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Defence Procurement in Germany



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- Threat and Protection
- Command and Control
- Effectiveness and Reconnaissance
- Survivability
- Support, Sustainability and Mobility
- Medical Support
- Training and Simulation
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The Dingos Saving Lives in Operations

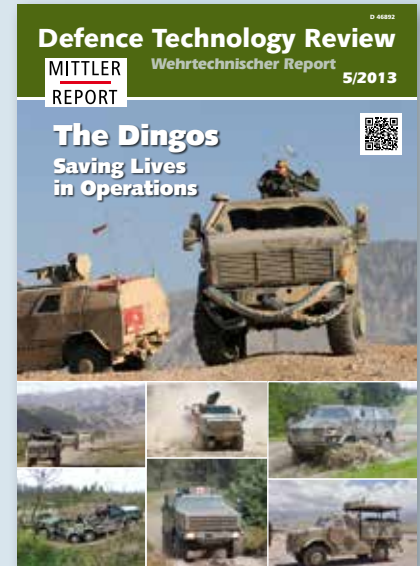
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Content

- 4 Well-Equipped – the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support
- 7 Equipment Management and Strategy Directorate (P)
- 11 Combat Directorate (K)
- 17 Air Directorate (L)
- 25 Sea Directorate (S)
- 33 Land Support Directorate (U)
- 41 Information Technology Directorate (I)
- 44 Information Technology Support Directorate (G)
- 48 The HERKULES Special Organization (SO H)
- 51 Purchasing Directorate (E)
- 54 Quality/Logistics Directorate (Q)
- 57 Central Affairs Directorate (Z)
- 60 The Agencies of BAAINBw
- 19 Masthead

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Well-Equipped – the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support

The procurement of defence technology is not quite as easy as private online purchasing. When dealing with the development of defence engineering, one quickly realises that military equipment must meet the highest requirements.

What is needed is robust state-of-the-art technology which can survive military operation and remain usable

for decades. In part, commercially available equipment can be used, but in many cases, a further or a new development

of special defence materiel is necessary. This being the case, procurement of such complex materiel takes time: Time in order to conceive the required technical solutions and also to test them by means of demonstrators. Not every new idea from the development departments passes the practical test at the first attempt. Here, realistic time schedules are indispensable. The procurement process must be as efficient as possible. Testing and quality assurance measures must be strengthened. These are also objectives of the Bundeswehr's reorientation.

Responsibility throughout the Entire Lifecycle

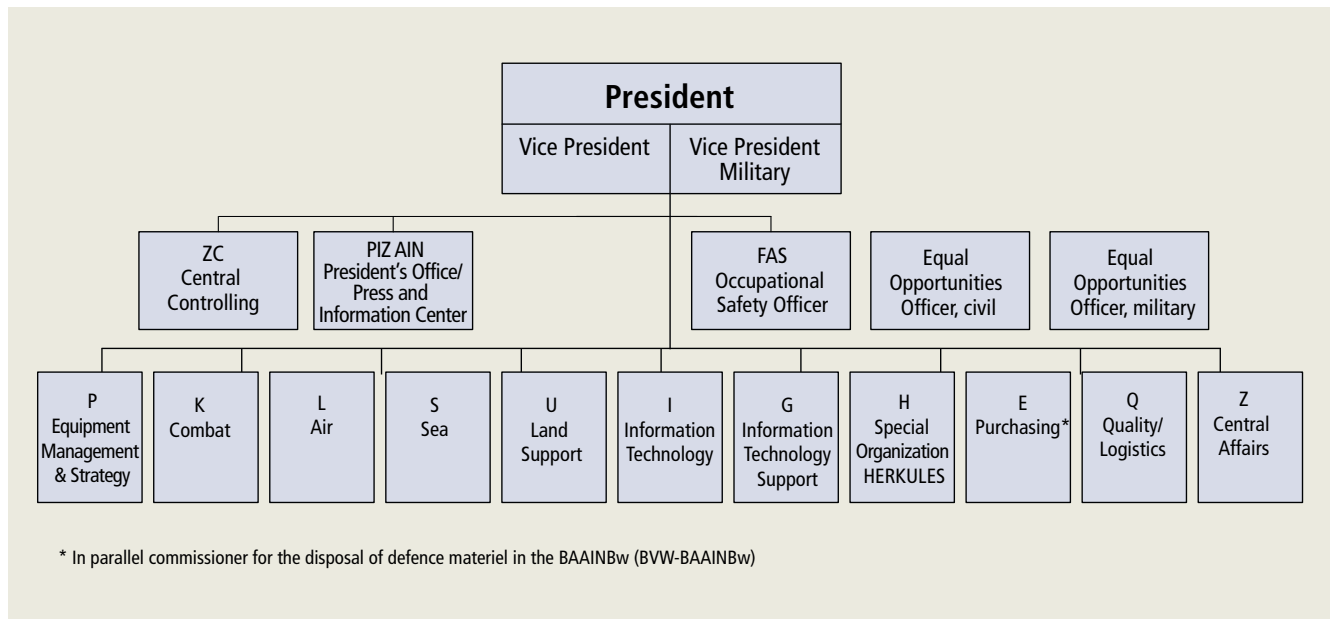
In the course of the reorientation of the Bundeswehr, a new Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (Bundesamt für Ausrüstung, Informationstechnik und Nutzung der Bundeswehr – BAAINBw) was established.

(Photos/Graphic: BAAINBw)



The BAAINBw buildings on the Rhine in Koblenz, including the "Bundesbehördenhaus"





While, before the establishment of the BAAINBw, the responsibility of the civilian Bundeswehr procurement organisation ended with the handover of the new defence materiel to the user, the new procurement procedure – the amended CPM – focuses on a holistic consideration and support of the defence materiel throughout its entire lifecycle – the so-called “material responsibility for operational maturity”. This holistic understanding requires a change of thinking in the equipment and procurement processes in order to implement this integrative approach. And this is the BAAINBw’s way to go.

With regard to the material responsibility for operational maturity, the BAAINBw is now confronted with a new task, which – previously – had not been performed

in the Bundeswehr in such an integrative manner. Thus, it is of utmost importance to bring together the persons who were responsible for the individual aspects before the reorientation. With the establishment of the BAAINBw, the Federal Office of Defense Technology and Procurement (BWB) and the Federal Office of the Bundeswehr for Information Management and Information Technology (Bundeswehr IT Office) were combined. In addition, elements of military offices responsible for in-service support management were integrated.

This also involved the relocation of personnel of military offices with in-service control tasks to the BAAINBw. Hereby, the existing knowledge of the two predecessor offices in terms of procurement was complemented effectively. Only by

means of this transfer of competence and know how can the new BAAINBw perform its comprehensive tasks in the area of material responsibility for operational maturity – from the analysis phase until condemnation – in a competent manner.

Capabilities of Directorates and Agencies Complement each other

Defence materiel expertise is pooled in ten directorates and one special organisation. For the implementation of armaments projects, there are six project directorates responsible for the following areas: Combat (K), Air (L), Sea (S), Land Support (U), Information Technology (I) and Information Technology Support (G). The in-service support tasks taken over

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from the former military offices and commands are integrated into the respective project directorates on a product-by-product basis.

The special organization HERKULES is responsible for the customer management within the HERKULES project, which is the largest IT modernisation project in Europe, and allows the Bundeswehr to be up to date in the area of administrative information technology, including theatres of operation.

The directorate "Equipment Management and Strategy" (P) is responsible for cross-directorate project coordination as well as strategic and operations-related tasks. It deals with topics of research and technology within the scope of the Integrated Planning Process and the Analysis Phase of the CPM (amended) as well as the update of the current status of capabilities and the conceptual further development of the Bundeswehr IT System.

The following directorates are in charge of central administrative and common technical-economic tasks: Purchasing (E), Quality/ Logistics (Q) and Central Affairs (Z).

The office's performance spectrum is complemented by modern test and research centres. Six Bundeswehr Technical Centres, two Bundeswehr Research Institutes and the Bundeswehr Information Technology Center (Bundeswehr IT Center) deal with the testing of defence materiel,

Central Controlling (ZC)

The Central Controlling (ZC) is responsible for BAAINBw controlling tasks across directorate or agency boundaries. It provides assistance to the executive group and ensures that the same controlling procedures are applied at the various directorates and agencies. It essentially deals with the following task areas.

The Strategic Controlling supports the BAAINBw executive group's management process, which is directed toward medium-term and long-term objectives. In principle, strategic objectives are defined in a structured process moderated by the Central Controlling. Controlling requires cooperation between managers and controllers.

Within the scope of Project Controlling, the Central Controlling conducts periodic or event-related analyses and assessments regarding the progress of armaments projects and complex services (including continuous efficiency review). It monitors the entire project management cycle ranging from objectives to planning, implementation, control and supervision as well as the preparation of project reviews. In addition, it provides comments on project-relevant submissions. On the basis of the assessment results, the BAAINBw executive group is provided with recommendations for action.

Furthermore, the Central Controlling combines the Research and Technology (R&T) Controlling, the BAAINBw Resources Controlling and the Agency Controlling. The Resources and Agency Controlling is based on the quantitative representation of performance in a periodical or event-oriented reporting. The assessments and recommendations derived from this aim at improving the cost-effectiveness of processes and performance.

Finally, the provision of technical support and advice to the controllers of the directorate/ agency is also among the Central Controlling's tasks.

the exploration of new technologies and the analysis of possibilities regarding the improvement of systems already fielded. The Naval Arsenal, another agency of the BAAINBw, ensures the operational readi-

ness of the German Navy and is thus a direct and valuable partner for the Navy in the theatres of operation. The liaison office in Reston/USA represents Germany's defence technology and armaments interests vis-à-vis government organisations and industry in the United States and Canada.

Solid Basis and Continuous Adaptation

The BAAINBw and its agencies are well-prepared for their challenging tasks, i.e. they are enabled to meet the new approach of holistic consideration and responsibility with regard to defence materiel. For almost two years now, the BAAINBw has successfully discharged the material responsibility for operational maturity entrusted to it.

Nevertheless, opportunities for improvement still exist. To this end, the so far different processes are thoroughly analysed and possible standardisations are reviewed and implemented. Also, the (amended) CPM procurement process as a whole is subject to evaluation.

One thing is for sure: This new approach – the BAAINBw's responsibility throughout the entire lifecycle – is reasonable. The office's integrative responsibility and the homogenous in-service control can be a valuable asset for the Bundeswehr. ■



The BAAINBw buildings in Koblenz-Raumental

Equipment Management and Strategy Directorate (P)

As a central technical service provider, BAAINBw is first and foremost responsible for equipping the Bundeswehr with materiel. In addition to development, testing, procurement and in-service support management of defence materiel, this task also includes purchasing commercial off-the-shelf products as well as complex services.

To meet the requirement of effective armed forces with technically up-to-date materiel, a multitude of – usually interdependent – influencing parameters must be taken into consideration in a modern equipment process. The correct and appropriate handling of complex armament projects in the early stages was one of the reasons why the “Equipment Management and Strategy Directorate” (P) was set up. In accordance with its mission, the directorate plays a key role in the performance of project management tasks. It acts as an interface between BAAINBw and the Bundeswehr Planning Office and represents the interests of all

users in the procurement and in-service process.

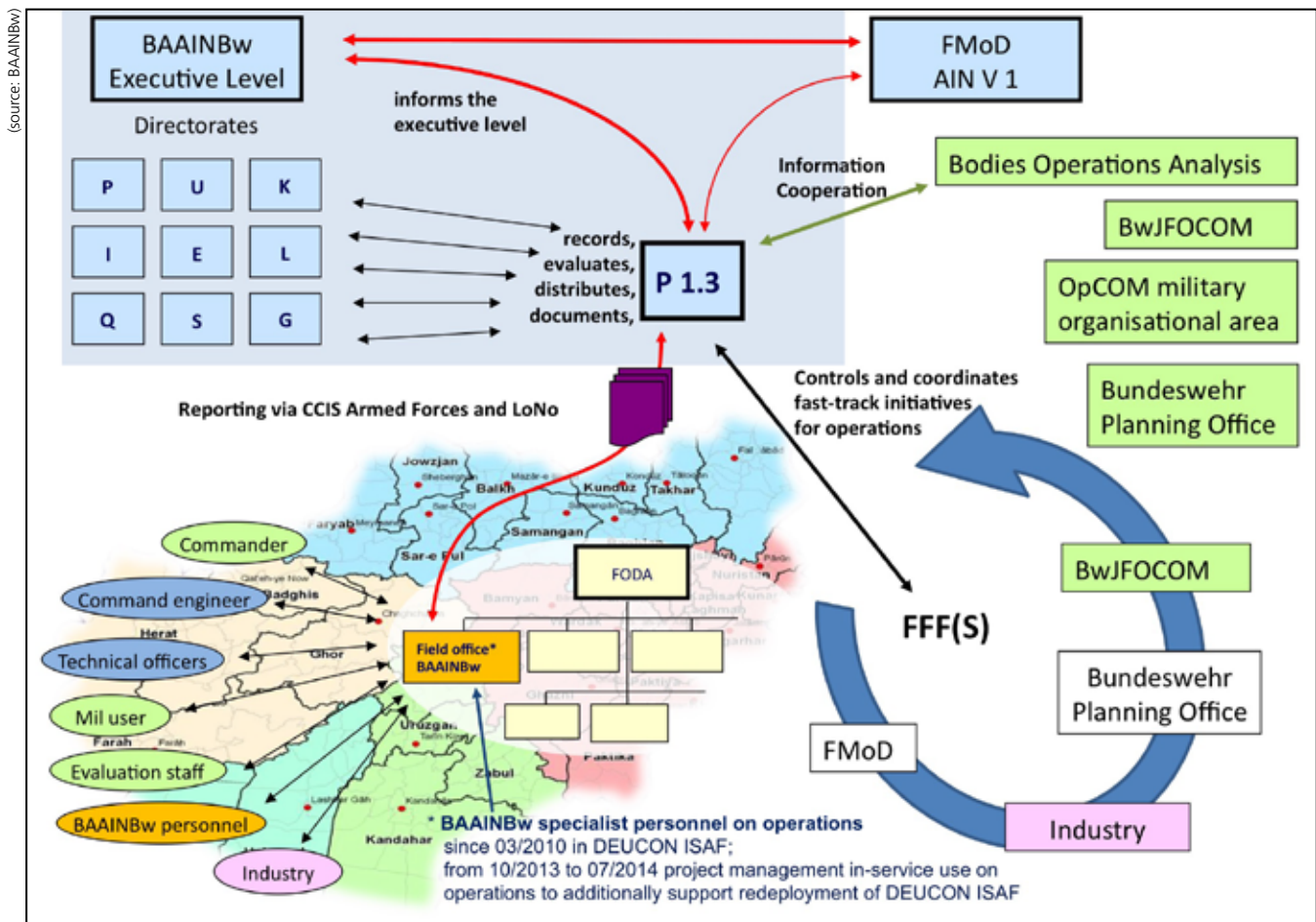
The Directorate is responsible for tasks across directorates and projects, which means that it exercises directive authority (within its competence) over the project divisions, yet it will not interfere with their respective technical expertise.

In addition to this management role, the directorate performs a range of strategic tasks for the Bundeswehr. This includes coordinating the implementation of the strategies and concepts in the following areas: Bundeswehr IT system, IT system architecture, service design, network-enabled operations, and concept development

and experimentation (CD&E). Furthermore, the directorate is responsible for the overall coordination of research and technology (R&T) tasks, the provision of tools used in modelling and simulation (M&S) in the area of responsibility of BAAINBw as well as project-independent international armaments cooperation.

The Directorate is structured into the divisions Equipment Management and Strategy with in total nine branches.

The main responsibilities of the Division P1 “Equipment Management” include coordination and handling of BAAINBw’s activities in the context of the Integrated Planning Process (IPP) and the analysis phase of



Working relations of Branch P1.3

the new Customer Product Management (CPM (nov.)), an advisory role for the executive groups of the BAAINBw in general or prominent project matters as well as a coordinating role concerning all mission-related tasks and R&T activities.

Integrated Planning Process

Within the Integrated Planning Process, the Bundeswehr Planning Office is responsible for the capability state and derives capability gaps from it. If these gaps are to be closed by materiel solutions, Branch P1.1 as the main interface with the Bundeswehr Planning Office contributes the technical and economic know-how of BAAINBw to the initiatives and to the preparation process of the "Capability Gap and Functional Requirement" (FFF for short) in the first stage of the analysis phase within the procurement process. To this end, lessons learned in own projects, system contexts, knowledge about commercially available services and products as well as about those that are still being developed, findings from defence research, international armaments cooperation, operations and in-service use are all taken into account. To the extent permitted by contract law, technical expertise from the economic and industrial sector is considered as well. Branch P1.1 covers the performance dimensions land, air/space, sea, cyber as well as the capability domains reconnaissance, command and control, effectiveness, and support. It also evaluates feasibility concerning time, cost, and technology. Thus, the Bundeswehr Planning Office is supported right from the start of the procurement process in order to be able to determine relevant data of a future project over the entire period from creation through in-service use to disposal and to include the findings in the decision-making process.

