufklärungs-/Gefechtsfahrzeug) 2 is to replace the AGF SERVAL. There have been some delays in the project. The Dutch company Defenxure B.V. is developing the tactical vehicle for the German Special Forces. The 8.8-tonne Mammoth platform is based on the proven Ground Force Platform (GFR) 5.12, which is in use as an Air Transportable Tactical Vehicle (ATTV) Versatile Expeditionary Commando Tactical Off Road (VECTOR) with the Dutch Special Forces (Korps Commandotroepen) and airborne forces (11 Luchtmobiele Brigade). The KSK is now expecting to receive the first two verification models in January 2024, with cold weather testing to follow in spring. The "medium special forces vehicle family" is made up of three different versions: the reconnaissance/combat vehicle (AGF-2), the fire support vehicle with a 20 mm automatic cannon (AGF-2-MK) and the command support vehicle (UFK). They all use the same vehicle base. For a long time, there was also the Fast Attack Vehicle in the light to medium vehicle group. However, this project is no longer a priority now that the focus is on LV/BV. This vehicle is more orientated towards HRO (Hostage Rescue Operations).

The Special Forces of the Bundeswehr are also among the users of the light airborne utility terrain vehicle (LL UTV). This is the Polaris MRZR-4D. It is also used to regenerate a wide range of vehicles. Replacements must be found for the Polaris Ski-Doo snowmobile, the Bv206S oversnow vehicle – which will be replaced by the joint project Collaborative All-Terrain Vehicle (CATV) or BvS10 from BAE Systems Hägglunds – the Yamaha Quad Grizzly 450 EPS or the KTM WR450F motorbike.

The special forces will also receive the Rheinmetall CARACAL vehicle as a replacement for the Airborne-WOLF (Mercedes-Benz G-Modell). The KSM also uses the Polaris MV 850 quad bike.

### VERTICAL DEPLOYMENT

The T-10 troop parachute, which is over 50 years old, is being replaced by the EPC-B (Ensemble de Parachutage du Combattant) across the German armed forces, including the Special Forces. In the area of parachute systems, the TW-7 (training and exercise) and TW-9 (deployment) parachutes are used across the board. However, these no longer meet the requirements of the Special Forces. Well-informed sources tell us that the KSK is very well positioned with the current interim solution, the Special Operations Vector Multi-Mission (SOV3-MM2) parachute from the US manufacturer Complete Parachute Solutions. This interim solution has now been extended once again with the procurement of additional systems. The trials for upgrading and full authorisation for use have been completed. They can also be used from the Airbus A400M and Lockheed Martin C-130 HERCULES aircraft. The advantage of the gliders is that the KSK soldiers can already use any US aircraft as a drop platform without any preparation. The system is supplemented by the PHANTOM breathing gas supply system from the manufacturer Cobham. The SOV3-MM2 is a 5-in-1 solution that enables self-set drogue, static line drogue, double bag static line (DBSL), bottom of container (BOC) hand-deploy and over-the-shoulder (OTS) ripcord deployment. The harness offers eight weapon and load attachment points. The maximum suspended weight should be 454 kg and the maximum altitude for deploying the main parachute is 10,668 m (minimum altitude 762 m).

However, the interim solution is now to become a second (parallel) permanent solution. This is because the KSK wants to keep the system in use. In parallel, the "Tactical parachute system, modular" (Taktisches Gleitfallschirmsystem, modular) is being developed for cross-sectional use in the Bundeswehr. This is scheduled to be operational from 2025. The first trials are running. In addition to the actual parachute systems, the project also includes a breathing gas supply for jumps from great heights – Oxyjump NG (New Generation) from Collins Aerospace. According to the company, the proprietary oxygen pulse technology of the Oxyjump NG system

increases the range of applications through a longer gliding distance, improved safety of the jumper, is easy to operate and offers significant size and weight advantages over previous systems. The technology is said to have already been certified by a NATO user state. According to the company, the two-cylinder system (200 bar) with a compact form factor can be used at altitudes of up to 10,000 m (33,000 ft). For a longer oxygen supply during ascent and descent, it switches automatically when the pressure of the ascent cylinder falls below 4 bar.

The dual use of the US system and the "Tactical Parachute System, modular" makes the KSK more flexible. Even if one system should be grounded.





### MARITIME TRANSPORT

The KSK has so-called 4- to 6-man boats and corresponding air-transportable equipment. No other projects are currently in progress for the KSK. The KSM is due to receive new RHIBs/hull inflatable boats from 2025. This project has also been delayed for some time and the capability requirements were recently reduced once again. The new boats are intended to replace the RHIB H1010.

### CLOTHING AND EQUIPMENT

Perhaps one of the most important projects in the Special Forces is the clothing system, also known internally as BDU 2.0 (Battle Dress Uniform). KSK wants to introduce a new, holistic and highly compatible clothing concept. This will utilise the latest technological developments and lead to ergonomic and modular garments that take functional and physical interfaces into account. All existing individual components should be harmonised in such a way that the weight of all subsystems is kept in mind. The system must enable the soldier to select garments according to mission profile, activity level and weather. The system has different modules, e.g. a basic module, a cold protection module, a moisture protection module and a special module. But here, too, there is currently no budget allocation. The KSK is therefore also using an interim solution for the operational clothing. From 2025/26, however, the BDU 2.0 project should start with the basic module.

The project also stands for the system concept and a system family. A similar fate applies to the "Special Forces Bundeswehr rucksack family" project. Here, too, the budget is currently lacking.

### COMMAND AND CONTROL

One of the biggest challenges for Special Forces – as for the army as a whole – remains command and control (C2) capabilities. This includes the issue of cryptography – both nationally and within NATO.

As the tactical level of Special Forces is not or only marginally considered in the digitalisation of land-based (D-LBO) operations, this gap must be closed by the "Special Forces Telecommunications Equipment" project.

Advance procurements were carried out for the NATO operational commitments NATO Response Force (NRF) and VJTF (Very High Readiness Joint Task Force). US support was utilised here. However, the equipment must be returned and replaced by national procurement. This will enable all current obligations to be fulfilled in the first instance. The L3Harris AN/PRC-160 (V) Wideband HF/VHF manpack radio is probably the main issue here.

The PRC-160 Software Defined Radio (SDR) shortwave radio with up to 120 kb/s changes the known possibilities offered by over-the-horizon (BLOS) radio. With the introduction of the wideband ALE4G waveform, even higher data rates will be available in the future, according to the manufacturer. Cognitive waveforms are designed to automatically avoid enemy interference or make transmissions almost impossible to detect by taking appropriate measures (LPI/LPD). This has yet to be proven by the Bundeswehr, among others, through operational testing. The VHF multiband capability or the connection via the network interface also makes the radio fully interoperable with PRC-117G, which is also in use by the German Armed Forces. The AN/PRC-160(V) DE-1 can be expanded to include an extended radio station by coupling it directly to the AN/PRC-117G via the network interface.

An advantage that is multiplied by the widespread use of these devices in NATO and associated countries. The AN/PRC-160(V) offers a data speed 10 times faster than the Bundeswehr's existing HF radios and features software-programmable L3Harris Sierra II encryption, which provides secure interoperability up to NSA Type 1 encryption level between the United States and allied forces. It can transmit voice, data and text.

Additional L3Harris PRC-117Gs were also procured for the NRF and VJTF.

The "Special Forces Telecommunications Equipment" project is still in the middle of the armament process. Among other things, it is intended to replace the Thales PRC-148.

▲ The KSK is to receive 16 systems of this parachute deployment system for special forces inflatable boats. Initial tests began at the end of 2023.

Photo: Bundeswehr / Rauchecker

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ANDRÉ FORKERT

# LAND MOBILITY FOR SPECIAL OPERATION FORCES



The return to national and alliance defence in the Western Hemisphere has consequences for training, personnel, material and tactics – not limited to any one troop category. Many countries are currently reviewing the capabilities that Special Operations Forces (SOF) and infantry need in order to be ready for national and alliance defence in the future: this has implications for training and equipment in all domains.

Light Land Units must be fast and highly mobile on land, as well as airmobile, and the community therefore needs highly mobile vehicles with reduced visual, noise and electro-magnetic signatures. Additional needs include connection to a Battle Management System (BMS) at higher command levels, as well as an appropriately integrated power supply to accommodate the necessary radio equipment, sensors and effectors.

Future motorisation also plays an important role in current development of land vehicles. For example, test vehicles are being developed and built that use classic combustion engines, but also incorporate a hybrid/electric or a purely electric drive. In the case of hybrid and purely electric drives, care will have to be taken to ensure that they can still be transported as internal and external loads in aircraft and helicopters, despite the potential hazards posed by batteries.

The British Army is currently having four of its (standard) Land Rover Defender 110s in use converted for testing. The Babcock International Group is responsible for this in cooperation with ElectroGenic Ltd. These four Defender E90s will then be subjected to intensive testing. The kit used corresponds to the adapted civil HV kit version. The Defender E90 will then have an electric drive with 150 kW, 900 Nm at the transfer case, a maximum speed of more than 85 mph and a range of more than 150 miles according to the manufacturer. The battery has a capacity of 93 kWh.

## INNOVATIONS

During Eurosatory 2022 General Dynamics European Land Systems (GDELS) Mowag presented the MERLIN 4x4 and an open EAGLE V as a commissioned study for Danish Special Forces. MERLIN is based on the proven DURO vehicle family. Thanks to this platform and a version with a length of 5.1 m (height 1.86 m), the vehicle can be designed in many different variants. A transport variant with a payload of 1.7 tonnes is required, as well as a troop carrier for 2+8 soldiers. The SOF EAGLE V in an open variant for the Danish armed forces is called EAGLE Recce Open, featuring a gross vehicle weight of up to 11.5 tonnes, with an extremely high payload. Despite the open roof design, the vehicle has a rotating ring mount for heavy weapons.

The Rheinmetall CARACAL is the new German-Dutch airborne platform (Luftlandeplattform). It is based on the ENOK Airborne (AB) from ACS Armoured Car Systems GmbH, already

in use in the Czech Republic, Hungary and Cyprus for special and airborne forces. The chassis (model G 464), engine and drive train are from Mercedes-Benz. ACS has built a modular aluminium frame onto the special Mercedes-Benz chassis, intended to provide the necessary weight reduction as well as flexibility for the different weapons fits. The system was



previously developed by ACS for the Swedish armed forces, at which time it was used for an LAPV 6x6. The vehicle, combining a steel floor with an aluminium frame, is air-loadable as either an internal or external load. The frame solution offers a high degree of modularity and, according to the company, is simple, robust, scalable and cost-efficient – a comparison can be made to IKEA kits. The vehicle has a maximum weight of 4.8 tonnes and can accommodate four soldiers in its basic configuration. A total of 15 variants is planned. CARACAL has been firmly commissioned with variants 1 and 2 up to now. Both actually have no difference, it is the shown 4x4, which can be adapted to many roles via kits. Variant 2 is identical, but in the ambulance variant. Germany then wants a material transport and a group transport version on 6x6. ACS is also working on a long-wheelbase version (not for the Bundeswehr) for logistical tasks, a protected variant, a pickup and one for direct fire support.

ACS Managing Director Sebastian Schaubek explained: "The requirements for future SF vehicles will change as the orientation of the military changes again. Instead of Internationalen Krisenmanagement (IKM – international crisis management), the focus will be on national and alliance defence. Mobility will remain very important for SF. At the same time, they will need modular mobility solutions to be able to take on a broad mission-specific range of tasks. Ideally, these vehicles will blur into the regular force."

A competitor in the same class is the Dutch manufacturer Defenture with the Ground Force (GRF) 5.12. The vehicle has an empty weight of 2.5 tonnes, with a maximum gross weight of 4.7 tonnes, and is already being used by Dutch

◀ Polaris DAGOR with the light weapon system Electro Optic Systems (EOS) R150 by DIEHL Defence and a four-times SPIKE launcher at the flat bed.

▲ The CARACAL will be the new backbone of the German and Dutch Airborne Troops and Special Forces.

Photos: AF

SOF as the Air Transportable Tactical Vehicle (ATTV) VECTOR, with whom it is currently undergoing final testing and adaptation. The GRF 5.12 has a fording depth of 750 mm and a ground clearance of 340 mm.

Germany, Sweden, the Netherlands, Northern Ireland and Great Britain will jointly procure the Collaborative All-Terrain Vehicle (CATV) as a successor to the Bv206 and VIKING over-snow vehicle. In addition to mountain troops, the SOF of many nations also use the BAE Systems Hägglunds Bv206. Bearing in mind possible missions in the Arctic or on NATO's northern flank in Norway, Sweden and Finland, this vehicle is once again of great importance. In Germany the CATV will be called BvS10, and 367 vehicles have been ordered in two lots with deliveries between 2026 and 2030. Germany has a calculated need of 600 BvS10.

IVECO Defense Vehicles (IDV), together with Dutch Military Vehicle (DMV), is offering the ANACONDA 4x4 SOF vehicle, based on the Military Utility Vehicle (MUV) family. The platform can be adapted to the needs of different Special Forces applications, including for fire support, as a rapid attack vehicle, materiel or personnel transport, ambulance, etc. It can accommodate a maximum of 2+8 soldiers, has an empty weight of 4,000 kg and a payload of 3,700 kg.

### **A LOT OF MOVEMENT IN THE MARKET**

Almost all countries have recently renewed their ground vehicle fleets or are in the process of doing so. Australia, for example, has just replaced its Land Rovers with Supacat Jackals, as used by Britain's SAS, among others. The open vehicle is protected, has underbody mine protection, and weighs 5.5 tonnes. Thanks to its size and capabilities, long range patrols of two weeks or more can be carried out. The SAS also uses OCELOT Foxhound vehicles.

Belgium recently procured the Light Tactical Transport Vehicle (LTTV) from the British manufacturer Jankel. It is based on the UNIMOG U5000 and will replace the ageing Mercedes UNIMOG 1.9T 4x4 JACAM vehicles. Jankel offers a protected cab (including a split windscreen) and a multi-functional flatbed to accommodate various "mission modules" on the Mercedes-Benz chassis.

These modules can be integrated quickly and easily as pallet or container variants, thanks to standard ISO fastening. The vehicle has protection level 1 (STANAG 4569) and can be upgraded to level 2, according to the manufacturer. The empty weight is 6.5 tonnes, and it can carry up to 3 tonnes of payload. It is intended for use as a long-range reconnaissance or mother-support vehicle. Belgium has ordered 199 of these vehicles for its Special Forces. Other countries use the standard Mercedes-Benz UNIMOG in protected or unprotected variants as a mother-support vehicle, to follow smaller combat and reconnaissance vehicles with additional equipment, ammunition, water and food.



Belgium also has the Jankel Group's FOX Tactical Utility Vehicle (TUV) in use. It is based on the Toyota Chassis Landcruiser 79 and serves SOF for covert operations. With the air-transportable Fox RRV (Rapid Reaction Vehicle), Jankel already supplies 100 lighter SOF vehicles to Belgian Special Forces. The new platform will have full interoperability with the Fox RRV fleet, procured since 2015. The Fox RRV uses a reinforced the Toyota Hilux chassis.

The Polaris Defence vehicles MRZR D2/4, MRZR Alpha and DAGOR (Deployable Advanced Ground Off-Road) are in service with Special Forces worldwide. The latter two variants in particular are currently being tested by other European nations. The first airborne Utility Terrain Vehicle (LL UTV) MRZR D4 has just been delivered to the German airborne forces, where Kommando Spezialkräfte (KSK), Fernspäher (Long Range Surveillance Unit, LRSU) and regular Airborne Troops are already using them. All German Polaris vehicles are tactically and road-legally converted by Diederich Engineering Systems Defense (DES) GmbH.

End of 2023 Polaris Defence presented the latest family member of its LTVs (Light Tactical Vehicle), a Polaris ALPA 6x6. According to the US manufacturer, the project started as a technical exploration project and is now a proof-of-concept. The main goal with the ALPHA 6x6 is to offer more payload. The target groups for this vehicle are infantry, naval and airborne forces as well as special forces.

Overall, many manufacturers are developing 6x6 variants of their vehicles in order to offer more space and, above all, payload with almost the same size. ALPHA 6x6 is said to offer a significantly higher payload of 3,000 pounds on the flatbed than the smaller ALPHAs. For comparison, the ALPHA 2 has a total payload of 1,400 pounds, the ALPHA 4 of 2,000 pounds (600 pounds on the flatbed). Also, thanks to additional payload and space, the vehicle can open up new operational concepts. For example, by accommodating other, larger or heavier weapon systems – launchers for Unmanned Aerial



▲ EAGLE Recce Open by GDELS-Mowag for the Danish Special Forces.

◀ The Defecture GRF 5.12 of the Netherlands Special Forces carrying an electrical bike for RECCE-Missions and silent approaches.

Photos: AF

Vehicles (UAV), counter-UAV systems, canisters for loitering ammunition, mortars, etc.

In addition, US Special Forces will receive the GDELS PANDUR Evolution 6x6, designating it the Armoured Ground Mobility System Heavy Platform Vehicle (AGMS). They are to replace the PANDUR 6x6, which has been in use for more than 20 years. Weighing about 18.6 tonnes, the PANDUR Evolution, including additional armour, offers a protection class according to STANAG 4569 Level 3 ballistic and more than Level 3 mine protection. By using the same turret as the demonstrator of the German Air Mobile Weapon Carrier (LuWa) from the

Slovenian company VALHALLA, a vehicle of this class can be equipped with autocannon (for example, 25 mm x 137) and loaded into the C-130 HERCULES without dismantling the turret. According to well-informed sources, the German KSK and the Austrian Jagdkommando are also considering the procurement of vehicles in the same weight class.

For Europe, Messer Waffenhhandel, based in Germany, is the new distribution partner for US manufacturer BC Customs, which builds the lightweight SRTV-SXV (Search and Rescue Tactical Vehicle Side by Vehicle). This vehicle has been in use with US Air Force Special Forces since 2021, mainly because it can also be transported as an internal load in a Bell-Boeing MV-22 OSPREY – alongside the Boeing CH-47 CHINOOK and Sikorsky CH-53. So far, 300 vehicles have been delivered, and another 300 are under contract. In addition, it is highly mobile and can be dropped by cargo parachute. According to

the manufacturer, the vehicle also has a convincing payload of around 1.5 tonnes, with an empty weight of 1.5 tonnes. Variants can fill the breacher or assault vehicle roles (with a weapon station up to 30 mm MK) or for the pararescuemen of the USAF Special Operations Command (AFSOC) with four stretchers for prone wounded. Messer will offer sales, including workshop service, in Europe. A hybrid version with diesel-electric drive will also be offered, which considerably increases the range of the troops. Caterpillar tracks are available for difficult terrain.

### SENSORS, EFFECTORS & CAMOUFLAGE

All these vehicles fulfil a single function: mobility platforms. They are only a means to an end, gaining effect only through the cargo they transport – first and foremost, commando soldiers as the most important (weapon) system. In addition, there are sensors for reconnaissance or electronic combat and, finally, effectors to achieve a direct effect. The market is enormous, so only a few examples can be mentioned here. First of all, special forces and their means of transport should remain undetected. For highly effective camouflage, there are systems such as the BARACUDA Advanced Camouflage Systems from Saab, customised for each platform. These systems are used in more than 24 countries, including Germany. The 3D material consists of a textile matrix in order to fully use the properties of the active materials. The design creates a non-snagging, easy to use system, supporting fast and safe operation. Saab's camouflage solutions offer multispectral capabilities against a wide range of sensors: visible, IR, thermal imager, etc., and also reduce the heat inside the vehicle, which is an important factor in mission areas like Africa. Another supplier of multispectral 3D camouflage is Saro GmbH with its GHOSTHOOD brand from Germany. In addition to camouflage nets, it also offers systems for vehicles. The solutions protect against vision (VIS), near-infrared (NIR) and far-infrared (FIR) detection. The mobile vehicle solutions can be applied to platforms from motorbikes to IFVs or battle tanks. There are different versions, such as static systems with a turning function and two different camouflage patterns



(e.g. 12 kg for 5.8x8 m), or an ultra-light version with a total of four camouflage patterns and a weight of 5 kg for the same size. These can be attached in less than two minutes, or removed in less than 30 seconds in an emergency. They also offer a very small pack size. Similar versions also exist as a "mobile system", which can then be used on the move once attached. There are light (4 kg for a G-Class) or heavy (12 kg) versions, each with a turning function. GHOSTHOOD customises the mobile systems to fit a specific vehicle. "Modern 4x4 vehicles are fully equipped with a lot of high-tech equipment, but the space in aircrafts as well as the vehicle itself is limited. Since classic camouflage is heavy and bulky, a new generation of camouflage is needed. Ultra-light and compact solutions replace old school systems while offering the same or even better camouflage. Soldiers in direct surroundings or dismounted also need to be camouflaged. Therefore, vehicle camouflage solutions for Special Forces should be a multipurpose tool with the thread of drones and thermal devices in mind", says Konstantin Möller, Development & Sales Manager at Ghosthood. In order to be able to approach the reconnaissance target even more closely and quietly, electric bicycles and motorbikes are now carried by 4x4 vehicles. Close to the reconnaissance target, the commandos can switch from the four-wheeler to the two-wheeler, and cover the last few kilometres quietly. Some manufacturers



have already been mentioned above, but the market is now quite large. DES from Germany, for example, designed an electric bike that can be delivered by parachute. This idea is not entirely new, because the British Welbike, developed in 1942/3 for Special Forces, was a light single-seat folding motorbike that could be dropped by parachute when packed in a container. Many were used by airborne troops in Arnhem during Operation Market Garden in 1944.

ACS has taken over the exclusive military distribution and adapts the electric motorbikes from Electric Motion from France to the tactical demands of Special Forces. Silent rides combined with extreme acceleration bring tactical advantages. An approval with a higher payload was obtained for the Bundeswehr. The e-bike bears the name "EMU" at ACS, and can be ridden with a 125 cc driving licence. The battery has a range of 40 km and can be easily replaced in seconds. Thanks to its 80 kg dead weight, it can easily be carried at the rear of a 4x4. It is in trials with the German Fernspäher in Schwarzenborn. Other suppliers of military electric motorbikes are Zero Mo-

torcycles from the USA and SurRon from Austria. So far the German Special Forces are using the not-electrical and not silenced Yamaha WR450.