This forms the basis of a requirement management process throughout the entire life cycle of the product. With its systematic analysis and evaluation of risks, P1.1 makes a substantial contribution to the risk management of armament projects.

The number and complexity of projects as well as the new tasks during the in-service phase necessitate resources at the executive level that can provide information at any time on the current armaments, IT and in-service use situation, with a focus on approximately 100 programmes relevant to the executive level. Branch P1.2 performs this task by summarizing and evaluating important information from the project directorates for the BAAINBw executive level. Current lessons learned from operations are also used for this purpose. A future-oriented view of projects is essential. This is achieved by risk management in particular. In the framework of the new armaments process, the project council, headed by the BAAINBw Director-General, was introduced. The project council decides on the way forward when problems occur in the projects and calls project reviews as required, which are held by the project managers under the control of the Directorate P. The resources for this control function are provided by Branch P1.2, whereas other BAAINBw branches contribute other resources depending on the task to be accomplished.

Planning Input for Financial Requirements

For the purpose of financial requirements analysis, Division P1 collects, documents and evaluates all BAAINBw contributions. The planning input for the financial requirements forms the basis of all financial titles managed under the primary responsibility

of BAAINBw and includes the financial needs for research and development/testing, procurement and maintenance, petroleum, oils and lubricants, the costs for IT and communication lines as well as all existing private operator contracts for the further development of the Bundeswehr. In this process, all financial requirements of all ongoing armaments projects are assessed, from the analysis phase through postdesign services to changes of already introduced products.

Branch P1.3 "Coordination and Control of Operational Demands" is primarily responsible for the coordination and control of mission-related information, the procurement of mission-essential and urgent demands, and the evaluation of lessons learned with defence materiel in Bundeswehr operations abroad.

P1.3 also coordinates the deployment of "BAAINBw specialist personnel participating in operations". Before leaving for a mission, this staff is introduced to current projects by various project teams and technical centres or research institutes and is prepared for the main challenges that defence materiel faces in the area of operations.

Major Areas of Responsibility

Since defence materiel for operations was often introduced via the "urgent operational requirement" procedure – in future via the "fast-track initiative for operations" – with a challenging timeline, more information is needed about the lessons learned in the use of this materiel in operations. This need is covered by the specialist personnel participating in operations. The results thus obtained are made available to BAAINBw's project work and to the armaments, IT, and in-service use situation by P1.3. As far as

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the temporary task of redeployment from Afghanistan is concerned, BAAINBw also has a coordinating role (point of contact, POC).

The second major area of responsibility is the coordination and control of the "fast-track initiative for operations" in accordance with the CPM (nov.) across all project directorates and technical centres of BAAINBw. As soon as responsibility is transferred to this branch, it coordinates and monitors all activities. This applies to both technical tasks and necessary contractual activities. Monitoring this process is of major importance due to the urgency of operational requirements and the tight schedule involved.

Branch P1.4 supports the Director P in assuming responsibility for the coordination of all R&T activities of BAAINBw and its subordinate agencies. To achieve a focused, efficient and effective performance of defence research and technology activities, Branch P1.4 closely cooperates with the points of contact in the directorates of BAAINBw who are responsible for R&T tasks and the different fields of R&T in BAAINBw and its agencies, and it does so without interference in their responsibilities in the technical field. In this process, special consideration is given to new conceptual guidelines, derived from the Bundeswehr Planning Office's capability analysis, the developing link between security and defence research, and the internationalisation of R&T, particularly in Europe. In this context, it is important to develop a common understanding with the Bundeswehr Planning Office on how to provide the right R&T results in a timely manner for decision-making within the CPM (nov.).

Division P2 "Strategy" performs long-term work across different areas and coordinates the implementation of strategies

and concepts for the Bundeswehr IT system, network-enabled operations, cyber defence, CD&E as well as modelling and simulation tools in the BAAINBw's area of responsibility. It coordinates international cooperation.

IT Strategy

The IT strategy of the FMoD states that the "architecture method" for the Bundeswehr IT system is to be applied to the ascertainment and satisfaction of demands. While the operational architecture is to be prepared by the armed forces, BAAINBw is tasked with the elaboration of system architecture and the technical architecture for all performance dimensions and capability domains. Branch P2.1 "Bundeswehr IT System, Architectures and Interoperability" acts as IT system architect and is as such responsible for the development of the overall architecture of the Bundeswehr IT system. On the basis of guidelines, which are harmonised with the Bundeswehr Planning Office, regarding syntax, semantics and tools for the development and processing of the architecture, specific architectures are prepared by the projects to highlight cross-project system contexts with little effort. The current status is documented continuously and consistently. This facilitates the evaluation of capability requirements of fielded products and products in the process of being fielded in the context of the overall technical system and results can thus be used by the Bundeswehr Planning Office in the preparation of FFF/FFF(S). The expected result is a better integration of new materiel procurement solutions in the Bundeswehr procurement system. In the long term, this also means a transition from Bundeswehr IT system architectures to operational and

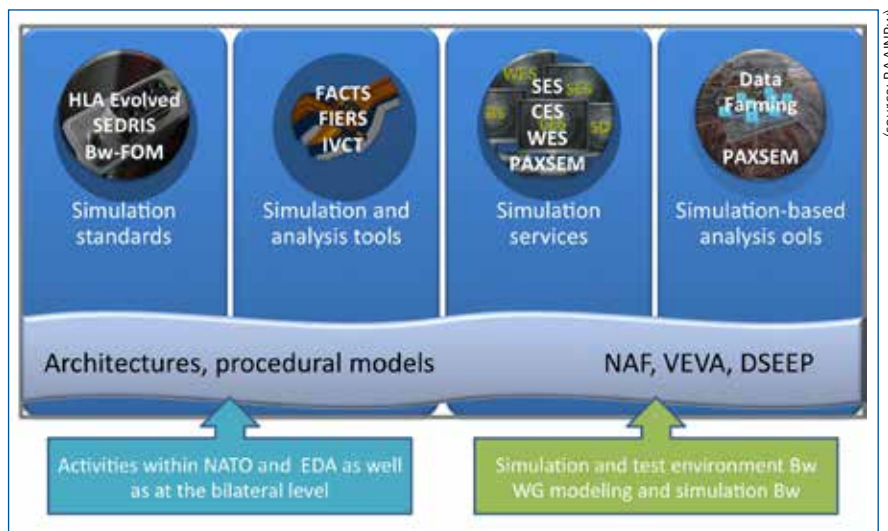
functional chains within the overall "System Bundeswehr".

Another task of this branch is to advise the directorates on methods in all matters concerning architecture production and development as well as to represent the method and the architecture tool to others (such as the Bundeswehr Planning Office or major organisational areas). The defined aim of the IT strategy of the FMoD is that all IT projects of the Bundeswehr are based on a service-oriented architecture. These IT services are to be made available on a shared IT platform.

Branch P2.2 "Service Design and Strategy" is the Bundeswehr service designer whose task it is to integrate these IT services into the service design of the Bundeswehr IT system. To this end, the Bundeswehr service designer uses specifically designed IT service management processes and IT service descriptions in order to identify new IT services and adapt existing IT services. This results in individual specifications for the respective projects. The shared IT platform thus also is a network within the IT services. As such, it is defined and developed further by the service designer. The IT service portfolio management for the Bundeswehr IT system, which includes the management of all planned, active and deactivated IT services, is performed centrally for the IT System Bundeswehr by Branch P2.2. There is a high level of interaction between service design and IT service portfolio management in this process. In future, BAAINBw projects that are related to IT will be part of the IT service management processes of the Bundeswehr IT system. The IT service management processes required for equipment and in-service use are intended to complement the existing processes, such as the Integrated Planning Process (IPP) and the CPM. These processes, too, are pre-

- Logistic vehicles
- Tactical vehicles
- Air defence systems
- Weapons and ammunition
- Infantry systems
- Protection systems
- Command and control
- Electro-optical components
- Simulation and training

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Main R&T activities in the field of M&S

pared by Branch P2.2 and integrated into BAAINBw's processes.

Selected strategic in-service use topics are coordinated centrally for BAAINBw, which is to say that the branch is a central point of contact for the FMoD. In contrast to service design or portfolio management, the range of topics is not limited to the Bundeswehr IT system.

Implementation

Branch P2.3 "Concept Development and Experimentation (CD&E), Tools of Modeling and Simulation (M&S) and Knowledge Management" pursues the implementation of the appropriate rules in the Bundeswehr concept and the subconcepts through the creation of a common armaments modelling and simulation landscape. The integration into a test environment allows for quick and effective testing of technical or technological solutions. The VIntEL¹ system demonstrator is used to record simulation systems already available in many agencies and makes them available as a network. As a result of this project, an architecture was created that allows real systems, simulation systems and command and control systems to be coupled reliably. Moreover, first central services have become available that enable Fair Fight² in a distributed simulation. As far as the VIntEL system demonstrator is concerned, it is a technical agent-based simulation that uses data farming to enable a comprehensive parameter analysis of technical and tactical aspects.

The simulation centre, which is anchored in Branch P2.3, serves as the central forum for the application and use of M&S. In addition to the provision of advice on the further development of simulation infrastructure for network-enabled simulation experiments, this also includes the coordination of standards with international partners. Beyond that, Branch P2.3 and the CD&E

centre together coordinate BAAINBw's contribution to CD&E projects that lie within the responsibility of the Bundeswehr Planning Office. Currently, the following national CD&E projects are supported: "situation in the information environment", "Bundeswehr-wide setup of network-enabled operations", "initial operations", and "air surface integration". At the multinational level, the US project series "Multinational Capability Development Campaign" (MCDC) is supported. This means that the focus is on operations and network-enabled operations. The aim of participation in the CD&E process is to obtain knowledge about project development in concrete terms and to support experimental projects with resources from the project directorates, the technical centres, the research institutes as well as the Bundeswehr Information Technology Center (Bundeswehr IT Center). The branch is also the point of contact for industry to submit conceptual ideas. This ensures that conceptual ideas from industry are dealt with in a legally permissible way and especially in accordance with the requirements of contract law and copyright law.

The terminology sector in the Bundeswehr seeks to achieve and maintain an unambiguous specialised vocabulary precisely in those areas where general definitions in the Duden dictionary cannot be used for the processes in the Bundeswehr. In this context, BAAINBw has a responsibility for all technical and economic terms. The participation of BAAINBw in nine terminology committees is coordinated together with the terminology coordinating centre at P2.3. Branch P2.3 is itself responsible for participation in the terminology committees "command and control support" and "missions and conduct of operations".

The knowledge management centre aims to make individual and public knowledge available in a quick and flexible fashion and thus to render the knowledge cycle

of employees more effective and efficient. This includes both shaping the boundary conditions, such as conceptual fundamentals, personnel and organisational aspects, training and even the actual IT support, and solving problems directly in daily routine operation. The knowledge management centre of Branch P2.3 currently deals with a number of platforms, for example wikis, sharepoint solutions, and the intranet of BAAINBw.

International Cooperation

Branch P2.4 "International Cooperation" coordinates and controls for all directs the international cooperation in interdisciplinary, project-independent defence technology cooperation within the area of responsibility of BAAINBw as well as the German spokesmen and delegates of BAAINBw in international bodies. Important tasks are, amongst others, the management of ITOPs (International Test Operating Procedures) and the consolidation of Test- and Evaluation (T&E) capacities on the European level by means of DTEB (Defense Test and Evaluation Database). In its role as the central point of contact for all matters concerning OCCAR (Organisation Conjointe de Coopération en Matière d'Armement) and EDA (European Defence Agency), the branch is able to represent German interests regarding the restructuring and improvement of the European test environment within international armaments cooperation. The branch is also the German point of contact for the US Foreign Comparative Testing Program: Branch P2.4 communicates national positions, status information, and results from international panels via the central application "Datenbank Internationale Zusammenarbeit" (DBIZA, database international cooperation).

Supporting and coordinating visits from foreign delegations and organizing bilateral annual programs under the auspices of the FMoD is another responsibility of P2.4. In Branch P2.5, there are still on-site tasks within the Bundeswehr IT system (frequency management, IT training, international exercises, tactical data links, operational view of the Bundeswehr IT system architecture), which will be carried out until the Bundeswehr IT system control centre is able to take over these tasks. ■

¹ Verteilte Integrierte Erprobungs-Landschaft (VIntEL – distributed integrated simulation environment)

² Fair Fight means that two or more simulation systems in a distributed simulation environment cannot use the overall system to the systematic advantage or disadvantage of other simulation participants.

Combat Directorate (K)

The BAAINBw Combat Directorate (K) is mainly responsible for weapon systems and their associated components. Projects include main battle tanks, armoured transport vehicles and a wide range of armament, air defence and artillery systems. The Combat Directorate is also in charge of infantry and engineer systems.

The BAAINBw's technical expertise is split among four project divisions:

- Ground-Based Air Defence Systems (K3);
- Air-/Ship-Borne Weapon Systems, Anti-Armour Systems (K4);
- Armoured Combat and Transport Systems (K5) and
- Artillery, Infantry and Engineer Systems (K6).

These four divisions are supported in the performance of their tasks by the interdisciplinary divisions for Economic and Technical Affairs (K1) and Economic and Legal Affairs (K2) in the fields of project and in-service management as well as research and technology (R&T).

The Director of the Combat Directorate is supported by KAS Directorate Staff and KAC Directorate Controlling.

KAS Directorate Staff is responsible for central organisational and administrative matters relating to personnel, training and future development as well as the organisational structure of the directorate. As such, KAS is the central point of contact for all members of the Combat Directorate and interfaces with the other BAAINBw directorates.

As an essential element of command and control support, **KAC Directorate Controlling** determines and analyses relevant project and performance data in preparation of executive decisions. Its main responsibilities are strategic controlling, project controlling, budget controlling and resource management.

The Economic and Technical Affairs Division (K1) supports the directorate in technical and economic matters across projects. The K1 Division Chief is responsible for planning and realising all research and technology activities in the field of ground-based weapon systems.

The division is structured into three branches.

Research and technology, system technology activities as well as international cooperation tasks are pooled in branch K1.1, which takes charge of these matters for the entire directorate. Among others,

K1.1 handles and coordinates all fields of technology in the task area. The main focus is on protection, ground vehicles, autonomy, weapons, ammunition, missiles and rockets, extended air defence and the soldier as a system.

Study results are immediately integrated into project work and the analysis phase. Furthermore, K1.1 represents the BAAINBw in international R&T bodies.

Branch K1.2 assesses systems and costs, i.e. it provides system analysis during the development of weapon systems, evaluates the technical and tactical system performance and conducts cost-benefit analyses.

As another main task, K1.1 models and evaluates the effect of ammunition on ground and air targets. In Bundeswehr operations, particular importance is attributed to the protection of vehicles against current threats. All directorates and projects deal with the various aspects of protection subsumed under the concept of "survivability".

Network centric operations, increasingly required by intelligent mobile platforms, are handled by K1.2 under the topic "systemics". National and international demonstrators such as the "Joint Operational Demonstrator for Advanced Applications" (JODAA) have already been presented in this context.

K1.2 also manages the "Joint Fire Support" (JFS) programme.

Branch K1.3 is responsible for technical safety and documentation. This includes ensuring operational and functional safety of defence materiel and ammunition safety in particular. Projects are supported by materiel documentation. State-of-the-art technology is used in the preparation of "Interactive Electronic Technical Documentation" to support the users. K1.3 also manages projects on fuse technology and initiates and conducts relevant research and technology studies. The branch takes care of all central matters of ammunition use, performs all interdisciplinary tasks and supervises the Bundeswehr Technical Center for Protective and Special Technologies (WTD 52) and the Bundeswehr Technical Center for Weapons and Ammunition (WTD 91). The five branches within the division for Economic and Legal Affairs (K2) are in charge of public procurement, contract management and contract award for the Combat Directorate. These branches pre-



LEOPARD 2A7 MBT – rear view from the right

Q&A

Interview with Brigadier General Erich Könen, Director of Directorate K

ESD: Are the planners in charge already thinking about future "heavy" combat vehicles?

Könen: In the framework of Franco-German cooperation a non-technical study has been undertaken to analyse potential future scenarios. For the time after 2030 military requirements from an operational point of view for a Main Ground Combat System and a Common Indirect Fire System are being investigated.

ESD: What developments can be expected regarding future indirect fire systems?

Könen: Experience in Afghanistan has shown that today, more than ever, artillery must be able to engage targets with pinpoint accuracy while the risk of collateral damage is minimised. Following this premise, the focus of current studies in the field of mortars and high-angle fire weapons is on the feasibility of a Light Weapon System for Indirect Fire. Here, the potential of development lies in increasing first-round hit probability and responsiveness.