Another important aspect of the equipment is the inclusion of various sensors and command devices. In terms of sensors, the spectrum ranges from optical, through electro-optical, to acoustic or radar devices. It is becoming increasingly important to reduce the size and weight of sensors in order to make optimum use of available vehicle payload. To increase the range of the sensors, mast systems are now also being integrated into the vehicles. This is a challenge, especially for smaller, lighter platforms. As was heard at the KSK Symposium 2022, the integration of mast systems as sensor carriers has been decided or is planned for almost all KSK vehicles in the future. Zippermast GmbH had recently conducted tests in the alpine operational area on the MRZRD4, together with the KSK. Mast systems must show flexibility by being used on different vehicles with different sensors (Safran JIM LR, radar systems, Thales SOFIE, etc.) as well as in remote use – dismounted – with an effector for drone defence. The range of sensors that can be integrated must include the systems already available in the respective armed forces. Acoustic shot detection, such as that of Microflown Avisa or the APV (Acoustic Protection for Vehicles) shot detection system from Rheinmetall Electronics, are also included. Another provider of heavy-duty mast systems is Will-Burt.

▲ Camouflaged protection by Ghosthood on a 4x4.

Photo: Ghosthood

◀ Electrical bike EMU by ASC is currently tested by the German Fernspäher. Well-informed sources also say that the EMU was delivered to Ukraine.

Photo: Bundeswehr / DSK

HENDRIK ENGELHARDT & ANDRÉ FORKERT

# TRENDS FOR SMALL ARMS SHOOTING TRAINING



In this article, the authors present the key points of current official firearms training. The main features of modern firearms training, the training facilities and the available training equipment are presented. This gives the reader a first impression and starting points for delving deeper into the subject.

### MODERN MARKSMANSHIP TRAINING

In view of current events in the world, it must be noted that individual small arms equipment must continue to make a decisive contribution to the ability to assert oneself and protect one's own forces.

Small arms within the meaning of this article are pistols, sub-machine guns, rifles, shotguns, machine guns and grenade launchers and their subcategories (e.g., assault rifles, rifles with scopes, universal machine guns, sub-mounted grenade launchers). Systems that only use "Less-Lethal" effectors, such as Taser or FN 303 Tactical, do not initially count as small arms, even if they are used in a comparable manner.

The small arms equipment of each member of an organization is determined as part of an overall concept for fulfilling the mission. Armed forces continue to rely on semi-automatic and fully automatic (assault) rifles as their basic armament.

These are supplemented by small arms with a special mission. In the infantry, the machine gun is the mainstay of firefighting. Pistols are increasingly used as cross-sectional secondary weapons for self-defense when the main armament fails or is no longer usable. Overall, a mix of weapons from all small arms is common for dealing with various tasks at all levels.

In the case of police authorities, the pistol tends to serve as the primary weapon and the submachine gun, shotgun or, increasingly, the rifle as a supplement to the armament of a vehicle crew. In Germany, there is a clear trend away from the submachine gun towards the rifle with greater range and effectiveness potential. These are referred to as medium-range weapons and are usually semi-automatic.

Members of the armed forces and security authorities (e.g., federal and state police forces) must be able to bring the potential of their small arms to bear at all times. This also includes "Less-Lethal" effectors fired from small arms, such as 40MM impulse cartridges. Despite all of today's technological advances, this requires basic and well-founded firearms training.

The objective of all firearms training must be to enable as many members of an armed force or security authority as possible to use their small arms successfully in accordance with their mission and with an acceptable use of resources. This means hitting the first shot as quickly as possible according to the motto – "Whoever shoots faster and hits better wins!" – is still THE training objective.

The training required for this is based on the respective operational doctrines and basic training documents. The basic document for all firearms training should be a concept that defines the objectives, content, structure and basic procedure, responsibilities and structures for the sustainable maintenance and development of skills.

This concept is followed by the necessary training documents, e.g. for the training on the respective weapons and for the training of the instructors. In addition, it may be necessary, especially in larger organizations such as armed forces, to define the integration into the overall training in separate documents, because small arms firearms training can never stand alone. It must be an integral part or element of an operational concept and thus also of the corresponding training.

The objectives defined in the concept must follow those of an overall concept for fulfilling the mission of the respective armed force/organization. These must be formulated in such a way that they can be fulfilled by all parts of the respective organization.

The practical content of the firearms training specifies how the defined training objectives are to be achieved. The minimum content of the shooting training must be:

- stringent, practice-oriented safety education that leads to personal responsibility,
- development of confidence in action and handling,
- solid teaching of the basic elements of shooting technique, through to application under the most extreme conditions,
- a target engagement procedure which combines safety, elements of basic shooting technique and the combat technique of the individual shooter and
- practical training on small arms over their entire range of use.

The content should be described as fundamentally as possible and yet in as much detail as necessary. The structure of the firearms training should show how the content is didactically organized to achieve the objective. For example, bundling content into modules is widespread. The organization of content into modules has proven itself internationally. These can also be easily adapted without calling into question the overall structure of the concept or even causing it to collapse.

The established basic sequence of the firearms training describes, for example, how the modules are to be run through methodically and sensibly as part of the training. At the same time, the sequence must provide the instructors with sufficient leeway to be able to react to changing framework conditions.

◀ Marathon Targets not only offers autonomous 3D personal targets, but also a 3D car for shooting training.

Photo: Marathon



In addition, the responsibilities for firearms training in the respective organization must be defined in the concept. Shooting training can only be carried out sustainably and developed in line with requirements if responsibilities are clearly defined. For larger organizations, a central, organization-wide and decision-making pooling of the necessary expertise for firearms training can be helpful.

It is also helpful to define a professional hierarchy. This should contain a definition of the qualifications to be achieved and the authorizations granted to users, instructors, instructors' instructors and a top function in firearms training.

The fact that firearms training on small arms is always individual training should not be neglected. When it comes to further training within the framework of operational doctrine, e.g. within the squad, group, platoon or company setting, individual

firearms training becomes less and less important. There is a shift to training in combat techniques, tactics and operational procedures. In particular, this means that the firearms training must have reached a level of training that enables a switch to these training topics using the individual skills and abilities achieved during the firearms training. One example is the so-called force-on-force training for the application and testing of operational and combat techniques using color-coded ammunition (e.g., Simunition or Ultimate Training Munitions) in a real-life situation setting.

In addition to competent, excellently trained instructors, the implementation of the principles outlined above requires, above all, appropriate training facilities and equipment. There are currently discussions in many areas as to whether and what effects a strategic realignment of the armed forces has or must have on small arms marksmanship training.

The author has a clear view here – excellent individual marksmanship training is the basis for the assertiveness of armed forces, regardless of their strategic orientation. An infantryman with a rifle fulfills the same mission in defense, regardless of whether this takes place in Afghanistan, Mali, Lithuania or on river Oder. Reversing the progress made in the firearms training of armed forces, e.g. as part of a "return" to national and alliance defense, e.g. to a 1980s range, is reprehensible and dangerous. The almost exclusive training to disassemble, assemble and check the function of small arms as quickly as possible does not produce any hits!





## TRAINING FACILITIES

Firearms training is carried out on shooting ranges, shooting facilities with several shooting ranges, in shooting halls or indoor shooting ranges and on training grounds. The design of these facilities varies greatly. This is primarily dependent on the number of trainees in a given time frame, the training content to be taught and the small arms used. Depending on the size of the organization, different training facilities are also provided for training different content or on different weapons.

Shooting ranges are primarily used for the simultaneous training of a limited number of shooters in a stable environment under simple conditions.

Shooting facilities with several shooting ranges offer the opportunity to offer special shooting ranges for special content. In addition, significantly more trainees can be trained with different content at the same time. Such shooting facilities are the norm for larger organizations.

Shooting halls or indoor shooting ranges usually offer the same possibilities as shooting ranges. The environment here is even more secure. The trainees are protected from the elements. There is the option of installing an interactive target display system and training in different lighting conditions around the clock. In addition, such installations can reduce noise emissions and the risk of ricochets and ricochets for the surrounding area to practically zero.

A special type of such systems are the so-called "shooting houses". These can often be used for extremely realistic

◀ Inside the German Special Forces Forces Command's (KSK) Shooting Training Centre (SAZ). One of the most efficient training centres in the world.

Photo: KSK

▶ Modular and mobile "shooting house" from the Israeli manufacturer Trango Systems. It takes three to four people around 20 minutes to set up such a system. Any conversion (e.g. from one to two rooms or changing the doors/windows) then only takes a few minutes. The German KSK also uses system target construction elements from Trango Systems.

Illustration: Trango

training in a 360° environment, over several floors and with observation options for the instructors (walkways above the training level or digital recordings/observation). The transition from individual shooting training to combat training using practice and combat ammunition takes place in these facilities. In these facilities, color-coded ammunition or ammunition with a reduced danger zone, e.g., plastic training (PT) ammunition, or reduced ricochet behavior, so-called frangible ammunition (e.g., SinterFire), is often used. Larger contingents can be trained simultaneously at training areas. In addition, training can take place at greater distances and practically all types of targets can be used. The trainees can also be exposed to the weather conditions to the maximum.

The training facilities used, existing or planned/to be created should be able to ensure the full training of all required contents of the respective organization. Particular attention must be paid to the following aspects:

- no restriction to current training content or described shooting exercises,
- minimal (preferably no) restrictions on exposure to ammunition and noise,
- integration of as many training resources as possible and their flexible, almost unlimited use,
- if possible, figure a 180° environment (at least), even if not on all ranges,
- no limitation to fixed shooting distances, shooting distances of at least 0m-25m, preferably 0m-300m
- training at least six trainees at the same time (even if different training contents can only be trained individually).

From the authors point of view, a training facility (e.g. a shooting range) fulfills today's requirements if it

- shooting distances from 0m-300m (including all intermediate distances),
- targets can be engaged at least between 0m and 50m in a 180° range,
- all flexibly deployable and movable target structures from 0m-300m can be engaged with short bursts from a machine gun on the move and
- six trainees can be trained at the same time.

## TRAINING RESOURCES

The necessary target equipment, simulators, analysis tools, a combination of all of these, as well as other material on the shooting ranges are regarded as training resources.

Paper targets, metal targets, hinged drop systems and even interactive target displays can be used as targets/target structures. These can be stationary or mobile.

Paper targets offer the advantage of precise evaluation of hits as a consequence of the application of the basic elements of shooting technique. In larger organizations, target systems are also used which automatically evaluate the hits, display them at the shooter's position and allow the target display to be changed. A representative of this type of system is, for example, the AUTA target display system (automatic hit display) from Capito & Assenmacher Defence Systems GmbH, which is used by the German Armed Forces.

Metal targets offer the advantage of immediate feedback of success/failure. The metal plates move after being hit, tip over and also provide direct acoustic feedback.

Folding drop systems also offer the advantage of displaying different behaviors of targets/opponents. Nowadays, collapsible drop systems offer much more than just folding over to display the hit. Targets of different sizes can be used. The targets can be programmed when they represent a hit. For example, the number of hits in a certain time can be specified to indicate a hit. Folding targets can switch between enemy and friendly sides. In addition, an exact display of the hit position is possible, including the display of misses with exact placement. Theissen Training Systems from Düsseldorf offers this functionality for its systems with the LOMAH – Location of Miss And Hit System.

The interactive target display offers the combination of all aspects of possible target behavior up to the display of scenarios for operational training with the use of hand firearms. Mobile and freely movable target construction (e.g., cross-tracks, diagonal tracks, preferably freely movable 3D targets/folding systems) significantly increase the reality of shooting training. The use of handguns against stationary targets or from a fixed position is the exception rather than the rule in real operations. The latest range today are freely moving 3D targets. These operate individually or in groups, can behave tactically and, if required, have a realistic signature for training with night sights.