The combined use of advanced laser, GPS and optronic sensor technologies including the automated processing of sensor data gained could help significantly reduce the process of laying the mortar weapon – and thus the time until firing readiness is established – and could also allow more precise target engagement. Furthermore, possibilities of weight reduction by using lighter materials or a smaller calibre are being investigated. This is designed to further enhance the mobility for fast gun position changes and the capability of responding to swiftly changing threat situations. In the case of the fielded systems MARS, a multiple-launch rocket system, and PANZERHAUBITZE 2000, a self-propelled howitzer, the requirements regarding precise target engagement are met by way of ammunition improvements. For the MARS system, which is equipped with the European Fire Control System, it is the GPS-guided missile of the type "GMLRS Unitary" that serves to meet this requirement. This missile



has been in the Bundeswehr inventory since 2009.

As to the PANZERHAUBITZE 2000, the "precise tube ammunition for indirect fire, 155 mm" (PRIF) is scheduled to be qualified in the near future. In addition to the inertial and GPS navigation functions, a semi-active laser in combination with a target designator guides the PRIF projectile to the target with high precision. GPS inaccuracies can thus be eliminated.

In order to avoid having to use a forward observer as active target designator, work is in progress on an infrared guidance system under which the projectile autonomously homes onto a target with defined thermal signature. Although this technology has been successfully applied in guided missiles, its use in artillery projectiles poses a technological challenge, given the smaller installation volume available and the high launch acceleration forces. On the one hand, the IR sensor suite must be hardened to withstand the high mechanical load, on the other hand it must have an adequate detection sensitivity in the IR range. Once a technical solution has been developed and validated under these framework conditions, the German Navy could use such artillery ammunition with autonomous infrared seeker head for its 127 mm naval guns on board the F125 frigate for naval gunfire support.

ESD: What is the status of the PUMA project? Are still measures required to ensure logistic supportability?

Könen: Apart from the technical and operational capabilities of the PUMA armoured fighting vehicle, its logistic

supportability plays an important role in achieving full operational readiness of the system. This includes – among other aspects – the availability of spare parts, the conclusion of open-end repair contracts, the availability of special tools, the creation of Interactive Electronic Technical Documentation and the availability of appropriate training assets. It was not possible to complete this whole range of measures for the Army by early 2015, when the in-service phase started. With the scope of assets available by then, the Army was, however, at least able to start its training activities. In addition, the necessary measures have been initiated to raise the degree of logistic supportability successively until 2017.

ESD: Is there a need to continue with the procurement of the BOXER, possibly in additional variants?

Könen: On the basis of the current contracts the BOXER series will be completed with the delivery of the last vehicles of the version "Heavy Protected Medical Service Vehicle" in mid-2016. By that time, all 272 ordered vehicles will have been delivered to Army, Joint Support Service and Medical Service.

The structural requirement for protected vehicles within the Army clearly exceeds the 190 armoured personnel carriers and command and control vehicles delivered so far. Therefore, stepping up the number of both armoured personnel carriers and variants is currently the subject of coordination talks.

ESD: What will be the points of emphasis in the procurement of future small arms?

Könen: The aim is to modernise all small arms, and in particular to improve night combat capabilities.

The outdated MG3 machine gun, which will be no longer logistically supportable in the long run, is planned to be replaced with the MG5, a weapon of the same calibre. Furthermore, the MG4, as a light machine gun, is planned to join the range of commonly used weapons outside the "Future Infantryman" concept. As regards sniper weapons, the 8.6 mm x 70 calibre will be introduced for better performance. All small arms will be adapted to the extended task spectrum by means of supplementary kits.

The questions were asked by Michael Horst.

pare, conclude and manage contracts for the individual projects as well as contracts that affect more than one project within the directorate's area of responsibility. This includes – as was the case in the past – contracts on the in-service phase of defence materiel. The contract branches also support the projects in concluding national and international agreements. Furthermore, K2 assists foreign nations which bought defence materiel from the Federal Republic of Germany in concluding and managing contracts with German industry. One branch of this division is specialised in matters of pricing regulations for public contracts and in charge of negotiating prices with contractors. The project LEOPARD 2 main battle tank, which is described in the following, serves as an example to illustrate all facets of a large-scale project.

Introduction of the LEOPARD 2A7 Main Battle Tank

Background

The current main battle tank fleet of the Bundeswehr comprises LEOPARD 2 main battle tanks (MBTs) in the versions 2A5, 2A6 and 2A6M (with mine protection). These versions were developed in the context of the weapon system improvement programmes I and II in the nineties and the mine protection improvement programme, which started in 2000. The LEOPARD 2A5 MBT was introduced from 1995 onwards and the versions 2A6 and 2A6M from 2001 and 2004 onwards respectively. In the framework of these programmes, the LEOPARD 2 MBT was significantly improved in the fields of front protection (increased duel capability), command and control (separate thermal imaging for the commander), combat (long barrel) and, at a later stage, mine protection. As a result of the budget situation, it was not possible to refit the entire MBT fleet. It was possible, however, to create systems with a high degree of logistic commonality which offered graded levels of different capabilities. At that time, the Bundeswehr still had, in addition to its 350 LEOPARD 2A5/A6/A6M MBTs, another 800 LEOPARD 2A4 MBTs. Already very early on, an operational capability requirement was made (back in 1987) for a new secondary ammunition on the basis of a high-explosive (HE) projectile in order to be able to engage not only MBTs, but also other ground targets. At the end of the year 2000, the required operational capability (ROC) for this ammunition was approved by the Ministry. It was not possible to implement the neces-

The new 120 mm HE ammunition from Rheinmetall

sary system adaptation of the MBT in the context of the weapon system improvement programmes mentioned above since the required ammunition was not yet available. Furthermore, additional improvement requirements were made at a later stage and approved in order to be able to use the MBT in the evolving different scenarios as well. To ensure that the MBT can be deployed worldwide and in combination with other arms and services, sustainability and command and control capability had to be improved. Requirements included a cooling system and a power supply unit. On the initiative of the tank troops, but then rightly on the basis of an interdisciplinary approach, a command and control system was designed and intended for implementation in the MBT.

The work was performed in three separate projects. The cooling system and the power supply unit were combined to form the energy and crew compartment cooling system. The new secondary ammunition, an HE projectile as a replacement for the multi-purpose ammunition, can be further divided into the round as such and the necessary adaptations to the MBT (HE system adaptation). The adaptations are necessary in order to be able to actually use the capabilities of the round. The integrated command, control and information system IFIS as well as its integration into the MBT was launched at the time as a project in the Federal Office of the Bundeswehr for

Information Management and Information Technology (Bundeswehr IT Office), which is today the IT Directorate within the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw).

Other Considerations

While these three projects increasingly gained in maturity for implementation as a result of the cooperation with industry, additional and more comprehensive considerations by the Armor School, Combat Development Division, led to the initiative "adaptation of the LEOPARD 2 MBT to operations within the entire task spectrum" of June 2006. This initiative was performed on the LEOPARD 2 MBT in accordance with the conceptual ideas of the tank troops. The fundamental assumption was that future operational scenarios are characterised by asymmetric warfare of enemy forces in an urban environment. Based on the principle of composite land force operations, this is already the case at a low level in a joint setting as well as in a multinational environment and in the most diverse intensities.

Other than in the past, the LEOPARD 2 MBT can in future as a generally conceivable possibility also be employed in a complex and dynamic operational environment (urban, populated terrain). Generally, the main threat is no longer posed by enemy MBTs, but by asymmetrically acting adversaries. They typically use hand-held antitank weapons and missiles at a short distance as well as improvised explosive devices (IED). The change in potential threats led to a wide range of new capability requirements. It was distinguished between upgrades required for additional employment options (especially for duel capability) and urban operations. The projects that were already under way could be integrated into this requirement matrix.

On the basis of the existing projects and the newer initiative, Krauss-Maffei Wegmann GmbH & Co. KG (KMW) developed a concept demonstrator called LEOPARD 2 PSO (Peace Support Operations). The concept was implemented in the prototype LEOPARD 2 PSO-VT. Specific sections of the prototype were subjected to intensive evaluation and qualification by Bundeswehr agencies. However, it was then not possible to realise overall industrialisation for series production.

Canada's MBT Loan and Return

In 2007, the Canadian armed forces acquired 20 LEOPARD 2A6M MBT on a loan basis for operations in southern Afghanistan. Within a few months, the MBTs



(Photo: Rheinmetall)

were supplied, equipped with the changes required by Canada, and deployed to Afghanistan. The MBTs demonstrated their capabilities in all areas on many occasions, but most notably in the field of IED protection. No Canadian crew member was killed. While the mission was still ongoing, Canada decided to procure Dutch LEOPARD 2A6 surplus MBTs, have them upgraded to the German K status and to return those to Germany, rather than the original vehicles. Upgrading the Dutch LEOPARD 2A6 MBTs required the vehicles to be dismantled completely, which in turn made it easier to implement other measures. An agreement could be reached with Canada that allowed the planned German measures to be implemented in the course of this upgrading work. This formed the basis for today's LEOPARD 2A7 MBT.

Implementation

It was not possible, as originally intended, to make the changes defined in the programme "adaptation of LEOPARD 2 MBT to operations in the entire task spectrum" to the vehicles in the context of their return after expiry of the loan because the period of time available for return did not match the period that the still outstanding development and qualification work would have required.

The situation was different for the HE system adaptation, the energy and crew compartment cooling system, and IFIS – their planning had already been under way. Final readiness for series production was not achieved in their case either, but the risk of the required remaining work was assessed as low. The contracts on their implementation were signed according to a phased schedule.

Components of the LEOPARD 2A7 MBT

The New HE Secondary Ammunition and System Adaptation

The current multi-purpose ammunition, which has been in use practically unchanged ever since the LEOPARD 2 MBT was introduced more than 30 years ago, leaves virtually no room for improvement in terms of its effect. This observation led to the development of a new secondary ammunition (DM11), which was designed purely as a fragmenting HE round right from the start.

In technical terms, the challenge was presented by the development of the fuse with three modes of operation, as follows:

- Nondelay contact fuse against unarmoured and lightly armoured targets

and to produce collateral damage at heavily armoured targets;

- Delay contact fuse against unarmoured targets immediately within and behind cover as well as against infrastructure;
- Programmable, i.e. time-adjustable ignition to achieve airburst with optimised fragment distribution pattern, against unarmoured and lightly armoured targets also behind cover as well as against helicopters.

A data communication interface is used to transmit the selected mode of operation to the fuse, and the fire control system must automatically consider a higher super elevation if airburst is selected. This requires MBT adaptations.

As far as the crew is concerned, both tank commander and gunner have access to operator controls with which the fuse mode can be selected. The eyepiece displays the selected mode to the gunner. The maximum effective range is increased to 5,000 metres, and the graticule in the auxiliary telescopic sight is changed.

Another change, which is introduced simultaneously with HE modification, is a new operating concept. This will be done on other vehicles as well. Most notably, this change will be felt by the tank commander, since several older controls and displays are replaced by a single commander system control panel.

The commander's station is now more neatly organized. The space thus gained was necessary for the IFIS monitor integration.

The Energy and Crew Compartment Cooling System

The purpose of the crew compartment cooling system is to create adequate climatic conditions in the crew compartment of the LEOPARD 2 MBT in order to increase the crew's sustainability and ensure the system's operational readiness in hot or hot and humid regions. All crew member positions in the turret feature individually adjustable cooling air vents. The cooling air requirements in the electronics compartment were also taken into consideration. The system is integrated into the turret bulge. In connection with the new stowage concept, it was necessary – as a follow-on measure – to completely redesign the turret bulge.

The independent power supply is to ensure MBT operation in the highest operating mode without having to start the main engine. Now, a water-cooled auxiliary power unit (17 kW) with a two-cylinder diesel engine developed by the

manufacturer is installed in the rear right-hand shoulder of the hull.

Integrated Command, Control and Information System IFIS

The combat direction system (CDS) of the combat forces IFIS ensures information supply for the command and control of combat forces. In several stages, the system provides the combat forces in their command and control or combat vehicles with a mostly common command and control equipment.

As far as the LEOPARD 2 MBT is concerned, the equipment will be made available to the commander as a minimum. It was possible to equip all 20 MBTs of this upgrade with this system at the loader's position and, based on a reduced and task-related approach, the driver's position as well. The equipment at the loader's position means that every vehicle can also be used as command and control vehicle.

For operational reasons, the user refused to have four antennas installed to transmit voice and data radio communication; Comrod antennas are used instead.

Additional Measures and Modifications

Since the MBT had to be dismantled to a high degree for the measures described, it was also possible in this context to fit brackets as a preparatory step for the installation of additional armour. Neither are the preparatory measures final, nor are the associated protective elements part of this upgrade. If required for operational reasons, it will be possible to implement these quickly because the time-consuming and cost-intensive workshare will have already been done.

What is more, obsolete parts are removed and deficiencies corrected as required for continued operational readiness. Also, measures are implemented to comply with legal requirements.

The following significant modifications are planned for the LEOPARD 2A7 MBT:

• PERI R17A3 Periscope

The 360 degree view periscope of the commander, the PERI R17, was equipped in the course of the weapon system improvement programme with a thermal imager (TIM), then designated as PERI R17A2. Manufacturer support for this TIM device ended several years ago and thus caused logistic problems. The thermal imager ATTICA from Cassidian is used as a replacement (R17A3). The LEOPARD 2A7 MBT will be delivered with this periscope. Also, conversion work within the troops has already begun. Initially merely intended as a replacement, the new TIM offers a new reconnaissance quality.

- **Fire Suppression System**

As part of the upgrade to the LEOPARD 2A5, the fire suppression system installed in version 2A4 was deactivated and uninstalled because the extremely oxidising hydraulic gun-laying system was replaced by an electric system; furthermore, the use of Halon as extinguishing agent was no longer allowed. After the user re-evaluated the threat situation and a replacement extinguishing agent became available, the fire suppression was reinstalled.

- **New Intercom System (ICS)**

The old ICS no longer complies with the ergonomic requirements of the new and more strict noise control regulation. The SOTAS IP system manufactured by Thales, already available in the BOXER ATV and the PUMA IFV, is used instead. The new radio headsets with active noise suppression also help the crew to concentrate on their tasks. The upgrade also includes an external telephone junction box at the vehicle rear, which has been a requirement for quite some time.

- **Optimised Vehicle Electrical System**

The changes made to the MBT over the years with their increasing effect on the electrical system led to an imbalance in the vehicle electrical system. Although this situation could be kept under control as a result of training and procedural information for the crew, it did no longer comply with the principle of simple operation. High-performance capacitors are now used to automatically achieve a balanced electrical system.

- **Reduced Carbon Monoxide Levels in the Crew Compartment**

When weapons with gun powder are fired, carbon monoxide gas enters the crew compartment. More strict limits made the performance of tests necessary. It was found that the carbon monoxide level is too high if the tank gun and the coaxial machine gun vent are used at the same time. Changing the fan control solved the problem.

- **Additional Measures**

The upgrade is also used to implement additional smaller measures to improve operational readiness. For example, an overpressure valve is fitted to the MBT, which renders the complex adjustment procedure of the NBC protective ventilation unnecessary.

Summary

Although the total number of MBTs that are being upgraded (20) is significantly falling short of requirements, use was made of the unique opportunity that presented itself by the return of the MBTs used by Canada on a loan basis.

The LEOPARD 2A7 MBT provides the German Army with a technically well-balanced main battle tank with significantly increased capabilities in combat, sustainability and command and control compared to the previous versions. It also offers a higher level of protection.

The first LEOPARD 2A7 MBT currently undergoes development testing at the Bundeswehr Technical Center for Weapons and Ammunition (WTD 91) in Meppen. After that, operational testing will be performed by the tank battalion 203 and the School of Land Systems Engineering. Delivery of the 20 MBTs was scheduled to be completed by the end of 2014.

The follow-on measures in the context of adaptation to the entire task spectrum, which had already been planned at an earlier stage, must be reassessed against the backdrop of changed procurement procedures.

Although currently not at the focus of attention, the further development of MBTs with regard to ammunition, combat system, protection and reconnaissance means must ultimately not be ignored. ■

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Combat Directorate – Glossary	
Project	managed by ...
Multifunctional Fuse for Mortars and Artillery	K1
Joint Fire Support	K1
PATRIOT (incl. Combat Efficiency Improvement)	K3
MEADS	K3
SysFla Air Defence System	K3
NBS C-RAM (Very Close Range Air Defence System Counter – Rocket Artillery Mortar)	K3
TORNADO Precision Weapons	K4
EUROFIGHTER Precision Weapons	K4
FUCHS Wheeled Armoured Transport Vehicle (Product Improvement Protection)	K4
90mm Effector direct/indirect Fire, Special Forces	K4
MELLS Weapon Station	K4
Laser Target Designation System	K4
MAW TAURUS 2.1 Engagement Infrastructure Target	K4
RAM Block 2 Shipborne Anti-Missile Defence System	K4
ESSM Shipborne Air Defence Missile	K4
Ship-to-Air Standard Missile 2 (SM 2)	K4
RAM Combat Efficiency Improvement	K4
IRIS-T Short Range Air-to-Air Missile	K4
METEOR Medium Range Air-to-Air Missile	K4
PUMA Armoured Infantry Fighting Vehicle (AIFV)	K5
WIESEL 2	K5
BV 206 S	K5
FENNEK Armoured Reconnaissance Vehicle	K5
BOXER Armoured Transport Vehicle (GTK)	K5
120mm LEOPARD 2 Tank Gun Upgrade	K5
30mm KETF (Kinetic Energy Time Fuse) Cartridge	K5
30mm x 173 LS Practice Round	K5
120 mm x 570 HE Cartridge	K5
MLG Light Naval Gun	K5
Mortar Combat System Command Vehicles	K6
PzH 2000 Armoured SP Howitzer	K6
MARS/MLRS GMLRS	K6
Rocket Launcher Combat Efficiency Preservation	K6
120mm Mortar Weapon Carrier	K6
155mm HE MOD 2000 Shell	K6
120mm HE Mortar Shell “NG”	K6
120mm Mortar Smoke Shell, multispectral coverage	K6
120mm Mortar Flare, infrared	K6
155mm Projectile (multispectral smoke)	K6
FENNEK Equipment	K6
Mobile GFF/GTF Weapon Station	K6
Machine Gun (MG) Successor Generation	K6
Equipment for Armoured Vehicle Launched Bridge	K6

Air Directorate (L)

The Air Directorate of the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) focuses on the management of all aeronautical projects. When BAAINBw assumed material responsibility for operational maturity on 1 January 2013, in-service control tasks were assumed in addition to typical defence procurement tasks.

For the Directorate, this meant assuming various tasks that had previously been the responsibility of the Air Force. With the large-scale transfer of mostly military posts from all service branches required for this purpose, the directorate's previous posts were doubled to approximately 700 as of today. The projects managed by the Air Directorate comprise important major projects as well as equipment specific to aeronautics. The spectrum covers very agile fighter jets, transport and special aircraft, state-of-the-art helicopter systems, unmanned aerial vehicles, tactical UAVs and space-based reconnaissance systems as well as crew escape and protection systems, simulators and training equipment. In addition, the directorate is also responsible for the operational maturity of weapon systems in service for many years or recently introduced into service. Nearly all major projects are managed in multinational, primarily European partnerships and management agencies.

The Air Directorate supports its associated (weapon) systems during the entire project life in accordance with the amended Customer Product Management (CPM (amd.)) procedure by means of

- System-related research and technology;
- Participation in the analysis phase by providing support to the Bundeswehr Planning Office, and during the realisation and in-service phases;
- Management and support of all manned and unmanned aircraft projects as well as flying and space-based Bundeswehr reconnaissance systems and
- System engineering and integration of subsystems including armament.

Furthermore, the comprehensive range of tasks also includes high-priority procurements within the context of "fast-track initiatives for operations".

Directorate L is well prepared for handling its tasks and products.

The five branches of the "Economic and Technical Affairs" Division (L1) deal with the directorate's common and cross-project tasks.

Branch L1.1 is responsible for system engineering aspects as well as research and technology activities (R&T) within the "Air and Space Systems" task area. These are manned and unmanned aerial platform technologies including their avionics and integration of equipment and technologies for space applications. Moreover, the branch represents BAAINBw in relevant international bodies such as NATO¹, EDA², ETAP³ and others.

personic flights etc.) are the responsibility of Branch L1.3.

Branch L1.4 is responsible for tasks within the context of type 5 materiel (= Air Force) documentation as well as materiel used by other major Bundeswehr organisational elements within the operational and support responsibility of the German Air Force Chief of Staff.

"Software Maintenance and Modification of Flying Weapon Systems" is the responsibility of Branch L1.5.

Branch L1.6 reflects technical competence for product families specific to aeronautics as well as common ground support and test equipment and maintenance depot equipment.

The "Economic and Legal Affairs" Division L2 consists of five branches and supports projects in legal and contractual issues (Branches L2.1 through L2.4). It performs price negotiations (Branch L2.5) within the context of contract establishment and administration. Moreover, Division L2 supports the projects within the context of international negotiations and agreements. The five other Divisions L3 through L7 of the directorate are particularly geared to

Photo: BAAINBw (L3, 3)



ASSTA 3.1 IDS TORNADO at the ILA 2014

In-service use specific aspects of aircraft systems, technical supervision of the Bundeswehr Technical Center for Aircraft and Aeronautical Equipment (WTD 61) in Manching as well as tasks associated with flight safety, incident handling (aircraft accidents/incidents) and the issuance of special flight operation-related permits (weekend flight operations, su-

working in a product and/or project oriented way. An essential task of Divisions L3 through L7 is to support products and services in the spectrum mentioned above during the entire life cycle.

For this purpose, Division L3 is responsible for fielded transport and special aircraft, TORNADO as well as rescue, special flight and parachute systems. The entire

(Photo: Bundeswehr)



Helicopter flight simulator at the Bückeburg "Hans E. Drebing Simulator Center"

range of Bundeswehr helicopters/rotary wing aircraft is the responsibility of Division L4. Division L5 is concerned with airborne and space-based reconnaissance systems as well as electronic warfare including unmanned aerial vehicles.

Division L6 deals with the EUROFIGHTER aircraft.

Division L7 manages the A400M project. The Directorate Staff supports the Director in administrative matters. Directorate Controlling provides coordination and advice when data are prepared with regard to a continuous time, performance and cost controlling.

Selected Directorate L projects are presented below so as to represent the variety of projects and the broad spectrum of project tasks.

ASSTA 3.1 TORNADO Software Upgrade

Modernisation measures in the form of product improvements for expanding and adjusting capabilities to the current threat situation are being performed continuously for the TORNADO weapon system, in service since the early 1980s. Core element of the TORNADO weapon system's operational capabilities is the Avionics System Software TORNADO in Ada (ASSTA). Avionics hardware upgrades and extensions always go along with ASSTA software upgrades. Due to the high testing effort required for ASSTA

certification, product improvements and weapon system modifications are combined in packages.

In mid-2012, the ASSTA 3.0 software status including the pertinent hardware was certified. This status includes the incorporation of the MIDS (Multifunctional Information Distribution System/Link 16) data communication system, installation of an advanced VHF/UHF⁴ radio in accordance with the SATURN⁵ standard and a digital video and data recorder. Another essential ASSTA 3.0 element was the integration of LJDAM (Laser Joint Direct Attack Ammunition/GBU-54) precision ammunition that can be guided to the target by means of both satellite navigation and la-

ser. The upgrading of all 85 series aircraft is intended to be completed by 2018.

In addition, the rear cockpit CRT displays dating back to the TORNADO early years will be replaced by LCD⁶ monitors in another upgrade to ASSTA 3.1 standard. These allow for a multicoloured display and information overlay. For economic and logistic reasons, the decision was made to use the same monitors already being incorporated in the TORNADO as pilot and navigator head-down displays within the context of ASSTA 2. Such monitors are required for an ergonomic display of MIDS functionalities that will be expanded considerably in the ASSTA 3.1 upgrade as compared to ASSTA 3.0.

ASSTA 3.1 will be introduced in two steps. The first step focuses on software adaptation for controlling the new monitors in order to allow for early and hence, cost-effective hardware installation. The current upgrade programme for ASSTA 3.0 functionality will be expanded accordingly to include aircraft not yet upgraded. Software for the operation of the first aircraft upgraded at that time is planned to be available in mid-2015. The second step focuses on the expansion of MIDS functionalities with a significant increase in MIDS/Link 16 messages. The pertinent software is planned to be released approximately one year later.

ASSTA 3.1 software processing is performed on a cooperative basis between the industry and the Air Force at the TORNADO system support centre in Manching. The overall project responsibility rests with Airbus Defence & Space, the system developer. Flight trials have been conducted at Bundeswehr Technical Center 61 since early 2014.

At the same time, a new RADAR/IR decoy container including missile warning device has been integrated; however, for

(Photo: Airbus)



A400M cockpit



The first A400M for the German Air Force (54+01) during its maiden flight near Seville on 14 October 2014

the moment it is not linked to ASSTA. In a cooperation with Italy, the threat detection capability and the capability of initiating countermeasures such as RADAR and IR decoy ejection will be expanded with this project. This will improve the weapon system's self-protection against missile threats.

By introducing ASSTA 3.1 including the associated hardware extension the TOR-NADO weapon system will be updated to the current state-of-the-art for the extended in-service phase.

Aircraft Simulators

In times of increasingly scarce budget funds and the associated reduction of flying hours, flight and combat mission simulators are becoming more and more important for the pilots' initial and follow-on training. Thus, the Bundeswehr maintains simulators for most airborne weapon systems. The simulators allow for the transfer of essential type rating training portions as well as realistic training of all in-flight and emergency procedures, night low-level flying in particular. There are a total of twelve helicopter flight simulators located at the Bückeburg simulation centre for the purpose of Army Aviation and Air Force initial and extension training. The centre operates two night low-level flying simulators for the CH-53GS and UH-1D helicopter systems each and another eight EC 135 training helicopter simulators. The simulators are modular in design and have type-specific variations only. Each simulator consists of one base, one type and one sensor module. The base module includes all elements that are not type-specific (such as simulation computer, image generator, simulator control station, energy supply) including motion system and an external view display (eight-channel dome projec-

tion with a 240° x 90° field of view). It is identical for all simulators. The type modules can be installed and removed as required. Furthermore, it is possible to integrate tactics modules. Among other aspects, this allows for the realistic display of the employment of self-protection systems.

The German Federal Police use the EC 135 simulators for their pilots' initial and follow-on training. In cooperation with the German Federal Office of Civil Aviation, the four EC 135 simulators were certified in accordance with civilian guidelines in order to accept simulation hours as flying hours. This also enables other interested partners to co-use these simulators.

CH-53G/GS/GA and UH-1D Aircraft Night Low-Level Flying Simulators

The CH-53G/GS and UH-1D night low-level flying simulator training systems display the environment in-flight as it is perceived by aircrews in the cockpit under day and night conditions. For this purpose, also ambient light intensifier goggles are used. A tactics module will be implemented for the CH-53G night low-level flying simulators with the purpose of simulating the operation of the CH-53GS helicopter self-protection system. Moreover, another two exchangeable CH-53GA modules will be delivered within the CH-53 product improvement project.

NH90 Weapon System In-Flight and Tactics Simulator

Two Full Mission Simulators (FMS) are available for the pilots' basic flying training at the Bückeburg Army Aviation School simulator centre. Furthermore, one FMS each for the follow-on and extension training of combat-ready pilots is available at the Holzdorf and Fassberg air bases. The NH90 simulator was imple-

Masthead

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mented as Private Finance Initiative (PFI) by HTMI (Helicopter Training Media International GmbH) as an Airbus Helicopter, CAE, RDE and Thales consortium. It is operated by HFTS Helicopter Flight Training Services GmbH. As prime customer, the Bundeswehr rents the required training hours at the simulator without being its owner.

The FMS consists of a functional NH90 helicopter cockpit trainer with a six-axis motion system and dome projection for an external view display (240° x 60°), a FLIR/NVG sensor vision system and a tactics module for the interactive simulation of electronic warfare sensor and weapon systems. An interconnection is planned

in two single cockpits, each including its own six-axis motion system and dome projection for an external view display, a FLIR/NVG sensor vision system and a tactics module for the interactive simulation of electronic warfare sensor and weapon systems. The Tiger simulators are also interconnectable both to each other and to the NH90 simulators.

Sea Lynx MK 88A In-Flight and Tactics Simulator

German Navy training is conducted by means of the international Joint Lynx Simulator Training Establishment (JLSTE) located at Nordholz Naval Air Wing 3 after relocation from the Netherlands. The

tor of AMSL at the Wunstorf A400M national training centre for flying training purposes. The introduction into operational service was originally planned for late 2014. Essential FFS parts are identical to the A380 simulator. However, the vision system is a completely new design meeting military requirements. All cockpit instruments are original aircraft instruments. All flight attitudes, flight conditions and missions including low-level flying can be simulated by means of the motion system.

Eurofighter Aircrew Synthetic Training Aids (ASTA)

In the Eurofighter FMS both basic training and retraining are conducted until aircrews achieve "combat ready" status. Training includes air-to-air and air-to-ground missions in dynamic tactical scenarios including airborne and ground-based threats. The simulators can be used individually as well as in formation. The FMS also allow for air-to-air refueling training. Furthermore, they serve to develop and test tactics as well as to conduct mission rehearsals. The vision system consists of 13 and 16 channels, respectively, with a 360° field of view each. The Eurofighter ASTA are installed at the Laage, Nörvenich, Neuburg and Wittmund air bases. Just like the helicopter flight simulators, the ASTA are also planned to be interconnected in the future.

A400M Airlifter

The Airbus A400M military airlifter is an all-weather capable cargo aircraft optimised for strategic and tactical air transport. The A400M development and procurement is one of the most important European defence programmes. The A400M development and procurement contract was entered into on May 27, 2003 between Belgium, Germany, France, the United Kingdom, Spain and Turkey – as represented by the European Organisation for Joint Armament Co-operation (OCCAR)⁷ – and Airbus Military. Since then, the project has been managed by OCCAR on behalf of the participating nations. With the French Air Force accepting the first airlifter into service in August 2013, the go-ahead for the in-service use was given. Step by step, the other partner nations will accept their aircraft into service in the years to come. In Germany, the A400M will, as follow-on solution, replace the C-160 Transall military airlifter, which has been tried and tested but is also approaching the end of its service life.



(Photo: Airbus Military)

EUROFIGHTER TYPHOON ASTA simulator

for flight training purposes when training is conducted in a flight of several helicopters.

UH Tiger Weapon System In-Flight and Tactics Simulator

The Tiger pilots' basic flying training is conducted at the Franco-German training centre in Le Luc/France. For this purpose, four Full Mission Simulators including a total of eight cockpits and eight Cockpit Procedure Trainers (CPT) are available for German-French joint use. Furthermore, the German Army has another FMS and another CPT at the Fritzlar air base for the follow-on and extension training of combat-ready pilots. The Tiger simulators are manufactured by Thales and RDE. They consist of functional tandem cockpit trainers that are separated

JLSTE is operated by Portugal, Denmark and Germany, which share both its use and its operational costs. The German share is approximately 70% with regard to both use and operational costs. A "Memorandum of Understanding" governs the nations' cooperation. All decisions are taken by the Joint Executive Committee (JEC) and are implemented by Germany as responsible host nation. The simulator configuration will be set up in accordance with the respective version required by the nation conducting the training. The work required for this purpose approximately takes two to three hours.

A400M In-Flight and Tactics Simulator

Among others, a Full Flight Simulator (FFS) is set up by Thales as subcontractor

BAAINBw is responsible for national project management as well as fielding the A400M into the Bundeswehr and will fulfil essential in-service support management tasks in the future.

In the future, the German Air Force will employ the A400M for both logistic and tactical air transport operations. In the A400M programme, the logistic air transport capability was already achieved when delivering the first aircraft to France. This capability includes both transportation of soldiers as well as of materiel, vehicles or special cargo. Within the scope of the following deliveries to the different partner nations, the tactical A400M capabilities are intended to be established gradually. In such tactical roles, the A400M is capable of conveying personnel and materiel straight into

a theatre of operations. For this purpose, the A400M requires neither a paved runway nor an existing infrastructure for instrument navigation.

Further tactical capabilities include airdropping of troops and materiel as well as various special roles like medical evacuation (MedEvac) and air-to-air refueling.

The A400M must have a sturdy, reliable and variable design to meet this wide spectrum of requirements. The spectrum also comprises the capability of taking off and landing on short runways as well as good flight qualities at slow speed and rapid loading and unloading capability on the ground. As regards the A400M's tactical usability, particular focus is on the self-protection system. This system shall be able to identify threats posed by

enemy air combat and anti-aircraft systems and initiate protective measures by deploying countermeasures (decoys) or deflecting enemy fire.