A well-known manufacturer of such systems is, for example, the company Marathon. The idea behind the use of simulators was initially to replace older training procedures in firearms training (e.g., triangular targeting), to make them independent of the weather, to optimize the time required for firearms training, to save ammunition and to provide the instructor with additional views of the applied shooting technique. Today, the functionalities are often extended to include the training of operational procedures using virtual reality and interactive target presentation. The authors has observed a reduction in the use of simulators in the training of elements of shooting technique. Today, simulators are in fact increasingly becoming "tactical trainers" for the individual or the squad. The reason for this, in the authors view, is the still limited ability to "simulate" the actual behavior of handguns when firing.

► Inside the German Special Forces Command's (KSK) Shooting Training Centre (SAZ). One of the most efficient training centres in the world.

Photo: KSK

▼ Autonomous 3D robotic targets for indoor shooting ranges.

Photo: Marathon



A current trend is analysis tools that are individually attached to the respective small arms and provide the trainee with comprehensive information on each individual shot. This can include the detailed trigger behavior (e.g., with preferred travel, velocities, total trigger travel, holdover, reset travel), the weapon movement before, during and after firing, recoil control, the contact pressure of shoulder rests, the tilt(s) in the course of target engagement and many more parameters. When issued individually, the tools also offer the possibility of individually tracking a trainee's entire shooting life with all weapons. This includes all shots fired, regardless of whether it is dry firing training or the use of maneuver, practice or combat ammunition. This not only helps to track and monitor the development of the shooter's level of training, but also offers the opportunity to evaluate the effectiveness of the training. This also provides feedback for the shooting training that is carried out in the respective organization. The company MantisX offers such systems, e.g., the X10 Elite.

Further material for use in shooting training can be dummy vehicles (or real vehicles), dummy infrastructure, boundaries and marking materials. This material is primarily used to figure various training contents such as forcing combat shooting positions when using cover, the organization and procedure of shooting training. The trend with this training material is moving away from the use of wood towards special polymers. This offers a reduction in mass, an improvement in shooting safety and an increase in realism in training. One supplier now also active on the German market is Trango Systems Smart Training Systems from Israel, which has developed a complete modular system for the presentation of infrastructure for shooting ranges.

The purposeful use of a mixture of different training resources contributes significantly to the success of firearms training. Instructors must be enabled to optimize their firearms training through the use of training resources.

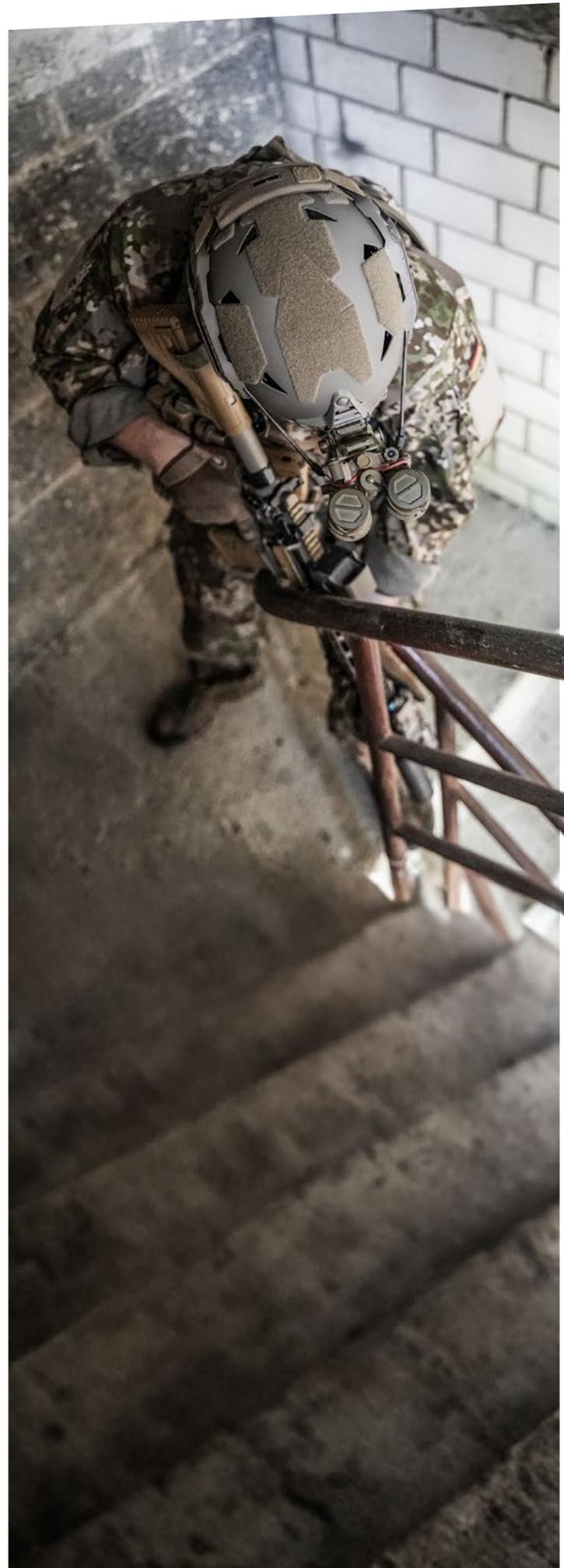
## CONCLUSION

Regardless of the organization, firearms training must be prepared, organized, carried out, followed up and updated on the basis of appropriate documents. Shooting training serves to fulfill the respective mission of members of the armed forces or security authorities and never stands on its own. As the proportion of training for operational doctrines increases, individual marksmanship training becomes less and less important.

Clear responsibilities in firearms training as well as the qualifications and skills of excellently trained instructors are the source of safe, goal-oriented and sustainable firearms training.

The combined use of shooting training facilities adapted to the respective organization, equipped with the appropriate training resources, leads to long-term success.

The current trends in didactics, methodology, training facilities and resources must be observed by the organization and integrated into the training if necessary. A cost-benefit assessment must always be carried out with regard to the needs of the organization concerned. Furthermore, "you only learn to shoot by shooting". From the authors point of view, this applies to every single shot fired, be it "dry", in simulation, with maneuver, practice or combat ammunition.





ANDRÉ FORKERT

# THE BUNDES- WEHR'S HANDGUN PROJECTS

According to an international survey of soldiers, handguns are the most important item of equipment, followed by boots. In the Bundeswehr, the concept "Handguns and Light Weapons of the Bundeswehr" (Handfeuerwaffen und leichte Waffen der Bundeswehr) regulates the conceptual requirements for capability-appropriate, task-oriented equipment. The concept is prepared in the Bundeswehr Planning Office (PlgABw) and is a living document. The future version of the concept is currently being reviewed and co-signed by the Bundesministerium der Verteidigung (BMVg; German MoD). In this article we will take a look at the Bundeswehr's small arms projects.

## HANDGUNS

All pistols currently used in the Bundeswehr are to be replaced in principle by two pistol projects::

- special forces pistol system
- new pistol system, cross-sectional.

The Pistol Special Forces system replaces all handguns previously used in the special forces of the Bundeswehr, i.e. the P8, P8C, P30, P9A1 (Glock 17 4th gen), etc.. The tender has already been initiated. With the new system, the special forces will not only be provided with the pistol, but also with all complementary components – silencers, optics/red dot sights, etc. – to cover all required capabilities. The system is thus characterised by a high degree of adaptability – also through Optical Ready (OR) and SD/SR-Ready – to the various missions of the special forces. With the New Pistol, Cross Sectional system, the P8 pistol is to be completely replaced in the Bundeswehr. The replacement is for technical and ergonomic reasons. The new system provides the armed forces with an upgradeable secondary armament of the latest technical standard. The elimination of an external, mechanical safety device that has to be operated by the user increases operability and handling safety. Internal safeties – e.g. trigger safety, firing pin safety,

drop and impact safety – ensure technical safety. The calibre specified is 9x19 mm NATO. According to well-informed sources the requirements for OR-readiness and SD-/SR-readiness are also part of this. First, however, a basic capability is to be procured, which cannot yet or only partially implement these requirements. Only in a second step will the full capability level be acquired. This also depends on what the industry can offer according to the list of requirements.

Why will red dot sights be the new standard on pistols in the future? A shooting instructor from AA1 Shooting clarified this during the handling briefing: "The greatest benefit of pistol reflex sights in the law enforcement area is where the shooter faces his threat directly. And here in the psychological area. In the target focus. In an attack, I normally only focus on the targeting. This is where the red dot sight picks up the user and streamlines the process. I no longer have to focus on the rear sight, as well as distance and levels. My focus is only on the threat. And it supports me in the decision to shoot or not to shoot, because I have much more visual information. I see a lot more of what's going on around it. I can process a lot more information without it having a negative impact on shot performance." This is because when using a reflex sight, the user shoots with both eyes open, he sees much more, especially at the edges. According to a study, thanks to red dot sights on pistols, there is much less "wrong" shot placement, especially in law enforcement/police.

USSOCOM relies on the red dot sights from Trijicon and Leupold, and the manufacturer Glock will offer the Multiple Optical Sights (MOS) system for all its pistols and for all optics manufacturers in the future. The only exceptions are Glock 31, 32 and 33 in .357 SIG calibre. Here, the calibre is too "aggressive" for the optics, which would not last long. In addition, Glock will increasingly offer the "Direct Cut" for its the Glock 47 and all 9 mm models. This reduces the mounting height when using the red dot sights. Mounting takes place directly on the pistol slide. Adapter plates are no longer used. However, this also means that each weapon is personalized for a specific optic from the moment of purchase/factory. It is then no longer possible to switch between different manufacturers. Unless they use the same mounting points. According to Glock, this solution should also be more reliable. Glock plans to announce more about this at the Enforce Tac 2024. The Direct Cut is already used with Glock models 43 and 48. These are the (sub-)



▲ Another example, Glock 17 5. Generation with red dot sight Bushnell RXM-200 MRS and a weapon light Streamlight TLR-7A. Also this pistol could be adapted with a silencer.

Photo: AF

◀ The Pistol CZ P-10 OR SR shows where the journey could lead. A silencer can be inscribed at the front of the barrel, and the sight is indicated at the top.

Photo: CZ

▼ G95A1 as shown by Heckler & Koch during the Infantry Days 2023 in Hammelburg.

Photo: AF

compact, slimline models that are optimized for concealed carry. Thanks to Direct Cut, the normal iron sights can still be used parallel to the mounted red dot sight.

## SUBMACHINE GUNS

Vehicle crews and operators of heavy weapons/systems will continue to be equipped with the Heckler & Koch MP7A1 submachine gun. This weapon will be continued to be procured as needed and in stages. In addition to the basic weapon, various supplementary sets are available, especially with various sighting devices.

For logistical/stowage reasons, the MP5 will in future only be used on board of the ships/boats of the German Navy.

## RIFLES

The Bundeswehr assault rifle system project (System Sturmgewehr Bundeswehr; G95A1 and G95A1K) is being implemented. The next step will be the integrated verification, including operational testing. Originally, the delivery of the series-produced weapons was planned for 2026. The Bundeswehr has applied to the manufacturer Heckler & Koch to bring this forward by one year. The manufacturer is preparing the implementation accordingly. The Bundeswehr assault rifle system will be procured in a long-barrel (A1) and short-barrel variant (A1K) and supplemented by adaptable modern sights and aiming aids. The main combat sight is supplied by Leonardo and is an adaptation of the Elcan Specter DR 1-4x. In addition, a very large number of laser light modules (Variable Tactical Aiming Laser (VTAL)) from Rheinmetall are also being procured with the Bundeswehr assault rifle system.