With an expected service life of at least 30 years, the A400M as the most advanced military aircraft for logistic and tactical air transport of the German Air Force will contribute considerably to the Bundeswehr's operational readiness and sustainability. ■

-
- 1 North Atlantic Treaty Organization
 - 2 European Defence Agency
 - 3 European Technology Acquisition Programme
 - 4 Very High Frequency/Ultra High Frequency
 - 5 Second Generation Anti – Jam Tactical UHF Radio for NATO
 - 6 Liquid Crystal Display
 - 7 Organisation Conjointe de Coopération en matière d'Armement

Air Directorate – Glossary

Designation	managed by ...
Renewal of FMOD Special Air Mission Wing medium and long distance aircraft fleet	L3.1
Maintenance of maritime patrol and anti-submarine warfare capability until 2035	L3.2
TORNADO short-range precision weapon integration	L3.3
TORNADO MIDS data radio transmission system integration	L3.3
TORNADO chaff / infrared decoy container	L3.3
IDS/ECR TORNADO electronic warfare upgrading	L3.3
TORNADO display upgrading	L3.3
TORNADO TV/TAB upgrading	L3.3
TORNADO service life extension	L3.3
TORNADO electro-optical target designator	L3.3
CH-53 G product improvement	L4.1
Light support helicopter for special forces	L4.1
Basic training helicopter	L4.1
CH-53 sensor-assisted landing aid	L4.1
Sea Lion naval transport helicopter (NTH)	L4.2
TIGER support helicopter (UHT)	L4.3
NH-90 helicopter for transport and maritime operations	L4.4
Airborne wide area signal intelligence, surveillance and reconnaissance system	L5.1
Deep theatre imagery reconnaissance system (Heron 1)	L5.1
Unmanned deep theatre imagery reconnaissance and surveillance capability	L5.1
Unmanned airborne close reconnaissance system (LUNA)	L5.2
Reconnaissance and identification in maritime theatres	L5.2
Synthetic Aperture Radar altitude high (SARah) radar satellite system for worldwide imagery reconnaissance	L5.3
Optical satellite system for worldwide imagery reconnaissance	L5.3
Radar jamming system for Bundeswehr aircraft	L5.4
EUROFIGHTER a/c	L6
AESA radar for the EUROFIGHTER weapon system	L6
A400M air lifter	L7
A400M DIRCM electronic warfare self-protection equipment	L7

Q&A

Interview with MinR Joachim Sucker, previously Director of Directorate I, today Head of Subdivision AIN V, FMoD

ESD: What are the special challenges presenting themselves with regard to enhancing the EUROFIGHTER capabilities?

Sucker: The EUROFIGHTER weapon system is a fighter aircraft developed by Great Britain, Italy, Spain and Germany for the air defence role. This weapon system has been in operational use in Germany without any air accident since 2004. The ongoing developments (role adaptation) will provide the aircraft with the additional capability of being used as platform for all-weather-capable precision munitions in the air-to-ground role. In the framework of independent programmes, the IRIS-T (short-range) and METEOR (medium-range) missiles are being integrated for the purpose of adaptation to future threats. This is accompanied by measures to improve the electronic self-protection suite. Development of a new radar (AESA radar) is in the phase of preparation. The NATO NETMA agency (NATO Eurofighter and Tornado Management Agency) realises the programme on behalf of the four core nations, while Eurofighter Jagdflugzeuge GmbH acts as prime contractor on behalf of the parent companies Airbus Defence & Space, BAE SYSTEMS and Alenia.

Experience from day-to-day flight operations and in particular findings gained by the four nations during international missions result in specific requirements forwarded by the respective nations. International harmonisation of these national requirements, which is designed to lead to future-oriented planning of the further EUROFIGHTER development, as well as the issue of cost-efficient operation of a complex weapon system will constitute the main challenges in the next few years. In order to be able to respond to these challenges, it will be necessary – among other measures – to consider whether modifications of the management structures might be necessary, both at NETMA level and in the single core nations, and implement such modifications accordingly. Industry will have to be involved in such considerations. All this can only work if deci-



sions are made in a good time and if the necessary financial arrangements for the project during the in-service phase are ensured with regard to the necessary amounts and the required distribution over the years.

ESD: ... and when is the first Luftwaffe EUROFIGHTER expected to have a full air-to-ground capability?

Sucker: The EUROFIGHTER weapon system has so far been used by the German Air Force in the air policing and air defence roles as well as for training purposes. The quadrinational "Phase 1 Enhancements" programme serves to realise for Germany the integration of the LITENING EF laser target marker and the all-weather-capable short-range GBU-48 air-to-ground weapon as well as the adaptation of the human-machine interface in order to support the pilot for the multirole capability.

The contracts for "Phase 1 Enhancements" as a project of four nations were concluded by NETMA and Eurofighter Jagdflugzeuge GmbH in March 2007. Implementation was scheduled to be accomplished by late 2014. Since the German variant of the GBU-48 weapon differs from the internationally integrated design status, a supplementary integration will be necessary afterwards. According to the current state of planning, the supplementary integration will be accomplished by mid-2015, as far as the basic weapon is concerned.

Besides the integration, especially the qualification and compliance demonstration of the modified GBU-48 components are pre-requisites for use by

the Luftwaffe. This will be completed by an Operational Suitability Test for the EUROFIGHTER equipped with GBU-48, followed by the official approval for service use, which is planned for late 2016.

ESD: The CH-53 is an ageing aircraft. Do the Bundeswehr planners currently think about a future transport helicopter?

Sucker: Under the lead responsibility of the Bundeswehr Planning Office a comprehensive study is in progress on "Future developments in the field of capabilities of rotary-wing aircraft in the Bundeswehr". My Directorate is involved in the analysis of "technological and economical" aspects. Within this context we also deal with a future heavy transport helicopter. In the past, we have already carried out studies and examinations on potential successors to the CH-53 Medium Transport Helicopter (MTH). The findings then gained are used as inputs for the current planning.

The final Bundeswehr Planning Office report is expected to be presented before the end of this year. Interim results indicate already that from the technological and economical point of view – and also in other respects – replacing the CH-53, which was introduced in 1972, with a successor helicopter would be reasonable. The costs of servicing, maintenance and elimination of obsolescence to keep the aged equipment in service are steadily rising.

ESD: After the first A400M has been handed over to the Bundeswehr, what other essential steps/measures are necessary before the armed forces can be given the go-ahead for use of the aircraft on operations?

Sucker: One essential measure in this context is the "complementary compliance demonstration", that is to say providing evidence of compliance as required for licensing or release of various additional capabilities and functions at the national level. For the first three A400M the logistic airlift capabilities will, in a first step, be adapted to the specific circumstances in the Bundeswehr. This covers, for example, the transport capacities of Bundeswehr vehicles and the types of pallets and containers used in the national logistic system. In the course of later deliveries of A400M aircraft, tactical capabilities, too, will successively be validated in the frame-

work of this "complementary compliance demonstration", for example the A400M as receiver aircraft in air refueling operations. Having been validated, these tactical capabilities will be released for safe in-service application. For use of the A400M in threat areas the self-protection capabilities of the aircraft – the "Defensive Aids Sub-System" – will be an essential pre-requisite.

Besides the complementary compliance demonstration the training of the A400 personnel will have to be ensured. Training of the instruction and top-level personnel at the Sevilla International Training Centre has started even before the delivery of the first A400M. Now the training of the pilots, loadmasters and maintenance personnel is coming into focus. To this end, a National Training Centre has been created specifically for the A400M. Courses at this centre, which will ensure the training of military and civilian personnel for day-to-day A400M operations, will start in July 2015.

Another step yet to be taken, depending on the type and scope of a mission, is the development of logistics for deployed operations. This calls for experience in the technical handling of the aircraft and the associated logistic procedures, and it requires that deployable ground support systems and ground handling equipment as well as established spare part logistics are available. We are working on all these pre-requisites and they must be met before the first operational mission can be undertaken.

ESD: How many of the A400M to be delivered to the Bundeswehr can be used as tanker aircraft for air refueling?

Sucker: The Bundeswehr will receive ten underwing adaptation kits for providing the A400M with the capability of refueling other aircraft in the air. These kits are of modular design, i.e. any of the A400M delivered to the Bundeswehr can be fitted with them. In addition, six adaptation kits will be procured for fitting the aircraft with a refueling station in the fuselage. Both systems enable the A400M to supply other aircraft with fuel. In addition, six internal tank adaptation kits will be procured for the cargo bay in order to increase the volume of fuel that can be passed.

By the way, independently of these adaptation kits each A400M will be ca-

pable of receiving fuel in flight from a suitable tanker aircraft via a so-called refueling boom.

ESD: What is the experience from using the TIGER helicopter on operations? Have operational findings led to current projects aimed at adapting the TIGER armament?

Sucker: In total, four TIGER support helicopters altogether have been employed in Afghanistan. A two-aircraft element was constantly available to the Task Force, whereas another two aircraft served as technical back-up. Altogether, the TIGER has proven its mission value. The forces employed in Afghanistan have very much welcomed the availability of the TIGER during the mission. In particular, the TIGER's long endurance in the area of operations – compared to other systems (e.g. Apache) – and its outstanding flexibility met with a very positive response.

From the technical point of view, the mission participation of the TIGER was a great success. Despite the fact that spare parts and equipment needed for operating the TIGER were available to a very limited extent only and little operational experience was available yet, the requirement of constantly providing an operationally-ready two-aircraft TIGER element could be met at all times.

None of the TIGER operational sorties involved live firing. During firing practice it turned out that despite high hit accuracy the effectiveness of both the gun and unguided rockets against ground targets is insufficient in primarily sandy terrain. From this lesson learned, requirements concerning future armaments can be derived.

These requirements – e.g. the introduction of a larger-calibre gun (20–30 mm) – will be examined in the framework of the TIGER Capabilities Assurance Programme (TIGER CAP), which is being discussed with France and Australia as the TIGER partner nations.

ESD: Will the creation of the Bundeswehr Aviation Office entail changes in the Air Directorate or the subordinate agencies of BAABw?

Sucker: By creating the Bundeswehr Aviation Office we are concentrating essential issues of national military aviation in a single entity. My Directorate has been actively involved in shaping

this newly created office. For this purpose we have established a dedicated "Certification" working group.

The procedures and rules/regulations of the Bundeswehr have to be adapted accordingly. The BAABw Director-General now has the responsibility to assign the ownership of a military type certificate. All tasks related to this (of which so far the Air Force has been in charge) will be performed by my Directorate in future.

Particularly affected by the organisational changes is, in my view, the Bundeswehr Technical and Airworthiness Center for Aircraft (WTD 61), whose area of activity "Type Inspection" including the task of military type certification is going to be incorporated into the Bundeswehr Aviation Office. Although this implies that we have passed the responsibility for type inspection and type certification to the Bundeswehr Aviation Office, WTD 61 will remain a reliable and competent partner of the Air Directorate and the Bundeswehr Aviation Office in view of its expert knowledge and its concentration on the testing of aircraft, aeronautical equipment and accessory equipment.

ESD: Looking at the current use of unmanned aerial vehicles in Afghanistan: should we continue to rely on leasing solutions as far as capabilities based on unmanned systems are concerned?

Sucker: The successful use of the Israeli HERON 1 system under an operator solution in cooperation with Cassidian Airborne Solutions has shown that a leasing approach can be a reliable solution for our armed forces. The essential point for answering the question "procurement or leasing" is, however, cost-effectiveness, with the key input parameter being the planned duration of a contract. As a rule, procurement of a system is more cost-effective than leasing, if we have a long contract duration. In addition, issues such as certification under aviation law, maintaining that certification over the whole contract duration and, above all, the potential limitations to operational flexibility imposed by the contractor or operator have to be taken into account.

No general decision can be taken in favour of leasing or procurement. Rather, the preferable option will have to be selected on a single-case basis.

ESD: There can be no doubt that the tactical unmanned aircraft systems (UAS) of the German Army – KZO, LUNA, ALADIN and MIKADO – have proven their worth during a number of operational missions since the start of the last decade. Each of them has its specific capabilities which it has demonstrated successfully and reliably. For the future, there are calls to introduce an unmanned aerial sensor platform in the field of maritime operations, too. What are the perspectives for the UAS, given the fact that they are getting older and that there are more advanced or new capability requirements?

Sucker: Generally one can say that – largely based on findings from operational missions – all the systems you have mentioned are undergoing a process of technical updating in the form of product modification and obsolescence management. As a result, their technical status is adequate and meets the requirements. The acceptance of these systems among the armed forces is high.

However, mere technical modifications to maintain products in operational readiness do not turn an aged system into a new one and do not constitute technical progress in the sense of achieving higher performance and more effectiveness. According to current plans, the KZO and LUNA systems will be replaced starting in 2018 with a state-of-the-art medium-range imaging reconnaissance system offering enhanced capabilities. The main performance features required for a follow-on system are a range of at least 100 km combined with more than ten hours of flight endurance and a highly advanced multi-sensor suite.

The ALADIN and MIKADO systems are scheduled to be replaced from approximately 2020 to 2022 onwards. Studies are underway on how the related capabilities have to be further advanced after the service life of these systems has expired. Depending on the user requirements, the options would be either a regeneration of the old systems or the analysis of a new system in the course of the procurement process.

As far as the use of tactical UAS in the field of maritime operations is concerned, the user has finalised his requirements to be met by such a system and the requirements regarding its integration into the K130 corvette. On the basis of this requirement, the Integrated Pro-

ject Team headed by BAAINBw is carrying out the necessary technical and economical examinations and developing proposals for a reconnaissance and identification system to be employed in a maritime area of operations. Once the Bundeswehr Chief of Staff has selected a solution – a decision is scheduled for 2015 – we can start with the implementation. The system is planned to be used from 2018.

ESD: What capabilities does the Bundeswehr currently have in the field of satellite-based reconnaissance and what capabilities are planned for the future?

Sucker: With the SAR-Lupe radar satellite system and the integrated system formed by SAR-Lupe and the French HELIOS II optical satellite system, the Bundeswehr currently has access both to radar and optical imagery of high resolution. Both systems have been in operational use for several years and will have to be replaced successively from 2018 onwards.

In order to safeguard this capability for the future, development of SARah as the successor system to SAR-Lupe started in 2013 already. In the framework of SARah, OHB-System as main contractor and AIRBUS Defence & Space (formerly Astrium) are building two satellites with a reflector antenna and one satellite with a phased-array antenna. Launching these satellites is planned for late 2018 and early 2019 respectively.

The second project to be mentioned here is the “Optical satellite system for worldwide imaging reconnaissance”, for which the selection decision is scheduled to be taken very soon (as of: September 2014). This project is designed to satisfy the requirement for high resolution satellite images that cannot be obtained by means of the desired continued cooperation with France (SARah and CSO as the HELIOS II successor system).

ESD: How does the Research & Technology section of the Air Directorate contribute to the objective of preparing the Bundeswehr for future developments in the military aviation sector?

Sucker: Based on the findings gained during the Bundeswehr deployment missions and on the conceptual baseline documents issued by the MOD, our work in the “Aerospace Systems” field of the Research & Technology task is mainly guided by:

- The increasing demand for unmanned aviation systems and the capability of the latter to participate in general air traffic;
- The need to integrate manned and unmanned systems;
- The need for efficient and powerful propulsion systems for future Bundeswehr aviation systems;
- The need to draw up a system concept and develop technologies for a potential Future Combat Air System, with different solutions still being possible;
- The need to increase automation, taking crew assistance systems and eligibility for certification into account, and
- The increasing importance of outer space utilisation and the significance of outer space systems as critical infrastructure.

To this end, recognised research institutes in the aviation sector (e.g. the institutes of the German Aerospace Centre or of the Fraunhofer Society), universities or aviation industry businesses are tasked to undertake selected examinations. This serves to ensure comprehensive capabilities of analysis and assessment and provide concrete inputs to capability management. Research & Technology also deals with technologies for product improvement on fielded systems for which successor systems will not be available in a long-term perspective.

In the sector of defence technology and engineering, it is indeed desirable to maintain and expand specialised solutions and isolated technologies at the national level, both for reasons of competitiveness and in order to have a guarantee that these technologies are basically available. This does not generally exclude, however, a willingness to cooperate. A large share of the project is carried out in cooperation with nations with comparable future capability requirements and a corresponding industrial basis. Partners are, for example, the European Defence Agency (EDA) or the six-nation European Technology Acquisition Programme (ETAP).

Of course, close cooperation in the field of defence research and technology is being carried out across the boundaries of single tasks and, thus, across the boundaries of Directorates.

The questions were asked by Ulrich Rapreger.

Sea Directorate (S)

The Sea Directorate is responsible for procurement and for maintaining the operational viability of ships and boats of the German Navy as well as of shore-based facilities and navy-specific equipment. It supervises the units also after their decommissioning and on their way from condemnation to disposal, thereby assuming material responsibility in all CPM (amended) phases.

All in all three project divisions of the Sea Directorate handle the units afloat:

- Surface units (frigates and corvettes) (S3)
- Subsurface units (U212A, mines, mine countermeasures, subsurface weapons)(S4)
- Support units, auxiliary vessels and support systems (S5)

For each class of ship a project manager is responsible from procurement to condemnation and manages the respective "Integrated Project Team" (IPT) during all phases.

As a result of the Bundeswehr reform, the responsibility was extended to in-service weapon systems of the Navy. The German Navy itself retains the "in-service and supply responsibility for the maintenance of operational capability".

Apart from the three project divisions the Sea Directorate has three specialist divisions that support the projects.

The **"Economic and Technical Affairs" (S1) Division** prepares during the analysis phase – partly in cooperation with the project divisions and with external support – the ship concepts as well as any technical and funding-related contributions. In addition, S1 coordinates the planning of all R&T activities related to naval technology. In order to support conceptual design activities, the "Overall Design Process Model for Ships" (VORGES) was created, which helps to determine at an early stage of the analysis phase how different requirements will affect the ship's design, as well as the costs to be expected. What is more, Division S1 provides projects during the realisation and in-service phase with specific technical and logistic support concerning shipbuilding, propulsion systems, electrotechnics and auxiliary systems engineering.

The **"Economic and Legal Affairs" (S2) Division** is in charge of all contracting and pricing issues. Furthermore, it draws up international agreements with regard to the projects.

The **"Navy C2 Systems" Division (S6)** assists the project managers and the Navy in planning, realising and using the CCI and weapons control systems (FüWES) as well as a number of highly complex subsystems of military relevance, including tactical data links. Apart from that the S6 Division supports special cross-sectional aspects such as maritime training facilities, which also includes the Tactical Training, Support and Test System of Systems (TAUES).

The Sea Directorate continues to have both a Controlling and a Staff Directorate. The **Staff Directorate (SAS)** handles organisational and personnel-related matters, while the **Controlling Directorate (SAC)** continuously prepares relevant project data in order to support the Director.

Current Status of the Class 125 Frigate Project

The four new Class 125 frigates (F125) have been designed for joint and combined long-term military operations of low and medium intensity. Their design was dictated by several important requirements: heavy use, worldwide operation and defence against asymmetric threats.

In order to be able to support long-term stabilization missions, the F125 was designed for in-theatre deployment periods of up to two years without planned yard periods and a considerably increased number of 5,000 steaming hours per year. At the same time, the permanent crew was reduced to about half the size of what it had been for Classes F122 to F124, i. e. to a manning level of 120. In order to make sure that heavy use will be possible and to implement the crew concept, extensive studies regarding operational procedures, system availability and crew workload were conducted. The results obtained were mainly implemented by choosing sturdy and low-maintenance systems and installations with a high degree of automation. The capacity for "heavy use" will be demonstrated during the construction of the vessels by 2016. Following the acceptance of the first ship it will be subjected by the Navy to 12 months of operational suitability testing.

The F125 is equipped with innovative sensors and weapons providing comprehensive surveillance, target detection, tracking and effective target engagement capabilities to counter asymmetric threats, particularly at short and very short range. The sensor suite includes, among other things, an all-new TRS-3D NR (non-rotating) radar, optoelectronic components for short and very short range surveillance, as well as a diver detection sonar. The F125's armament suite supports gradual, selective and precise engagement. Remotely controlled 12.7 mm heavy machine guns (HMGs) and two 27 mm naval recoilless guns (MLG 27) are available to counter asymmetric threats. The Rolling Airframe Missile (RAM, a



F125 BADEN-WÜRTTEMBERG after undocking in Hamburg

(Photo: Bundeswehr)

close-in weapon system) and the Multi Ammunition Softkill System (MASS, a decoy launcher) protect the F125 from conventional threats. For long-range engagement, the vessel was outfitted with HARPOON anti-ship missiles and Oto Melara's new 127mm/L64 gun, which allows for naval gunfire support with high-precision VULCANO ammunition.

seas as well as antisurface warfare and naval gunfire support.

Given the extensive task profile of the K130 corvette, which is in particular contingent on the littoral warfare requirement, and considering the ship's design required for this purpose, the corvette offers only a relatively small construction volume.

this context a maximum amount of capabilities was to be implemented ("design-to-budget / design-to-cost").

There were concrete requirements for the K130 combat direction system. The 76 mm gun, the RAM system and the MLG 27 mm (light naval gun) were laid down from the beginning. The RBS15 Mk3 (robot system) heavy antiship missile as well as the MASS decoy launcher were stipulated as well. At the same time, the maritime unmanned aerial vehicle and the POLYPHEM light antiship missile were projected and earmarked for integration. The UL5000K ESM/ECM (electronic support measures/countermeasures) system, which corresponded to the requirements, was under development at this point in time and was ready for series production. Moreover, parts of the Class 124 Frigate operational software were provided for the preparation of the K130 operational software.

The construction contract on the delivery of five corvettes was concluded in December 2001 between the then Federal Office of Defense Technology and Procurement (BWB) and the ARGE K130. The ARGE K130 was a consortium consisting of the following shipyards: Blohm + Voss, Nordseewerke Emden and Fr. Lürssen Werft.

As early as during implementation, the ship class under construction was subject to a continuous adaptation process. The overall project was characterised by significant changes.

The POLYPHEM project was not pursued until operational maturity was reached; as a result this missile was not procured. The integration of the Compact Towed Array Sonar System (COTASS) has been prepared as far as the platforms are con-



(Photo: Fassmer)

Tactical vessels for the F125

The F125 accommodates not only two shipboard helicopters, but also four 10 m tactical vessels.

ARGE F125, a joint venture of Thyssen-Krupp Marine Systems and Fr. Lürssen Werft, is in charge of the construction of the vessels. The first Class 125 vessel, called BADEN-WÜRTTEMBERG, was christened at the premises of Blohm + Voss in Hamburg in December 2013. Delivery of the first ship is scheduled for early 2017, with the other vessels following until mid-2019.

K130 Change Management during Implementation and Service Use

A complex sea weapon system such as the K130 corvette is subject to continuous changes, which are primarily brought about by operational reality. Initial requirements become less important or are cancelled, while additional capabilities become necessary and already existing ones are intensified.

Given the extended task profile of the German Navy it became quickly apparent that there was more to it than finding a replacement for the fast patrol boats with their foreseeable end of use. The task profile includes worldwide operation, joint and combined maritime low- and high-intensity operations as well as a high level of endurance, effective range and combat power. Moreover, the following capabilities shall be ensured: reaching into coastal areas while coming from high

In 2001, the K130 corvette became the first complex weapon system which was to be procured within the context of competitive bidding and on the basis of a functional statement of work without binding requirements with regard to technical solutions (systems/equipment). The aim of the then newly established CPM (Customer Product Management) procedural provisions was to provide the potential bidders with freedom of design in order to be able to present innovative solutions. With regard to the implementation the public customer was to focus on control tasks. In order to ensure the economic efficiency of the project, a strict price ceiling was specified. Within



(Photo: Bundeswehr)

The Class K130 corvette MAGDEBURG



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cerned ("space & weight"), but it has not been implemented due to the evaluation of currently possible operational scenarios. The same applies to the maritime unmanned aerial vehicle.

The implementation of the project was accompanied by various "labour pains". One factor to be mentioned here is that a damage occurred at the port gear

missions and have been permanently deployed in the UNIFIL mission since October 2014.

As a result of the experiences gained during these missions an adapted software version is currently being prepared for the combat direction system. Moreover, heavy machine guns with ballistic protection were retrofitted.

Spare Parts Repository after Decommissioning

The spare parts supply becomes increasingly difficult for all shipboard installations and systems that have not been regenerated at regular intervals. Thus, it was a reasonable decision to use the decommissioned units as spare parts repositories before they are eventually

Directorate Sea – Glossary

Project	managed by ...
Class F124 frigate	S3.1
Class F125 frigate	S3.2
Class K130 corvette	S3.3
Data processing equipment Class F122/F123 mission system	S3.4
Class U212A submarines	S4.1
Torpedo DM2A4	S4.2
Submarine Defence Weapon 90 UAW 90)	S4.2
Underwater reconnaissance drone AUV	S4.2
Sonar 90 surface vessel	S4.3
Underwater detection system Class F122/F123 frigates	S4.3
Combat support ship (EGV)	S5.1
Class 751 defence research and evaluation vessel	S5.1
ECDIS/AIS radar navigation system	S5.2
MKS 180 Multi-Role Combat Ship	tbd.

transmission of the OLDENBURG shortly before acceptance in March 2009; the investigation that followed showed that all installed boat gear transmissions exhibited defects.

Another factor that delayed the date of acceptance of the boats was that the cause of the pollution burden within the machinery areas exceeding the limit values had to be eliminated. The routing of exhaust pipes through the machinery areas and the setup of the exhaust tract isolation had to comprehensively revised. The corvette ERFURT was commissioned at the Warnemünde Naval Base on 28 February 2013 and thus the 1st Corvette Squadron was complete. The transition of the project into the in-service phase was accomplished.

In the meantime the 1st Corvette Squadron can look back on various operational experiences:

The corvette MAGDEBURG was the first to be used within the scope of a mandated mission in the Maritime Task Force in Lebanon (MTF UNIFIL), up until the end of 2012, followed by the BRAUNSCHEWIG in April 2013. In spring 2014, the MAGDEBURG took part in the Standing NATO Maritime Group 1. The corvettes have proven their worth during these

The project manager will continue to initiate changes and improvements in order to maintain operational maturity. Examples include continual adjustments of the combat direction and communication systems. In this context the integration of the RAM Block 2 shall be emphasised in particular. The K130 corvettes will be retrofitted by means of this improved close-in defence system.

The K130 corvette is currently the most modern German warship. Thanks to this ship class, the German Navy possesses a future-oriented means to comply with operational and Alliance commitments of the Bundeswehr.

The Class 122 Frigates – the End of an Era

On the frigate BREMEN the following was announced on 28 March 2014: "Hol' nieder Flagge und Wimpel" (Take down flag and pennant), and thus the decommissioning of the Class 122 frigate lead ship was completed. Since then, the ship lies at anchor at the port of construction at the Naval Arsenal Wilhelmshaven and serves as a spare parts repository for the sister ships that continue, with the help of their crews, to fulfil their operational tasks.

condemned and disposed of. It is now one of the tasks of the Sea Directorate of BAABW to conduct spare parts acquisition and condemnation.

At the moment the four frigates KÖLN, RHEINLAND-PFALZ, EMDEN und BREMEN lie at anchor at the Naval Arsenal Wilhelmshaven. Pursuant to the Planning Directive which was issued by the Chief German Navy in 2012 the frigate NIEDERSACHSEN will be added on 30 June 2015. Thus BAABW will have a total of five frigates which shall all be available as spare parts repositories for a period of up to two years following their decommissioning. Subsequently, the ships will be condemned and disposed of. The preparations as regards personnel-related and logistical arrangements will start for each unit six months prior to the scheduled decommissioning date by removing it from service. From then on, the crew number will be reduced to a rear party. The materiel drawdown will start by handing over loose TOE¹ materiel. The related discharge of the ship's command is a prerequisite for decommissioning. Immediately after that the Naval Arsenal will assume responsibility for the protection and surveillance of the ship. In the subsequent two years all required parts (from

the RAM starter to the navigation light) will, pursuant to the preceding determination of requirements, be disassembled and returned to the logistic chain. During this time the ships must be lighted, aired and kept accessible. The fact that most of the disassembled parts are no longer available by other means justifies this effort, though. Numerous of these items are also used on the frigates of the BRANDENBURG Class (F123), some of them on the SACHSEN Class (F124), the Class 702 combat support ships and the minehunters.

One of the mentioned challenges consists in confining the time expenditure with regard to spare parts acquisition. The reason for this is the finite water area as well as the quay wall length of the Naval Arsenal Wilhelmshaven. The decommissioned Class 122 frigates are not the only laid-up ships being prepared here for their disposal. All of these units claim valuable space which is then missing as far as the equipment and maintenance of the seagoing fleet are concerned.

Condemnation

Condemnation will be effected subsequent to spare parts acquisition. By means of this administrative act and the

handing over to the disposal organisation VEBEG GmbH the materiel responsibility of the Sea Directorate will end. BAAINBw will finally part with the Class 122 ships. Condemnation must be prepared for. From a legal perspective the ship that is to be condemned is waste materiel. The basis for this is the EC Regulation on shipments of waste. It governs the safe and environmentally sound breaking up of ships. This comprises a general information obligation concerning "vessels and other floating structures for breaking up". Prior to the disposal "the existence of hazardous/prohibited substances, radioactive substances, appliances that emit ionizing or laser radiation or other significant facts for recovery/disposal" shall be tested. The handing over of the ships to the VEBEG GmbH requires moreover that all US equipment is dismantled and that the ship is at least partly demilitarized, i.e. all on-board military installations and equipment have been destroyed or rendered unusable.

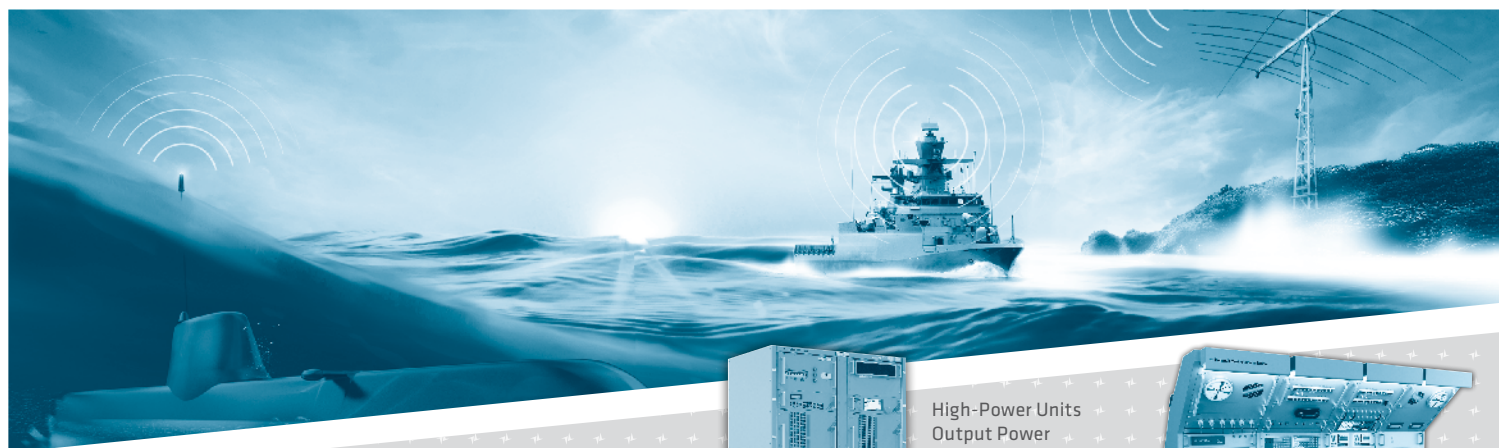
Final Destination: Disposal

After the handing over to the VEBEG GmbH each ship "prepared" in this way will be sold to an interested purchaser and will set off for its last journey. Demili-

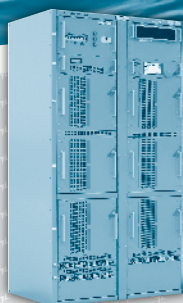
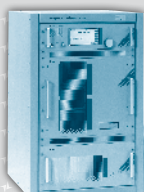
tarization will be finalised by dismantling the hull. The process of condemnation and disposal is thus completed. At the end of 2019, after the condemnation of the frigate AUGSBURG, the frigates of the BREMEN Class will be history as well. The frigate KARLSRUHE shall, immediately after its decommissioning in mid-2017, be handed over to the Bundeswehr Technical Center for Ships and Naval Weapons, Maritime Technology and Research (WTD 71) in Eckernförde and used as a target for contact explosions. In this context, the effect of high shock levels will be measured. The frigate KARLSRUHE will thus contribute to the research and development of more realistic shock calculations, shock simulations and, as a result, improve the design principles applied to future naval vessels. Though it will not escape the fate of final disposal, it will provide valuable findings gained from contact explosion tests. Thus, the KARLSRUHE will still be talked of in 20 years.

Class U212A Submarine

The Class 212A (U212A) submarines serve primarily the purpose of covert reconnaissance, the engagement of targets

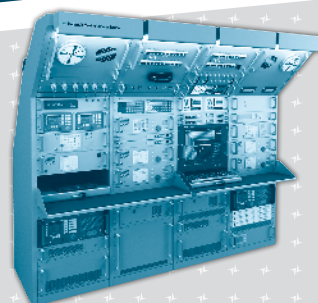


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(Photo: Bundeswehr)



U212A in the Kiel Firth in winter

above and under water as well as the deployment of special forces. These submarines are particularly difficult to detect and have an air-independent fuel-cell propulsion, far-reaching sonars and armament that is adapted accordingly. The submarines are considered to be almost “invisible” since they are able to operate submerged considerably longer than comparable diesel-electric powered submarines. Since 2014, the two submarines of the second lot have been supplementing the four submarines of the first lot.

The submarines are procured within the context of a successful German-Italian cooperation and are jointly supported during the in-service phase. With four German and two Italian ships of the first lot, all in all six ships are currently commissioned.

As regards the second lot, both nations have commissioned two additional submarines each. In order to achieve cost reductions with regard to procurement as well as during the in-service phase and in order to establish a high level of operational interoperability almost identically constructed units are aimed at within the scope of the cooperation. During the in-service phase current issues are compared and common solutions to problems encountered are being sought. Among others, spare and exchange parts are jointly stocked and software maintenance for the CCI and weapons control system will be performed jointly.

In the missions conducted to date, the submarines of the first lot (U31 to U34) lived up to the Navy's high expectations. The U212A sets new standards with regard to low-frequency acoustic detection, has excellent manoeuvring qualities and is extremely difficult to detect for an opponent.

The proven design of the first lot has basically been retained for the 2nd lot as

well. Changes have only been performed because of the extended operational requirements and the experience acquired so far.