The special forces have already received a new assault rifle, the G95K. This is a precursor variant of the Bundeswehr G95A1/A1K assault rifle system. They are also already using the VTAL.

Currently, the tender for the Special Weapon SD (Sound Suppressor) Special Forces (Sonderwaffe SD Spezialkräfte) is underway. This is to replace the HK MP5SD 9x19 mm due to obsolescence. The aim is to increase the range and effectiveness potential compared to the MP5SD. The signature suppression performance is to be maintained.

In the field of telescopic sights rifles, the Bundeswehr uses the rifles G27P (HK417 in calibre 7.62x51 mm; P = patrol with the sights RSA-S reflex sight and the telescopic sights Hensoldt 4x30i RD or Schmidt & Bender 1.5-6x20) and G28 in calibre 7.62x51 mm with Aimpoint Micro T1 reflex sight on the Schmidt & Bender 3-20x50 PM II telescopic sight. The G27P was initially procured for the Special Forces, and later became part of the Armed Forces Joint Use. The ongoing telescopic sight rifle project (Projekt Zielfernrohrgewehr) is bringing the G27P as a telescopic sight rifle to all units of the Bundeswehr. In particular, the sighting system is to be replaced. The G28 was procured as a replacement for the G3 ZF (Zielfernrohr). The G3A3A1ZF with the Hensoldt Fero Z-24 telescopic sight is currently still in use in parts of the Bundeswehr. Now, thanks to the adaptation of the sighting system, the G28 is to become a support weapon in the sniper squads.

The sniper rifles in use, the G22A2 (AX10 System by Accuracy International) in 7.62x67 mm (.300 Win Mag) calibre with sight Steiner Military M5Xi 5-25x56 MTC LT LPF with illuminated TreMoR3 reticle and a parallax adjustment and the G29A1 (Haenel RS9 in 8.6x70 mm (.338 LM) calibre with telescopic sight Steiner M5Xi 5-25), have recently been updated to the latest technical standards.

However, the sniper set naturally includes more than just the weapon and the main scope. For example, the G22A2's dual-chamber muzzle brake with integrated signature damper minimises recoil by 48 % and reduces muzzle flash and noise signature by 23 dB(A). For short distances and suddenly appearing enemies, the main scope is supplemented by a Steiner Micro Reflex Sight MRS (red dot sight).

► G22A1 as used by a German sniper in Lithuania as part of the NATO Enhanced Forward Presence Battle Group.

Photo: AF

The equipment set also includes the Hensoldt NSV 80 XD4 (night vision) aiming/prefixing device. Also included in the kit is the Kestrel 5700 Elite weather station with ballistics software (Applied Ballistics) and Bluetooth interface for the Kestrel app, the Really Right Stuff Ascend-14-BH carbon tripod with integrated ball head, weapon bag, modular carrying equipment, shooting bags and battle belt (all from Lindnerhof), a weapon rucksack from Eberlestock and the winter camouflage suit Special Forces from Carinthia.

And on the G28, the main scope on top is supplemented by the Aimpoint Micro T1 reflex sight. It is used for target engagement at close range up to 100 meters. The reflex sight has four brightness levels for night vision and eight brightness levels for daylight. In addition to the Schmidt & Bender PMII 3-20x50, soldiers can also use the Schmidt & Bender 1-8x24 optic as patrol equipment. The set also includes the Qioptic MERLIN LR (lightweight night vision adaptor), the thermal imager from the IdZ set, a Leica VECTOR laser rangefinder, the Zeiss Spotter 60 spotting scope and the Thales LUCIE night vision goggles, XACT NV33 from Elbit Systems or the newer MIKORN goggle from Theon Sensors. The long-range rifle G82A1 covers the range band up to 2,000 meters. It is planned to upgrade all existing G82A1 rifles to the latest technical design status. Later, the functionalities and capabilities, e.g. signature damping, will be expanded.

The G27P is also interesting from another point of view. Because to increase infantry counter-drone defence, the Bundeswehr has procured the Smart Shooter SMASH X4 fire control system. These are now being used in combination with the G27P. The procurement is being carried out by IEA MIL-OPTICS GmbH. SMASH is a "target assistance system for the detection and kinetic defence of Class 1 UAS" (drones weighing less than 150 kg).





## MACHINE GUNS

The machine guns MG3, HK MG4, HK MG5, MG6 (Dillon Aero D134) and FN Herstal M2 QCB will continue to be used and procured as supplements. In the process, MG3 stocks continue to dwindle while MG5 stocks of all variants grow. The MG4 is to be upgraded to MG4A3 in order to bring it into line with the MG5. The manufacturer Heckler & Koch has already shown a corresponding proposal at trade fairs.

The MG6 machine gun with a high rate of fire is gradually being integrated into other platforms and is also being used in parts jointly by the armed forces. So far, it is in use on the AGF (Reconnaissance and Combat Vehicle) SERVAL and the Airbus H145m LUH SOF (Light Utility Helicopter Special Operation Forces) for the Kommando Spezialkräfte. The integration of the 20 mm machine gun 20M621 from Nexter is being examined for the AGF SERVAL as well as the subsequent generation AGF 2 from Defenture.

The M2 QCB (Quick Change Barrel) heavy machine gun from FN Herstal is also being procured further in stages for integration into various platforms, including new ones, in order to meet requirements. For the machine guns, the integration of muzzle flash suppressors and signature suppression is projected to increase night combat capability as well as self-protection. For the ground-based use of the MG5, the field mount still dating from the 1930s will receive a modern successor.

◀ Fire Control Systems SMASH X4 on a G27P for Counter-UAV missions.  
Photo: Bundeswehr

▲ Possible MG4 configuration shown by Heckler & Koch at the Infantry Days 2023 in Hammelburg. The MG4 is to be adapted so that it corresponds to the MG5 in terms of ergonomics and operation.  
Photo: AF

## LIGHT WEAPONS

In addition to rifles, the infantry and infantry-like forces of the Bundeswehr also have launchers for 40 mm cartridges at their disposal. Currently, a sub-assembly is used for the G36 rifle (HK AG36) and the grenade pistol (HK69A1; calibres 40×46 and 40×123 mm). These will be replaced for the G95. The new system is to be able to be used as a sub-unit as well as a stand-alone weapon. The tender for the G95 Special Forces is already underway. Since the functional requirements for the G95A1 and G95A1K are comparable, this will probably be adopted for the cross-sectional project.

For the support weapon 40 mm grenade machine gun, the introduction of air-burst ammunition is under way. The ammunition is programmed when fired and the point of detonation is determined. Thanks to the "air burst" capability, it can also be used to hit targets from above or behind cover.

The so-called light indirect fire weapon (Leichtes Wirkmittel Indirektes Feuer) is currently being introduced. This is a 60 mm mortar from Hirtenberger Defense Systems in a hand-held version (command mortar) and a bipod version. This is intended to significantly increase the firepower of special forces and cross-sectional forces at ranges of up to 2,000 meters. Different types of ammunition – High-Explosive, Smoke, Illumination – can be fired.



RAINER KRUG

# ENFORCER –

FROM MULTI-PURPOSE MUNITION TO  
ANTI-TANK AND AIR DEFENCE





Between 2010 and 2015, the first industrial work began on a weapon that would complement the capabilities introduced into Bundeswehr with Wirkmittel 90. The operational experience of the armed forces made it clear that there was a need for an assertive and capable effector against concealed positions and lightly armoured mobile targets over distances of up to 2,000 meters.

Industry-funded development concentrated on realising an effector containing components already available on the market, which could be available fast and procured in large numbers at low cost. An effector intended to fill the gap between the effective Wirkmittel 90 and the MELLs, and importantly, that a solo operator could use.

MBDA in Schrobenhausen took on this task, and by 2019 had realised such a missile and one that could be the basis for the "Lightweight Effector 1800+" initiative. On 20 December 2019, after extensive preparation work primarily defining a corresponding capability requirement, the provision of budgetary funds and the tendering process, MBDA Germany was commissioned by the German procurement agency BAAINBw to manufacture and supply Enforcer guided missile systems.

The entire system - a missile in its tube with a sighting system - weighs approx. 12 kg, so it is comparatively light, and as the procurement contract emphasised utilising components already in service, Enforcer's sighting system is the same used on the 90mm unguided weapon.

As mentioned, MBDA designed the missile to provide dismounted forces with a fast and precise effector against moving targets and targets behind cover at a distance of up to 2,000 meters. Serial production by MBDA has already started.

#### **STATUS ENFORCER / LIGHTWEIGHT EFFECTOR 1800+**

The requirements for ammunition, and therefore for a missile of this type, are high. A wide range of tests, including under extreme environmental conditions, have enabled the demonstration of important technical, functional and safety requirements and the achievement of associated milestones over the last two years. Very high standards apply to the manufacture and delivery of missiles. The test and verification processes planned in this regard were particularly challenging, pushing the material to the limits of its resilience and technical usability. This has been delivered and series production of the ammunition for the troops started at the end of 2023.

#### **ENFORCER X CAPABILITY GAIN**

The Enforcer/Leichtes Wirkmittel 1800+ not only closes a capability gap due to the modularity of the system design, but it also offers a wide range of options for further developing capabilities. With Enforcer X MBDA is planning to create an anti-tank variant of the guided missile in the "Light Anti-Tank" class. In contrast to the basic model of Enforcer, which has a multi-effect warhead with a multi-mode fuse, Enforcer X intends to use a warhead with a tandem-shaped charge. This should make the effective engagement of heavily armoured combat vehicles – even on the move – possible at distances of up to 2,000 meters.

The further development of Enforcer X also offers logistical advantages. With the use of a large number of identical LWM1800+ components and only a slightly adapted operational concept, there are synergies in the provision and stockpiling of spare parts, as well as in training, which would reduce effort and costs for the Bundeswehr and lead to a considerable reduction in utilisation.

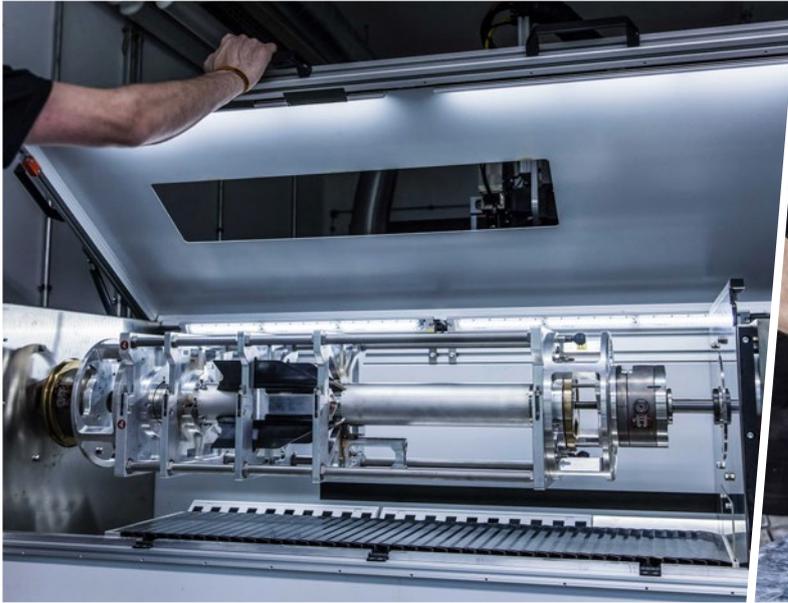
#### **PRODUCTION / QUANTITIES**

Due to the changes in the security policy environment, it will be necessary to produce large numbers of missiles as quickly

◀ "Leichtes Wirkmittel 1800+" Enforcer version.

▲ Launcher for the anti-drone Enforcer.

Photos: MBDA



as possible. Production capacities required for this are currently building up, and MBDA is aiming for annual production of missiles in the four-digit range. A further increase in unit numbers to cover additional requirements in the short or medium term is also conceivable and feasible. However, limiting factors could include the availability of raw materials or supply chain bottlenecks.

#### WHAT OTHER EXPANSION STAGES ARE CONCEIVABLE? COUNTER DRONE

Firstly, a small anti-drone solution based on the Enforcer missile for short and close range. Such a missile would be cost-effective, but at the same time a highly modern guided missile that adapted Enforcer for use against small and medium-sized drones. It would be deployed on platforms that carry out anti-aircraft/drone defence, providing capability against formations or individual targets. In particular, it is important to engage such highly agile and low visible targets with a very high probability of hitting the threat at the furthest and earliest possible engagement range. The best option to do this is a guided missile system. Enforcer, as it is light and small, already provides the necessary technology base to quickly adapt an existing solution and transform it into a much-needed new capability.

The small size of the effector makes it possible to integrate high firepower by deploying a large number of effectors on highly mobile platforms/fire units, also in combination with other effectors. A good example is the combination of a small anti-drone missile with the Skyranger 30 air defence system.

#### ENFORCER AIR-LAUNCHED

Another option for utilising the basic technology of Enforcer is to provide an air-launched version. This concept is investigating its further development into a high-quality munition for drones and light helicopters.

Enforcer Air-Launched could be the entry point of a new generation of small guided missiles for uncrewed combat aerial vehicles (UCAVs) and light attack aircraft in the future.

An Enforcer missile weighs around 7 kg and could be launched from the air against lightly armoured vehicles. Future integration of other warhead variants better matched against more heavily armoured targets is also being considered in the company's studies today.

MBDA is currently in the phase of collecting data on the operational requirements of the armed forces for such a system. This data forms the basis for the design of the "sensor to shooter" chain of effects and is fundamental to the weapon's design.

Against a background of international interest in such a solution, MBDA is currently working with the Brazilian armed forces and Brazilian industry.

If we summarise the requirements for an Enforcer Air-Launched, we are talking about a small, lightweight and affordable missile.

It should have a modular guidance and navigation unit for semi-active laser seeker heads and be part of a family concept characterised by maximum commonality of components.

It can be integrated into tactical uncrewed aerial vehicles (UCAVs) or "high-load-out" configurations for medium altitude long endurance (MALE) platforms, and have a high level of precision even with fast-moving targets and operate with an accuracy that promises to minimise collateral damage.

In conclusion, what began in MBDA's laboratories in Schrobenhausen at the beginning of the last decade has developed into a system family with an extremely wide range of applications and, therefore, a wide range of capabilities.

In these times of deteriorating security policy conditions especially, Enforcer and its further developments provide a weapon system that offers an operator urgently needed options for action and provides them with the appropriate weapon effect for the prevailing combat situation.

▲ MBDA Deutschland uses laser to produce the Enforcer missiles (l.).

▲ MBDA production-site of Enforcer in Schrobenhausen (r.).

Photos: MBDA

ALEX SHAPOCHNIK, CEO, CREOMAGIC

## NEXT-GENERATION TACTICAL COMMUNICATION: INTELLIGENT PERSONAL RADIOS FOR SECURITY AGENCIES AND ARMED FORCES

In the demanding and dynamic realm of security and military operations, the ability to communicate effectively under any condition is a critical component of mission success. The latest technological development in personal radios specifically designed for Security Agencies and Armed Forces embodies this ethos. These solutions go beyond mere communication tools; they are resilient lifelines designed to operate in diverse environments, navigating the challenges of electronic warfare.

### TAILORED COMMUNICATION NEEDS

Operating in diverse and frequently hostile environments is routine for Security Agencies and Armed Forces. The communication devices employed in these scenarios must be versatile, resilient, secure and infrastructure-less. They are required to operate reliably across urban landscapes and challenging terrains. The communication solution must facilitate full situational awareness, allowing seamless information sharing and coordination between team members and command centers. In an era where electronic warfare presents a real threat, ensuring the resilience of communication in the face of such challenges is imperative. For effective decision-making and mission success, communication devices must uphold consistent connectivity and ensure flawless real-time communication for all operational teams.

### NAVIGATING THE CHALLENGES

Communication solutions for critical missions must maintain continuous connectivity in diverse operation environments where conventional technologies and solutions might fail. These advanced radios must support various data rates to accommodate a wide range of applications, from low-rate text, voice and data communications, to high-bandwidth video streams, ensuring mission-critical teams can access and exchange the full spectrum of mission-critical information. In the realm of electronic warfare, the ability to resist jamming and interception is paramount. Furthermore, operational security requires communication to be encrypted and secure from cyber threats, maintaining the confidentiality and integrity of sensitive data across all transmission rates.

► CreoHub Pro (l.) and CreoHub Light (r.).  
Photos: Creomagic

### INNOVATIVE COMMUNICATION SOLUTIONS

Creomagic intelligent personal radios address these challenges with CreoHub, a personal MANET (mobile Ad-Hoc Network) radio system that enables mission and tactical teams to share voice, data & high-resolution video across dozens of devices in the toughest environments. These radio systems embody innovative technologies meeting the harshest requirements of mission-critical teams:

- **Advanced Signal Resilience:** Utilizing state-of-the-art waveform, Mobile Ad-Hoc networking and AI technologies, these radios ensure strong and consistent communication in various environments, countering common signal disruption issues.
- **Electronic Warfare Readiness:** The radios operate in environments with high electronic warfare activities. They feature adaptive frequency hopping, low probability detection and interference avoidance against jamming and signal interception, ensuring uninterrupted communication.
- **Robust Security Features:** With sophisticated encryption algorithm, the radios provide a secure communication channel, safeguarding against eavesdropping and cyber threats, crucial for maintaining operational integrity.
- **Durable and Reliable Construction:** Built to military standards, these radios are capable of withstanding extreme environmental conditions, ensuring dependable performance when it's needed most.

In summary, Creomagic intelligent personal radios are much more than communication devices; they are an integral part of the operational toolkit for Security Agencies and Armed Forces. Engineered to adapt to varied environments and face the challenges of electronic warfare, they represent a groundbreaking advancement in tactical communication technology, enhancing the efficacy and safety of those on the front lines.



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ANDRÉ FORKERT

# THE SANITÄTSSPEZIALZUG FOLLOWS THE COMMANDO SOLDIERS DIRECTLY



The Bundeswehr's Army Special Forces (Kommando Spezialkräfte) are deployed covertly or even behind enemy lines. They often operate in small teams, in distant countries, without being able to rely on a large German field camp nearby. Nevertheless, they must be able to react to all tactical situations, even when it comes to wounded care. For this reason, the commando soldiers regularly train with the special medical platoon (German: Sanitätsspezialzug) of the Kommando Spezialkräfte (KSK). During the exercise "DCR Week" (Damage Control Resuscitation Week) in August 2022, they also worked together with a civilian hospital for the first time.

The commando soldiers of the KSK train an assault operation on a high-ranking terrorist. Of course, gunfire and casualties can occur at any time. The special medical platoon can be requested by the commando soldiers to care for the most seriously wounded, or it is permanently integrated into the force deployment from the very beginning. Depending on the operational scenario, the special medical platoon can be directly attached to the access element as an airmobile medical team (LBAT; German: Luftbeweglicher Arzttrupp) or flown in by helicopter and fast rope into operations. Afterwards, they would follow the commando soldiers under self-protection to liaise with them.



### THE KSK SPECIAL MEDICAL PLATOON

The special medical platoon belongs to the KSK Medical Operations and Supply Centre and thus to the support forces of the KSK. It is stationed in Calw in the Graf Zeppelin Barracks and is thus an integral part of the KSK. The platoon's mission is to directly support the commando forces in action, e.g. during hostage rescue operations, and to ensure qualified emergency medical care.

The special medical platoon is divided into four medical groups, each of which consists of an airmobile medical unit (LBAT) and two rescue units (Rettungstrupps). Corresponding to the companies, these squads are directly subordinated to the command forces and accompany them during training, exercises and operations.

The basic qualification of the individual medical groups is identical. In addition, however, they undergo additional specialisation such as high mountain specialisation or vertical insertion (free fall parachute jump).

The personnel of the special medical platoon (SanSpezZg) is made up of paramedics, emergency paramedics and operational doctors. In addition to civilian vocational training or civilian studies and general military training, the soldiers go through a one-week selection procedure in advance and are checked for character, professional and physical aptitude. Afterwards, the soldiers complete the additional training to become so-called "specially qualified support forces" (BBU; German: besonders befähigte Unterstützungskräfte). This BBU training includes tactical basics, a basic shooting course, reaction shooting as well as a part in urban and house-to-house combat, tactical close combat, airborne operations (transport by helicopter with fast roping, rappelling, etc.), survival course "SERE-B/C" and a planning course "Mission Planning". In addition, each soldier receives advanced emergency med-

ical training. The combination of these qualifications is called „Rettungsspezialist or Einsatzarzt Spezialkräfte" (NATO Special Operation Medical Technician and NATO Special Operation Medical Physician). The additional training of the BBU takes about nine months.

The Air Mobile Medical Team (LBAT) mentioned above is one of the core elements. The LBAT is composed as follows:

- 1x squad leader: medical sergeant emergency paramedic with completed commando training
- 1x medical officer NSOMP
- 1x medical sergeant emergency paramedic "rescue specialist special forces" NSOMT
- 1x driver: emergency medical technician (paramedic)

The LBAT differs from the BAT (mobile medical unit) mainly in terms of movement. The BAT usually arrives at its place of deployment by land vehicle or on foot. The LBAT also has the ability to be transported by aircraft and arrives at the scene of the incident, e.g. by "quick landing" with a helicopter. Some LBAT are also qualified in parachute operations to be deployed together with the commando soldiers. Airborne deployment is often accompanied by baggage/material limitations. This means that the LBAT can carry less equipment than the BAT.

### THE EQUIPMENT

On the one hand, the helicopters are limited by their maximum payload, and even before the mission, it has to be calculated exactly how much medical material can be carried. This factor affects the soldiers' personal equipment, as well as the medical equipment, which is set up in the helicopter beforehand according to the mission. In addition, there are other tactical equipment items, such as ammunition or radios. Space in the aircraft is also very limited, so there is hardly any room for large rucksacks and the personal equipment has to be constantly optimised.

This is another reason why the special medical platoon is a pioneer when it comes to the further development of medical equipment. The premise here is that it must become smaller and lighter. In principle, the special medical platoon also bases its material on current emergency medical findings and recommendations. This includes, among other things, the use of blood products or, for example, REBOA (Resuscitative Endovascular Balloon Occlusion of the Aorta). In addition, everything is tested for its tactical operational suitability during exercises or training. Are these procedures also suitable for KSK operations and can they be used promisingly? Testing and further development are partly carried out in close contact with the Bundeswehr's central medical service and the Bundeswehr hospitals.