It shall be emphasised that the ships of the second lot have been provided with an improved equipment for covert missions of special forces. An air lock hatch within the conning tower speeds up considerably the previously lengthy undocking procedure via the torpedo tube and also renders it safer for the personnel involved. Depending on the operational requirements, materiel required for operations conducted by special forces may be carried along in removable, pressure-tight containers. By increasing the amount of oil fuel carried and by improvements in the field of hydrodynamics the operational range required for future worldwide operations will be attained. By means of an appropriate adaptation of air-conditioning terminal units and chilled-water plants the submarines are prepared for climatic requirements of operations conducted in tropical areas. As a result of these measures the submarines of the 2nd lot are approximately 1.2 m longer.

By means of flat-top side antennas submerged targets can be detected in a more precise way. An active sonar may be additionally used in order to reconnoitre the underwater situation. By integrating LINK 11 and 16 as well as SHF² SATCOM the communications capability has been increased in comparison to the submarines of the first lot.

All of the submarines are armed with the heavy DM 2 A4 multi-purpose torpedo.

There are plans to equip the submarines with a guided missile. This way, the submarines could also defend themselves against airborne hostile detection. Such a system would also offer better options with regard to effectiveness, precision and escalation capability, for example to be able to respond appropriately to asymmetric threats.

The public customer's acceptance committee accepted the first submarine of the 2nd lot in September 2014. The acceptance of the second submarine is scheduled for mid-2015.

Combat Support Ship BONN

With the commissioning of the combat support ship (CSS) BONN in Wilhelmshaven on 13 September 2013, the required worldwide deployable logistical and medical support unit was handed over to the German Navy.

For more than ten years, the CSS BERLIN and FRANKFURT AM MAIN have been ensuring world-wide logistic support of the German Navy in a reliable and flexible manner. These ships, which are the largest within the German Navy with a displacement of more than 20,000 t and a length of 174 m, make it possible to extend the endurance of a mixed task group consisting of four frigates to up to 45 days.



(Photo: BAABW)

CSS BONN in front of the skyline of New York

In addition, an air transport component with two helicopters can be carried along and modern and comprehensive medical equipment can be provided by means of the mobile naval surgical hospital (MNSH).

The commissioning of the CSS BONN has not only sustainably increased the capacity and availability of combat support ships, but has also provided a CSS which has been further developed in all technical matters. The completely new design of the propulsion systems and the power supply, significantly expanded medical facilities, advanced means of communication and a helicopter directing radar are just a few examples of a comprehensive orientation towards current requirements and a cost-effective and environmentally sound operation of the ship.

Today, after almost one year of intensive operational suitability testing by the Navy and four months of sea travel in all kinds of climatic regions around the world during which the ship was thoroughly inspected on board by specialists of the Bundeswehr Technical Center for Ships and Naval Weapons, Maritime Technology and Research (WTD 71) and intensively supported by the BAAINBw project team, the following can be stated: The CSS BONN has fully met the expectations. All in all, the CSS BONN has up to now covered more than 23,000 nautical miles. The CSS have not only convinced the German Navy, but also the Canadian Navy, which has opted for the CSS after a comprehensive selection procedure as well. Their future Joint Support ships of the QUEENSTON class will be built based on the CSS BONN. Following the successfully completed operational suitability testing the CSS BONN is currently going through the "warranty lay period", which means that the CSS consortium performs the fine-tuning for a 30-year service life which is about to begin.

The Multi-Role Combat Ship MKS 180

The future maritime MKS 180 platform will cover a broad range of capabilities. The most important tasks include sea surveillance, the enforcement of embargos, the support of special forces and evacuation operations. As regards

the performance of its tasks, the German Navy will for the first time be supported by mission modules. For this purpose, special mission modules and operational components will be available on board. The requirements as to the MKS 180 include the following mission modules:

- "ASW situation picture" (Anti Submarine Warfare) including a towed sonar for the preparation of an underwater situation picture;
- "Detention" for the preliminary detention of persons;
- "MCM" (Mine Counter Measures) for the individual engagement of underwater ordnance (sea mines);

- "Diver pressure chamber" for the support of diving operations.

For further requirements shipborne helicopters or an unmanned aerial system (UAS) can be taken aboard. Moreover, special forces, a fleet surgical team or SIGINT personnel may be embarked. This kind of modularity is designated as shipboard component (in contrast to the mission modules). Even without these modules and shipboard components the MKS 180 will provide basic capabilities that meet in particular the standing operational commitments. These include above all the command and control capability in a maritime task



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Q&A

Interview with EDirBAINBw Peter Grundmann, Director of Directorate S

ESD: What are the basic development stages in a new shipbuilding project such as the MKS 180 project?

Grundmann: The Integrated Project Team MKS 180 (multirole combat ship) has developed different proposals for solutions on the basis of ship designs. They range from completely meeting all requirements to a graduated solution combined with significant cost savings. The study on risk analysis of key armament projects, which was initiated by the Federal Minister of Defence, rightly points out that projects have to deal more intensively and, above all, more systematically with the risks involved.

Naval shipbuilding projects have always been of highly complex nature; the concept of building prototypes in limited numbers is not viable in this case. This complexity calls for efficient management. In the F125 project we have already taken the right path with the risk management established in that project. For MKS 180 this means that we are going to consolidate and methodically establish this useful approach. Of course, methodical risk management is not an issue that concerns the purchasing organisation only. It invariably involves the contractor as well.

ESD: What are the changes you experience as a result of the amended CPM?

Grundmann: The most significant changes the amended CPM has brought for us are related to the activities in the in-service phase. Whereas in the past we were only in charge of "armaments issues in the in-service phase", which included product modifications for example, my directorate now additionally deals with logistic tasks. Since the 1 July 2014, the Navy has a live picture of all its products via SASPF. The databases used so far are successively being replaced by SASPF. Furthermore, our responsibilities within the life cycle of equipment now reach up to the point of scrapping of entire ships. It is now part of the tasks of my personnel to ensure that scrapping can be implemented in an economical and environmentally sound way.

ESD: What is the state of progress with regard to the adaptation of capabilities of the Class 123 and Class 124 frigates?

Grundmann: The aim of the CDS (Combat Direction System) F124 hardware regeneration is to eliminate obsolescence in the field of the command, control, information and weapons control system of the F124 frigate.

After the initiative called "Elimination of obsolescence of the SMART-L long-range sensor for the F124 frigate and expansion of F124 air defence capabilities" had been approved, part 1 of the analysis phase started in 2013. Approval of the FFF (Capability Gap and Functional Requirement) document in May 2014 marked the end of that analysis phase. My directorate is now tasked with developing proposals for solutions. Following the selection of a solution next year, it will be possible to initiate an invitation for bids.

Capability adaption for the Class 123 frigates, on the other hand, is taking place in two steps. It is based on an advancement of the existing CDS family concept and will be implemented in combination with a structure that is logically equal to the CDS of the Class 124 frigate and Class 130 corvettes.

In Step I the CDS is going to be refurbished in order to enable it to support existing and planned tasks as well as tasks to be expected for the future. Step II includes the measures concerning the components that are relevant for the command and control capability, especially Link 16 and IFF (Identification Friend or Foe).

Step I is scheduled to be completed on board the MECKLENBURG-VORPOMMERN Class 123 frigate by early 2016. Once Step I has been successfully implemented, upgrading of the ships 2 through 4 as well as Step II can be initiated.

The questions were asked by Dieter Stockfisch.



force as well as self-defence capabilities. Its design was dictated by the heavy use requirement of the MKS 180 for in-theatre deployment periods of up to two years with a simultaneous reduction of the crew size. In this context, the MKS 180 project is based upon the already existing Class 125 frigates.

Analysis Phase, Part 2

The analysis phase part 2 began for project MKS 180 after the Bundeswehr Chief of Staff had approved the document "Capability gap and functional requirement (FFF)" on 25 March 2013. The leadership of the Integrated Project Team (IPT) MKS 180 was transferred from the Bundeswehr Planning Office to BAAIN-Bw and from there to the Sea Directorate. It was the aim of the analysis phase part 2 to prepare proposals for solutions for the selection decision, to reduce existing risks with regard to the implementation and to assess in detail the life cycle costs of the MKS 180 weapon system.

The IPT MKS has worked on several solutions. These range from the complete fulfilment of the FFF to a gradual solution with a significant cost reduction.

Financial Management

An essential part of the proposed solutions is the presentation of the financial requirements throughout the entire life cycle from implementation and service use to disposal (life cycle costs). The MKS 180 project pursues the aim of predicting the full costs by means of parametric cost estimation tools.

Within the context of risk reduction the areas that are critical with regard to implementation were analysed and evaluated.

Outlook

Following the selection decision taken by the Bundeswehr Chief of Staff the award procedure will be started without delay. For this purpose, the preparations were already under way during the analysis phase part 2, which means that a requirements model is prepared in accordance with V-Model XT. As regards the award, a period of approximately two years is planned, with the aim of concluding a construction contract and handing over the first ship to the German Navy six years later. ■

1 Table of organisation and equipment. The TOE establishes the authorised level of personnel and materiel with regard to the units and the military agencies.

2 Super High Frequency

Land Support Directorate (U)

The Land Support Directorate has one of the most versatile areas of responsibility within BAAINBw. The projects worked on in this directorate range from soldier's personal equipment over field camp designs and military wheeled vehicles to various reconnaissance and security components (e. g. radar, electronic warfare, robotics).

The core tasks of the Land Support Directorate include: Project management in accordance with Customer Product Management (amended) throughout the entire life cycle of the materiel, systems engineering and integration tasks, research and technology, technical support during in-service use, contract management and price negotiations. In addition, the Land Support Directorate exercises the general functional supervision over the Bundeswehr Technical Center for Automotive and Armored Vehicles (WTD 41) in Trier, the Bundeswehr Research Institute for Protective Technologies and CBRN Protection (WIS) in Munster and the Bundeswehr Research Institute for Materials, Fuels, and Lubricants (WIWeB) in Erding.

In comparison to other BAAINBw directorates the Land Support Directorate covers an extraordinarily broad technical range of tasks, a very high number of projects which also include smaller ones and distinct procurement activities, in particular, for the Immediate Operational Requirement.

Directorate U is supported by the Directorate Staff and the Directorate Controlling. The actual project work is done in the four divisions of the directorate. These are being supported in their work by the two divisions Economic and Technical Affairs (U1) and Economic and Legal Affairs (U2).

Economic and Technical Affairs Division (U1) with its four branches serves as

the central point of contact for interdisciplinary and cross-project tasks and, at the same time, as Service Use Coordination Centre (U1.1). System Aspects Policy/In-Service Use Policy, Materiel Documentation / Maintenance (project-oriented) are covered by U1.2. Branch U1.3 is responsible for the functional supervision of WTD 41, WIS and WIWeB and for coordinating R&T. The required master data records are maintained by U1.4.

All aspects of contract management and price negotiations are dealt with in the **Economic and Legal Affairs Division (U2)**.

In addition to managing the contracts for Divisions U3 to U6 (U2.1 to U2.4) Branch U2.5 is responsible for concluding framework contracts on maintenance/repair, technical logistic support, software maintenance. The field of activity of U2.6 is price negotiations.

The manifold tasks of project work (implementation, use, condemnation) are reflected in the diverse projects of Divisions U3 to U6.

The tasks of Division U3 include field camp technology, protection and logistic



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(Photos: Bundeswehr)



Operational evaluation of the new combat clothing

support, CBRN and medical equipment, infantryman personal equipment and clothing.

U4 is tasked with protected wheeled vehicles, special vehicles & equipment, integration, protection and R&T processing. Division U5 is working on projects in the fields of electronic warfare, reconnaissance, air traffic control and identification.

Division U6 is tasked with training technology, simulation and robotics.

The diversity of the Directorate U projects is illustrated by the following examples.

New Combat Clothing for Operations Worldwide

For its operational tasks the Bundeswehr needs functional clothing that provides a significant contribution to the survivability, protection and sustainability of armed forces deployed on operations worldwide.

The current field clothing needs to be improved in terms of wearing comfort, protection, thermal and mechanical suitability and the suitability required by the climatic environment in the theatres of operation.

At the beginning of the project it was a difficult task and a challenge to define the combat clothing functional requirements for all military services. The requirements of the respective users had to be organized and coordinated as well as verified for feasibility. Only a feasibility study by the Bundeswehr Research Institute for Materials, Fuels and Lubricants (WIWeB) has finally made it possible to meet all functional requirements of the armed

forces and to start with the project. The functionalities required for Bundeswehr missions were the key factors for the new clothing concept. The enlargement of the pocket volume is just one example of the seemingly small details which have to be taken into account. Another factor which is crucial to the design is the compatibility with ballistic protection elements. In contrast to the current field clothing the new combat clothing is also flame-retardant and has been treated with a vector repellent. This increases the protection of soldiers in the theatres of operation.

The new combat clothing consists of a clothing set which includes more than 20 different individual articles; the individual protective layers are complementary

and may be worn on top of each other. The first layer is functional underwear which ensures fast redrying and basic moisture transport for all layers worn on top of it. As next layer a cold weather protection gear (worn underneath) made of a warm fleece material may be worn as first insulating layer at low temperatures. At extremely low temperatures during missions a suit with an insulating layer made of warm polyester fibres with high fill power provides additional warmth. This cold weather protection gear can be packed in a space-saving manner and is carried along in a compression bag. Moreover, there is a fluffy flameproof fleece jacket which is worn on top of the combat uniform and which provides additional warmth in cold climate zones.

A wet weather protection gear (worn underneath) with a wind and water-repellent membrane and extremely high water vapour permeability provides the necessary protection during moderate rainfall. For heavy rain a wet weather protection gear (oversuit) in 3-color or 5-color camouflage print is included in the new combat clothing set.

During the development of the new combat clothing set the acceptance by soldiers and the compatibility with other systems were in the focus. In the course of an extensive operational evaluation soldiers had the chance to test the functionalities of the new combat clothing thoroughly and to evaluate them on a daily basis by means of a questionnaire. In addition, the suitability of the new combat clothing has been extensively tested in four different climate zones (El Paso, USA; Lizum, Austria; French Guiana, France; Arvidsjaur, Sweden). After



9 cbm tank container on a MULTI FSA truck (with protection equipment)



Protected road tank truck 8x8 with dispenser

all the results of the soldiers' survey had been obtained and compiled modification requirements were included in the technical specification of the respective items of clothing by WIWeB. Possible optimisations are defined after consultation within the Integrated Project Team (IPT). The first 6,000 combat clothing sets will be delivered at the beginning of 2015.

Protected Fuel Transport During Operations

The fuel supply for the Bundeswehr has to be ensured under difficult climatic, geographic, infrastructural conditions and under conditions which require protection. To achieve this, the Bundeswehr relies on the cooperation with allies and partners of the host nations wherever possible. Nevertheless, the Bundeswehr prepares for temporarily performing fuel supply tasks for several simultaneous operations in selected theatres of operation using its own assets.

On principle, fuel is supplied to the theatre of operations' logistic base by making use of third-party services, while the fuel supply in the actual theatre of operation is to be ensured by own military means. Besides the storage of fuel, fuel transport plays an important role for an effective supply of fuel during operations. In theatres of operations the fuel is mainly transported in the largest possible transport volume by protected road tank trucks (STW 8x8) or by tank semi-trailers with protected truck tractors (6x6).

The tank semi-trailer has a fuel-tank capacity of up to 31,500 litres and ensures the supply to the forward supply faci-

ties of a bulk-fuel installation. Up to this date, six tank semi-trailers have been introduced.

The STW 8x8, which also has the capability to directly discharge the fuel to the end user, has been designed for a transportation capacity of up to 21,000 litres. The tank bodies of the STW 8x8 and the tank semi-trailer have both been designed as cylindrical, stainless steel single-chamber

in combination with a dispenser trailer equipped with filter systems to separate water and suspended solids, may be used for helicopter refueling. 36 units of this equipment configuration have been procured over the last few years.

In addition, 9cbm tank containers (TCK 9) which have been designed for the transport on protected and unprotected MULTI carrier vehicles facilitate a highly



Protected tractor and semi-trailer

pressure tanks. This design also makes it possible to obtain an authorisation for fuel transport by seagoing vessels. Consequently, an initial supply with fuel that has been transported by sea would be possible for troops going ashore. 70 vehicles of this type have been procured. A variant of the STW 8x8 has been designed for Army aviation units which,

flexible combat service support. The TCK 9, thanks to its double wall tank and its integrated autonomous pumping station, can be used as filling station when it is unloaded as a roll on/roll off container using the hook and lift system. Under certain conditions the TCK 9 may also be transported with a filled tank in a cargo aircraft. For this reason, the tank



The tower including installed primary and secondary radar antennas was handed over to the troops at Büchel in mid-November 2014.

container is suitable for strategic airlift in the A400M aircraft to provide initial supply during stability, evacuation and initial operations.

The vehicles described above are used by the supply corps, all driver's cabs are protected and can be retrofitted with com-

munications and C2 assets to be used in an asymmetric threat scenario.