One of the important and at the same time most challenging issues is CBRN decontamination and special medical care for contaminated wounded. Here, the special medical platoon can fall back on an extensive special medical NBC and DECON kit. In order to be able to carry out decontamination on the wounded, the specialists have (further) developed their own solutions together with the industry and had them produced.

◀ The special medical platoon from the Bundeswehr's Army Special Forces (KSK) train together with commando soldiers in an access operation with casualty care and transport.

Photo: Bundeswehr

▲ The medical platoon uses state-of-the-art equipment, like here a small and mobile ultrasound device.

Photo: see metadata



One example is the so called "decontamination agent, personally", an application sponge with chloramine-T solution for decontaminating a lying wounded person.

In addition, the medical platoon has access to a wide range of emergency medical equipment, including an emergency craniotomy set, intubation materials, alternative airway aids such as i-gel, decompression puncture needles, chest drains, FAST1 (intraosseous access), red blood cell concentrates, blood plasma, warm blood donation sets, ultrasound equipment, portable perfusers, REBOA catheters, junctional tourniquets, various medications depending on the order, such as fentanyl in various dosages, e.g. Actiq (fentanyl for buccal administration), Instanyl Spray (fentanyl for intranasal administration), Abstral (fentanyl for sublingual administration), esketamine, midazolam and many other emergency drugs. The range of equipment and medications can be as wide as that of a small intensive care unit. The emergency paramedics can also carry out direct blood donations or make use of the blood bags they carry. Among other things, a Warrior blood and fluid warmer from the company QinFlow is used to warm the chilled blood to body temperature before administration. This is unique in the Bundeswehr: only the KSK special medical platoon can perform human-to-human blood transfusions.

### THE CIVILIAN HOSPITAL EXERCISE

There are various situations in which the military can provide medical support. One example would be a disaster such as an earthquake or a flood. According to Art. 35, Para. 2, Sentence 2, Para. 3 of the German Grundgesetz, the Bundeswehr can also provide domestic support here. Special rescue techniques such as the use of helicopter winches or high-altitude rescue enable the personnel of the special medical platoon to reach terrain that is difficult to access in order to rescue people.

But even in domestic and foreign training operations, it is not unlikely that, for example, in the case of a traffic accident, the medical service personnel who are on the scene will take over first aid, ensure transport with their own helicopters and hand over injured persons directly to the hospital. Even in the context of a military conflict, it is only advantageous for the KSK medical service to be able to handle cohesion with all possible civilian providers. For this reason, during the "DCR Week", cooperation was established with a civilian hospital for the first time ever.

For both the special medical platoon and the hospital staff – in this case the RKH Ludwigsburg – it is a good opportunity to practise the complete rescue chain from the scene of the incident to the hospital. Normally, such an exercise scenario would end with care in the helicopter. Through civil-military cooperation, however, processes can be practised together so that they function smoothly in an emergency. After all, the handover to the civilian staff in the hospital's shock room is a decisive moment, in reality and in the exercise.

Appearance and behaviour in the hospital was also an important part of the exercise for the participants. The sight of fully equipped commando soldiers in their battle dress appears very threatening and bizarre. Here, the soldiers had to observe some safety aspects and, for example, establish security on the weapons before entering the hospital. When entering the

◀ Transport of a wounded soldier.

Photo: Bundeswehr

▼ Handing over a wounded man to the staff of the civilian hospital.

Photo: see metadata





hospital, the faces of the soldiers remained covered by the balaclava to protect the identity of the soldiers. Protective equipment, such as body armour, also remained on.

However, the reaction of the hospital staff was very professional, as they were also informed about the exercise in advance. The cooperation on site worked very well and appearance and demeanour did not seem to play a role. In addition, the hospital had previously posted several signs indicating that a Bundeswehr exercise was taking place.

### REALITY THANKS TO ROLE PLAYERS

During the exercise, civilian role players from the British company Casualty Resources were used. This allows many wounded scenarios to be portrayed particularly well. Together with a detailed mask design and artificial tissue that even allows medical incisions, extremely realistic injury patterns can be simulated and professional feedback obtained from the actors. Thanks to the special moulages and make-up, the KSK soldiers can optimally practise certain medical measures directly on the wounded. For example, it is possible to relieve pressure on the chest with a needle if air is trapped there or to prevent a wounded person whose airway has been affected by an explosion from suffocating with a scalpel without injuring the actor. Few simulators offer a comparable possibility that is so close to reality.

In addition, the actors can act on the soldiers and portray pain or states of confusion.

"Casualty Resources" and consists of several actors who have been limited since birth by illness or even wounding. The team also includes several make-up artists and actors without physical limitations. There is no comparable company in Germany.

▲ Role-players, fake blood and realistic moulage challenged the soldiers during the exercise. But this also provided previously unknown training opportunities.

Photo: see metadata

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# Strong Partnership: Hexonia and NFM

Hexonia GmbH is a manufacturer of combat clothing and ballistic protective equipment for modern soldiers and security forces. The company specialises in the development of integrated clothing systems, from underwear and combat clothing to head protection systems: The innovative production of each individual layer of clothing and their precise coordination with each other guarantee the highest level of protection, functionality and comfort.

Hexonia develops and produces the majority of its clothing at its headquarters in Nettetal, North Rhine-Westphalia. A special manufacturing technology is the seamless process, with which protective and comfortable underwear is produced almost seamlessly. The company was founded in 2005 and currently employs around 250 people. With the merger with the Norwegian NFM Group in 2022, Hexonia is further expanding its capacities. The company is now headed by Norwegian Nils Holm Toverud, who runs Hexonia together with Managing Director Sabine Albert and who, as he himself says, has an "interesting journey" ahead of him. Tobias Ehlke met him for an interview.



**Who is Nils Holm Toverud? Our readers are keen to find out more about this person.**

A good question, and one that I have often asked myself. I grew up in the Norwegian countryside, in fairly simple conditions, where hard labour was the prevailing mentality. The world was pretty small for me back then. Joining the Norwegian Army at the age of 19 was therefore a big step and the almost 10 years I spent there were formative for my future career. I have worked at procurement agencies for both the Norwegian Defence and the Norwegian Police, so I know the customer side quite well. I then spent almost 15 years at the defence group Thales.

I have always been interested in defence equipment and systems. Through my experience as a user, procurer, developer and supplier of these systems, I know how important it is to have the right equipment to enable soldiers and police officers to fulfil their tasks. At the same time, I know the challenges that we at Hexonia and NFM take very seriously: When developing new systems and technologies, our focus is always on user requirements. This user-centred approach is essential for us if we want to create innovative and valuable solutions for soldiers and police officers.

Taking over the management of Hexonia is a great challenge for me, not only because I enjoy working in an international environment. I am very impressed by what the company has already achieved and hope to make my contribution in the future.

**What is it like to run a German company as a Norwegian?**

I think it's important to approach every management position with a great deal of curiosity and humility. This is all the more important when you take on responsibility for a company in another country.

Hexonia is first and foremost a German company, with the Bundeswehr as our main customer. It is therefore mandatory for me to keep German as the main language in the company. I am therefore required to improve my German language skills, which I am working on diligently.

As the Managing Director of a German company in a Norwegian group, I am reminded every day of how close the two countries are culturally. That makes many things easier. I experience great helpfulness from the Hexonia team. The employees there have great experience and skills and are not afraid to take on responsibility when necessary. However, there are also differences that need to be taken into account: At NFM, for example, we are strongly inspired by the Vikings and express this in our



communication and company branding. In the German context, this can have a completely different meaning and is therefore not transferable 1:1.

It is fundamentally important to me not to transfer structures from the parent company to Hexonia at any price. That would be counterproductive and would not work. Hexonia is very well established on the German market and has grown enormously in its own structures in recent years. Our approach is to benefit from each other's strengths and maximise synergies.

**You are Managing Director of Hexonia and at the same time Chief Business Officer of the NFM Group. How do you reconcile the two positions?**

The dual role as Chief Business Officer in the NFM Group and as Managing Director of Hexonia offers me two interesting areas of activity: On the one hand, I have the opportunity to act in a completely operational field in which capacity building and the delivery of high-quality products to the German Armed Forces are a priority. On the other hand, my strategic task is to develop the Norwegian-based group in an international context.

At NFM we have a clear strategy to build a strong presence close to our most important customers. The efforts we are making in Germany are exactly in line with this strategy and certainly pave the way for the further development of the group.

▲ Nils Holm Toverud, Managing Director at Hexonia GmbH.

◀ Modern production facilities at Hexonia in Nettetal.

▶ Tobias Ehlke, owner and publisher cpm Defence Network, in dialogue with Nils Holm Toverud.

Photos: Hexonia GmbH

At the same time, I am a strong advocate of transnational co-operation, both between the armed forces and on the industry side. Combining our overall capacities and capabilities within the NFM Group gives us the opportunity to be much more robust in terms of production capacities and a reliable European supply chain in a turbulent geopolitical situation. We can also offer our customers in Germany and other markets even more leading technologies and develop future solutions together with them.

However, the dual role also brings some challenges, especially when it comes to dividing my time and energy between the two roles. Given the importance Hexonia currently has for the entire NFM Group, my focus is certainly more on this role at the moment.



#### **How are employees responding to the changes brought about by the merger with NFM?**

I want to be careful when I speak for the employees, but so far I have a very positive impression. Hexonia was founded almost 20 years ago by the entrepreneur Gerd Hexels, who has certainly played a very large part in the company's current success. I therefore believe that his departure from the company as part of the takeover represents a more significant change than the fact that

▼ A lot of work still requires human hands and experience.  
Photo: Hexonia GmbH

Hexonia is now part of the NFM Group. However, as Mr Hexels has built up a company with many great, qualified employees, I am not worried about the future of the company without him. In addition, the integration of Hexonia into the NFM Group is supported by a common strategy that is in the genes of both companies: Both are striving for technological leadership in the field of personal protection.

#### **You talk about integration: is Hexonia actually still a German defence technology company?**

Absolutely, and we want to keep it that way. We as Hexonia have taken some significant commitment after the "Zeitenwende", to equip the German soldiers, and this remains a priority for us. Our clear goal is to continue to build up Hexonia here in Germany and to secure the necessary expertise and production capacities in order to remain a reliable partner for the Bundeswehr in the future. To dispel any doubts about this, we have increased the production area and machinery since I took office and the number of employees has risen by a good 20%. And we are planning further growth.

Hexonia is also in a position to make a strong contribution to equipping the police in Germany. Many of our leading technologies are also highly regarded in this market. Through its integration into the internationally active NFM Group, Hexonia also has the opportunity to make its own cutting-edge technologies available to international markets and thus increase added value in Germany.

#### **What has been done so far as part of the integration into the NFM Group and what are the further plans?**

The integration of Hexonia has significantly increased the overall capacity of the NFM Group in the textile and clothing sector. At Hexonia, we have a strong team with over 40 textile engineers who have access to key technologies and future-orientated machinery. This is a very strong factor for us, which we want to utilise in the NFM Group: Efficient competence centres for individual product areas are to be established throughout Europe in order to serve important customers on the one hand and to promote further cooperation in Europe on the other. With the expertise and production capacities of Hexonia, we are establishing the centre of excellence for combat clothing here in Germany. The close co-operation between the two companies is intended to further improve the existing product lines in the clothing sector.

We certainly have a very interesting journey ahead of us. I think our goal of protecting those who protect us is now more important than ever.

**Mr Toverud, thank you very much for this interview.**

# INTELLIGENT TACTICAL NETWORKING FOR USE IN EXTREME ENVIRONMENTS



Ensuring a stable and secure communication is a crucial prerequisite for successful operations. The variety of data that needs to be exchanged during operations poses a significant challenge: Situational information, coordinates, images, videos, but also control signals for various end devices (UAVs, robots, cameras). Depending on the deployment scenario, different communication systems must also be used in parallel or additional systems (e.g. repeaters) must be integrated in order to increase the range or compensate for terrain influences.

## MPU5 – THE SMART RADIO SYSTEM

With the Mobile Ad Hoc Networking (MANet) MPU5, Persistent Systems has developed a powerful device for highly mobile IP communication.

The MPU5 has the following performance data, among others:

- 1GHz quad-core ARM processor (Android® operating system)
- 2 GB RAM working memory
- Control of unmanned systems can be integrated directly into the device
- Direct Camera control via the device
- Interchangeable radio modules and therefore choice of different frequency bands (e.g. L-, S-, C-band)
- Up to 120 Mbit/s data throughput
- IP68 protection class

All data is transmitted in encrypted form using the Advanced Encryption Standard AES-256 (256-bit encryption).

▲ Photo: Persistent Systems

## MIMO AND WAVE RELAY® MANET

The transmission technology of the MPU5 system is similar to that of a router, i.e. the reception and transmission of different data packets must be ensured at all times. In order to achieve the highest possible efficiency and transmission reliability, MIMO (Multiple Input Multiple Output) technology is used. The MPU5 has three antennas, which enable the following functions:

1. Simultaneous reception and transmission of different data packets (e.g. simultaneous voice radio, video and control of a UAV).
2. Use of so-called multipath effects (signals can take different paths through a terrain) and reflections to improve communication and increase distance.

MIMO technology is particularly suitable for environments with poor signal propagation, such as ships, tunnels or urban terrain. The biggest special feature of the MPU5 is the MANet network technology Wave Relay. This enables all end devices in the system based on this technology to independently establish a network with each other.

In Mobile Ad-hoc Networking (MANet), each device represents a separate node. This means that each participant is a transmitter, receiver and repeater in one. This also includes unmanned systems such as robots, UAVs or remote sensors that are controlled or transmit data via an MPU5. Each new participant increases the density of the network and the range in its periphery. The result is a (technically) unlimited range and very high mobility.

The German distributor of this reliable technology is ELP GmbH European Logistic Partners, Wuppertal.

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ANDRÉ FORKERT

# REAL-TIME HEALTH MONITORING

Until now, this procedure has been familiar mainly from current action films. Special Operation Forces are on a mission. Their headquarter is live with them, get the feeds from the tactical helmet cameras of the operators or the service dog in front of the troopers. HQ also sees medical parameters of the soldiers. They show their performance, but above all the health risks after an injury, or even their death by expiration of the pulse curve.

This year the U.S. Army tested something like this in the U.S. Army Best Squad Competition, a week-long competition that evaluates the technical and tactical skills of individual squads as well as their ability to work as a disciplined and cohesive team.

For the test, each of the 60 participants from the 12 command squads wore a HRAPS (Health Readiness and Performance System) device throughout the competition. The HRAPS consists of a lightweight transmitter, about the size and shape of an earplug, attached to the wearer's chest with adhesive strips, and handheld portable devices that receive and display physiological data for tactical leaders and medical providers on and near the front line.

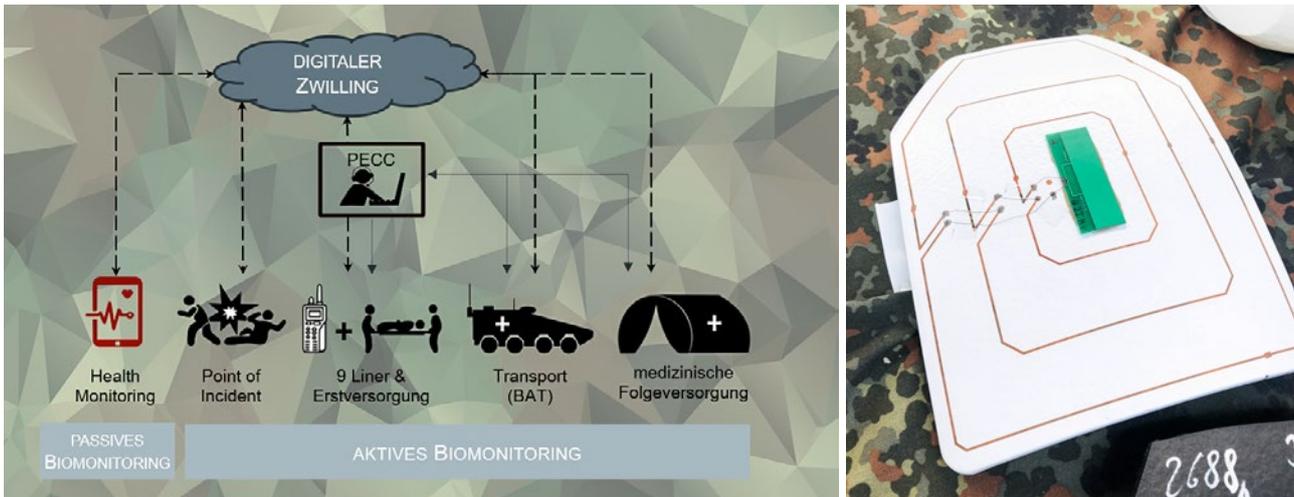
"As teams vie for the title, the competition provides the perfect opportunity for the HRAPS development team to evaluate the programme's progress in real-world conditions", said Emily Krohn, deputy product manager for USAMMDA's HRAPS programme. "HRAPS is a fantastic tool to help tactical leaders and frontline healthcare providers make critical decisions about soldier health and performance, both during training and in real-world operations. It is designed to help smaller unit leaders and frontline medics identify potential health problems before they become critical. It provides a snapshot of critical health and performance data about once a minute, so leaders are aware of their soldiers' location and vital signs at all times when the device transmits data. With future combat operations forecast, it is imperative to have modern, user-friendly, robust and expeditionary tools like HRAPS so that frontline force commanders can make more informed decisions. The reality is that the medical capabilities that were available in previous deployments such as Iraq and Afghanistan will be severely limited in the potential operational conditions of the future, where small teams will be deployed far from higher-level utilities in remote areas. Having tools such as HRAPS to help identify health problems early on, before they become emergencies, will be a key advantage. Real-time health information for soldiers on the front lines will help improve medical care on the ground and

maximise the effectiveness of available resources," says Kohn. "Body-worn health monitors are not a new concept – health and fitness monitoring devices have been used in one form or another since the early 1980s. However, HRAPS, which has been in development at USAMMDA since 2018, goes a step further than anything commercially available and is specifically designed to enable faster decision-making for small units and improve troop accountability during intensive training and future real-world military operations", Krohn said. HRAPS not only provides real-time physiological data, but also tells commanders where troops are in the field during training. For example, HRAPS has already been tested during training and competitions over the past year, and there have been some cases where troops have been lost. HRAPS has helped commanders locate missing persons on several occasions, which is very important for frontline leaders.

"HRAPS is a very useful tool for us in the field, especially for soldiers in medical service. I used one to monitor my vitals during the AFC Best Squad competition and was surprised at what it could do. As a medic, having a device like this that provides this kind of data in real time would be extremely useful in a real-world setting", says Staff Sgt. Jesse Hylton, AFC team leader and practical nursing specialist at the Telemedicine and Advanced Technology Research Centre. Here, experts can see the impact of sleep deprivation and calorie consumption and the physiological responses that result. In this way, medical problems can be identified before emergencies arise.

"In emergency situations, when treating injured and casualties, every minute counts and a baseline of physiological data tracked over a period of time helps with decision-making while treating soldiers in the field. We know that the impact of injuries increases over time. Therefore, it is important to detect abnormalities in vital signs before they occur in a patient to prevent possible complications when symptoms occur. When abnormalities do occur, we can treat them early, which helps alleviate injuries before they begin to escalate and helps care providers apply a more holistic approach to treating injured people, leading to better overall outcomes", Hylton said.





### BUNDESWEHR ALSO DEVELOPS COMPARABLE SENSORS

The Wehrwissenschaftliches Institut für Werk- und Betriebsstoffe (WIWeB) in Erding, Bavaria, is also working on similar projects under the title "Physiological/Biomonitoring in a Military Context". Responsible at WIWeB is the Business Unit 250 (System Soldier). The technology demonstrators realised at WIWeB are a prerequisite for evaluating and improving the sensor systems used. For example, WIWeB has already developed a so-called sensor suit as Smart Textiles.

Another application, for example, is the integration of sensors in protective plates, but here these are to measure whether the plates have developed internal cracks, i.e. assess the condition of the plate. In this way, too, the soldier can be warned of damaged material and thus be protected. It also reduces the logistical effort involved in regularly inspecting the plates, for example by X-ray.

But the sensors do not only have to provide reliable information. They must also be able to be integrated into uniforms or equipment without restricting their actual function or impairing the soldier's mobility and combat strength. All parts of the monitoring systems must also be able to withstand several washing processes or natural abrasion during training or a mission.

Corresponding sensor technology can be integrated into existing equipment (uniform, combat helmet, combat waistcoat, etc.) or realised through (smart) "wearable" equipment. The latter can be wristbands, for example, or stick-on (chest) sensors as in the case of the U.S. Army.

LTRDir PD Dr.-Ing Dr.-habil. Jens Holtmannspötter, Head of the Materials, Structures & Digitalisation Division (200) at WIWeB, points out that it doesn't always have to be new sensors. Smartwatches can already do a lot today and more than just record and transmit biometric data. So why not use existing material?

▲ Example of the importance and integration into the rescue chain.

Graphic: WIWeB

▶ Example of the integration of a sensor on a ballistic protection plate. This makes it easier to assess the condition of the protective plate after ballistic tests.

Photo: AF

◀ The Health Readiness and Performance System (HRAPS).

Photo: US Army

According to WIWeB, biomonitoring in a military context can support the following applications:

- ✦ Evaluation support for training
- ✦ Support for medical first aid
- ✦ Up-to-date information on the combat capability of the troops
- ✦ Enabling seamless document landscape in health care delivery
- ✦ Automation of medical procedures
- ✦ Feedback to assistance systems for adapting the level of information and support
- ✦ Enabling personalised medical (immediate) care
- ✦ Supporting medical personnel in (automated) triage in the event of a mass casualty incident.

Many factors play a role here. For example, environmental sensors, motion sensors and medical sensors must be integrated into so-called wearables or smart textiles and combined with telemedicine. In the end, all this makes biomonitoring possible. In addition, there are other aspects such as the connection of the medical history, medication or the current state of health via the connection of the digital G-file. Senior technical advisor Christoph Petroll, head of the Assistance Systems research group in the System Soldier innovation laboratory at WIWeB, points out: "The digital e-recognition tag could play an important role in identifying the patient. It would help to automatically locate and recover wounded people on the battlefield by an Unmanned Ground Vehicle (UGV). The UGV could then take the patient to Role 1 care without the need to tie up or endanger other forces."

As this shows, it's a chain of new capabilities, not just a single sensor. Overall, biomonitoring could help improve the rescue chain. However, this is in contrast to the issue of the "transparent patient". Therefore, a discussion with corresponding specifications and decisions at other levels must take place in advance or in parallel. In Germany and Europe in particular, data protection is very high on the agenda. Therefore, the topic must also include discussions on data use, data security and data protection. WIWeB supports the advancement of the topic from a technological point of view.

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