When the fuel must be supplied to the "last mile" of the area of operations smaller transport capacities with a higher degree of manoeuvrability are required that have the capability to operate in terrain sections which are scarcely developed, difficult to access and where there is an increasing need for cover and protection in a terrorist threat scenario. In order to supply fuel to remote end users, for instance surface-to-air missile units, transportable 4,600 litre refueling systems (TA 4600 vlb) in combination with ZETROS 5 ton transport vehicles are available. As the TA 4600, transportable, will soon reach the end of its service life, there are efforts to close this arising capability gap based on an initiative in accordance with the CPM (amended) procedure. In general, possible alternative solutions are a flexibly usable truck-borne fuel tank equipped with a pumping station which can be separated from the vehicle or a protected four-wheel transport vehicle with a fully integrated tank body which therefore has a larger tank volume.

Aerodrome Surveillance Radar Mode S (ASR-S)

Two key tasks of project division U5 are, amongst others, radar technology for airspace surveillance and air traffic control. The Aerodrome Surveillance Radar with Mode S capability is, in contrast to Tactical Air Command and Control Service radars, used to control and monitor air traffic in the aerodrome area.

The ASR-S project provides for the replacement of ASR-910 radars at 20 military airfields in Germany including NATO Air Base Geilenkirchen because their maintenance is becoming increasingly uneconomical. The objective is to monitor military air traffic in the aerodrome area, to control air traffic together with other systems and, in addition, to exchange obtained air traffic data with the joint Bundeswehr Air Traffic Information System (FSInfoSysBw). Hence, BAAINBw takes into account the partly different requirements of German Air Force, German Army, German Navy, NATO and Bundeswehr Technical and Airworthiness Center for Aircraft and Aeronautical Equipment (WTD 61).

The procurement contract for the ASR-S project was concluded in mid-2008. The first series production systems were installed at Laupheim, Manching and Büchel in 2012. At these locations the systems have to pass various tests and

acceptance inspections before the systems are put into unrestricted operation. In a narrower sense, the ASR-S system, in addition to the actual primary radar, is equipped with a Mode S capable secondary radar including the components necessary for analysing and displaying detected targets. Therefore the system meets the relevant ICAO (International Civil Aviation Organisation) Regulations for civil aviation. The ASR-S covers the airspace up to a distance of 110 km and up to an altitude of 7,620 m. In contrast to its predecessor the ASR-S can operate as part of a network and can provide radar data for the military radar data network of the Bundeswehr (MilRADNET) and is able to interrogate by using the modern Mode S radar code system. In this way, the Bundeswehr makes a contribution to the reorganisation of the "Single European Sky".

Major challenges faced by the project management are that interfaces and systems with which the ASR-S communicates (MilRADNET and FSInfoSysBw) are themselves current projects subject to constant further development. All of these activities are undertaken to meet future requirements which further developments in civil aviation management will bring about and which are subsumed under the term SESAR (Single European Sky Air Traffic Management Research). Moreover, a large number of different stakeholders from Bundeswehr and industry are involved in the projects and have to work hand in hand. The close cooperation with the persons in charge at the respective locations must be highlighted. Supported by the responsible local Bundeswehr Service Centres and construction authorities, they have to arrange all infrastructural measures in good time before an ASR-S installation while having to accept considerable disturbances during that time, including the temporary discontinuation of flight operations. However, equally important is the cooperation with the Government Quality Assurance Authority, the Bundeswehr Technical Centers 61 and 81 (Bundeswehr Technical Center for Information Technology and Electronics, Greding) and the Bundeswehr Air Traffic Services Office. As the ASR-S is an air traffic control device, the site-specific approval in terms of aviation law and technical operational aspects (SLTBF) has to be granted by the Bundeswehr Air Traffic Services Office for each individual system. This approval is based on the expertise of the Director Airworthiness and on extensive flight inspection campaigns.

Within the ASR-S project Directorate U will, in terms of “customers” and in terms of the technical classification between radar technology and air traffic control, introduce a cross-service/cross functional system into the Bundeswehr. Within the task spectrum of Branches U5.3 (“Tactical Air Command and Control Service, IFF, Ground-Based Radar Reconnaissance”) and U5.4 (“Air Traffic Control”) the ASR-S is also of central importance.

Off-Road Truck with Assistance Systems

In the area of robotics the Bundeswehr is evaluating unmanned land systems ranging from remotely controlled reconnaissance vehicles weighing 2 kilograms to military trucks. For this purpose, the Bundeswehr relies on both the latest research activities of universities and institutes and well-proven industry components, in particular those of the automotive industry. The objective is to support soldiers on operational deployment with mobile land systems which partly operate autonomously.

The largest system which is currently converted into an autonomous vehicle within the project Road Transport with Robotic Assistance Systems (StrAsRob) is an MAN military truck. For the time being there will always be a driver in the driver’s cab, who, for safety and legal reasons is able to directly take over control at any time. This truck is equipped with additional sensors and software which are able to passively provide further information to the driver and actively influence control. Sensors include a laser range finder as well as several optical cameras to detect obstacles in driving direction. All around the vehicle radar sensors used in the automotive industry monitor the immediate area around the vehicle. It is planned to improve night vision capability by using infrared cameras. Failures of individual sensors are automatically recognised and taken into account so that wrong sensor information cannot “throw the truck off its track”. In addition, the central computer is designed to be redundant and monitors itself.

The following assistance systems from this field of technology have already been implemented: Emergency Brake Assist, Speed Limit Assistant, Traffic Sign Recognition, Adaptive Cruise Control, Lane Departure Warning and Lane Recognition and Automatic Vehicle Following. These assistance systems can be subdivided into passive and active systems. Within this project the following stages will be considered:



Computer setup in the driver's cab

- Stage 1: Passive assistance;
- Stage 2: Assisted accelerator and brake control (Active Cruise Control);
- Stage 3: Assisted vehicle control (automatic vehicle and road following);
- Stage 4: Autonomous vehicle control (autonomous vehicle and road following).

Depending on availability offered by the system the driver may freely choose between the different stages. Passive assistance systems (stage 1) provide assistance to the driver by means of warning signals and additional information while the driver remains in full control of the vehicle. Depending on the degree of autonomy chosen, the control of the vehicle is partly or completely transferred to the electronic system when using active assistance systems. At stage 2 the system automatically assumes the longitudinal control (i.e. no steering). At stages 3 and 4 the electronic system also assumes lateral control. Nevertheless, the driver's full attention and readiness to immediately take over the vehicle is still required at stage 3. At stage 4 the driver may, thanks to a longer advance warning to take over control of the vehicle, direct his attention to other tasks. The implementation of stages 1 to 3 is envisaged for the end of 2015.

The implementation of the fourth stage will be a major challenge. The task here is to increase safety and robustness. The system will be considered safe if it is capable of taking the right decisions even

in unexpected situations, e.g. an obstacle suddenly appearing in front of the vehicle. The system will be considered robust if it is able to cope with as many different environmental influences as possible, e.g. backlighting, dirt, rain, snow, darkness. Only then may the system obtain an approval for Bundeswehr use by the officially recognised expert.

Possible Applications

Possible applications which have basically been implemented up to this date include the “MULE” operational mode (Multifunctional Utility/Logistics and Equipment Vehicle) and the “Following” mode. In the “MULE” mode the vehicle is capable of autonomously driving on a programmed route repeatedly. This mode facilitates, for instance, the transportation on known routes. In the “Following” mode the vehicle accurately follows the vehicle in front at a given distance on an unknown route. This mode may, for example, be applied for convoy transport.

Way Ahead

Assistance for drivers of military vehicles by robotic capabilities will continue to be thoroughly tested in future. According to current estimates, the system described above may be fielded in the year 2020. The long-term objective is to drive the vehicle entirely without a driver. In order to achieve this objective technical and legal challenges still have to be mastered. ■

Land Support Directorate– Glossary	
Project	managed by ...
Accommodation and Support in Operations, Field Camp Technology	U3.1
Field Camp, Modular, Air-transportable	U3.1
Modular Medical Treatment Facilities (MMTF)	U3.1
Protection of Objects and Facilities, General Security Technology	U3.2
Command Posts, Tents	U3.2
Power Supply and Air Conditioning Technology	U3.3
Test Equipment and Electronic Components, Lighting Technology	U3.3
Power Management, Generation and Distribution in Operations	U3.3
Military Pharmacy, Military Medical Research, Laboratory Systems	U3.5
Medical Facilities and Medical Equipment	U3.5
CBRN Protection	U3.6
CBRN Reconnaissance Systems	U3.6
Decontamination Equipment	U3.6
“Future Infantryman” Combat Equipment	U3.7
Clothing	U3.8
Combat Clothing	U3.8
Protective Clothing	U3.8
Integration, Protection, R&T Processing	U4.1
Protected Command and Utility Vehicles (Classes 1-4)	U4.2
Protected Light and Medium Trucks	U4.2
Protected Transport Vehicles	U4.3
Multi A4 FSA Palletized Load System	U4.3
20 ft. ISO Container, Protected, Personnel	U4.3
Recovery and Loading Vehicles, Engineer Construction Equipment, Special Service Equipment	U4.4
Protected Recovery and Crane Vehicles	U4.4
Protected Recovery and Towing Vehicles	U4.4
POL Vehicles, POL Supply Technology	U4.5
Fire-Fighting Vehicles	U4.5
Tools and Tool Kits	U4.5
EW	U5.1
ESM/SIGINT Sensor Systems, Sensor-Specific Evaluation	U5.1
Signal Reconnaissance Systems	U5.1
EW: Central and Common Evaluation	U5.2
Tactical Air Command and Control Service, IFF, Ground-Based Radar Reconnaissance	U5.3
Radar Identification Equipment, Mode S Interrogator / data network	U5.3
Mode 5 Transponder	U5.3
Air Traffic Control	U5.4
Airfield Surveillance Radar System, Series (ASR-S)	U5.4
Optics/Optronics for Ground-Based Reconnaissance	U5.5
Thermal Sight and Thermal Observation Devices	U5.5
“Future Infantryman” Combat equipment	U5.5
Media Technology, Geoinformation	U5.6
Provision of 3D Terrain Data	U5.6
Training Assets, Training Technology	U6.1
Live Simulation and Robotics	U6.2
Virtual Simulation	U6.3

Q&A

**Interview with EDirBAAINBw
(ret.) Horst Minning, former
Director of Directorate U**

ESD: What deficits do you see as far as the battle dress is concerned? Are there plans for improvements?

Minning: The field dress used so far basically goes back to the dress introduced in the nineties that had actually been designed as a "work uniform". For operational missions, additional components such as armour vests and other clothing items have been procured, which, however, have not always been adapted to each other. Technical reasons have so far not allowed an integration of certain functions such as flame resistance and vector protection in a single piece of clothing.

The new battle dress is a set of clothing comprising 20 single clothing items. The different layers of clothing – including underwear, cold weather protection gear to be worn below the outer uniform layer and waterproof overgarment – are adapted to each other and are, for the first time, designed as a system. Apart from an improved cut, this ensures an improved wearing comfort and contributes significantly to a better sustainability of the individual soldier on operations. Flame resistance and vector protection have now been combined in a single fabric, with the result that the clothing now offers an unprecedented level of protection.

The new battle dress was tested in four climate zones with environmental temperatures between -20° and +40° C. Operations-related requirements and functionalities were taken into account and lessons learned were implemented, e.g. an increased pocket stowage volume. Special care was taken to ensure compatibility with ballistic protection gear.

ESD: What is the concept for future procurement activities in the field of ground mobility? What protected and unprotected wheeled vehicles are planned to be procured?

Minning: The Conclusive Functional Requirement "Protected Command and Utility Vehicles" (GFF = Geschützte Führungs- und Funktionsfahrzeuge) forms the basis for the future procurement of protected ground mobility vehicles. This requirements paper takes account of the Bundeswehr task spectrum in conflict



prevention and crisis management operations, including combat.

Protected command and utility vehicles must offer adequate protection and high tactical mobility to operational forces. This includes command and control (C2) capability as well as protection against ballistic projectiles, mines and NBC agents. The measures derived from that result in optimum survivability.

The Conclusive Functional Requirement defines not only the requirements regarding mobility, protection, sustainability, survivability, C2 capability and operational areas but also the procurement numbers.

In another step, the Bundeswehr Planning Office has brought these future procurement requirements into line with the funds available. In addition, reprourement is initiated for condemned vehicles, e.g. vehicles lost in accidents or vehicles that have reached the end of service life. On the basis of the Conclusive Functional Requirement "Protected Transport Vehicles" (GTF = Gepanzertes Transportfahrzeug), approvals for realisation have been issued for the respective vehicle classes. These approvals are being transferred into follow-on documents in accordance with the amended CPM. After the respective selection decisions have been taken, procurement of protected transport vehicles – which are assigned to three classes, depending on payload (2 t, 5 t and 15 t) – is now moving into focus. Here again, the number of vehicles to be procured has to be brought into line with the financial limits determined by the Bundeswehr Planning Office and approved by the Federal Ministry of Defence.

The current intention is to procure the 15-t-class GTF vehicles from 2016 onwards and those of the other payload classes in the follow-on years.

The requirements regarding communications and C2 capability as well as protection against threats – including self-defence capabilities – will be completely implemented in accordance with the Conclusive Functional Requirement.

As to Protected Special-Purpose Vehicles (GSF = Geschützte Sonderfahrzeuge), procurement of the truck tractor 2 for hauling a semitrailer (payload class 70 t) is going on in line with the funds ceilings. For unprotected vehicles, regeneration is planned for the near future in all payload classes. A "Permanent Working Group – Ground Mobility" of the Bundeswehr Planning Office is analysing the future need for unprotected vehicles and conversion/adaptation kits in detail.

The future payload classes 5 t and 15 t are in the focus of regeneration planning.

ESD: The "Future Infantryman- Extended System" has been fielded. What is the overall planning and is there currently a need for corrective interventions?

Minning: With the FFF (Fähigkeitslücke und Funktionale Forderung / Capability Gap and Functional Requirement) paper dated 18 February 2014 a follow-on procurement project has been defined: the minimum procurement volume – as the so-called Initial Capability – includes 68 platoon-level systems comprising the equipment for 2,597 soldiers. This equipment is scheduled to be procured between 2015 and 2019.

The 90 team-level systems already procured for operations abroad will be counted as 24 additional platoon-level systems. The structural overall requirement amounts to 416 platoon-level systems.

A decision on procurement of a VHF (Very High Frequency) radio set for C2 connectivity is still pending. Such equipment is designed to be in conformity with the IT strategy. However, we do not expect solutions for mobile radios to be available on the market before 2019, possibly even later. Proposals for solutions do exist already. Conceivable options are the procurement of an alternative type of equipment that is not yet in line with the IT strategy requirements (isolated solution) or the use of radios without C2 connectivity until a solution in conformity with the IT strategy is available on the market. The Bundeswehr Chief of Staff is expected to make a decision on that very soon.

**The questions were asked by
Michael Horst (October 2014).**

Night vision technology for reconnaissance and targeting

For the most likely operations of our forces, superiority in fighting at night time or under degraded visibility is a key discriminator against asymmetric aggressors for mission success, protection and effective engagement.

Asymmetric military missions require outstanding performance of surveillance and targeting sights. Non combatants are often present. To separate them from an aggressor or to precisely identify an individual by means of a picture ID prior to engagement requires highest resolution. Comparable to an HDTV in the hand of the military leader or sniper, networked to manage complex operations, and all this at minimum size, weight and power consumption (SWaP).

Thermal sights

High-resolution thermal sights are the gold standard to detect, recognize and identify targets at night or in bad weather conditions. They do not need any illumination as they "see" the radiation, which passively is emitted by anything around us. This also significantly improves the capability to detect camouflaged targets at day time.

Since 2004 the thermal targeting sight HuntIR has been fielded as WBG-HaWa-Inf for the German SMP Infanterist der Zukunft (IdZ). In 2010 the follow-up sight RangIR with laser range finder, magnetic compass and ballistics calculator was brought into service as day/night fire control unit for the 40mm HV automatic grenade launcher and – extended with some extra features – also as thermal reconnaissance and targeting sight WBZG for the second phase of the SMP IdZ-2 or Gladius.

Key demand for the dismounted soldier is minimum SWaP. Uncooled technology is therefore often used as a compromise despite of its lower performance. To provide the dismounted soldier with superior cooled sights, the BAAINBw has pushed the development of new IR-detector chips which provide cooled performance at SWaP comparable with uncooled sights. Based on such technology, the next Gen sight HuntIR Mk2 is ready for being fielded.

To further improve identification capability, current R&D studies are focused to move high definition (XGA) resolution into tactical sights with even further reduced SWaP.

New image intensifiers and gated viewing technology

Driven by SWaP and cost issues, dismounted soldiers use a mix of thermal and image intensifier (I²) equipment. I² technology doesn't "see" the passive thermal radiation but rather needs some residual illumination of stars etc. Available I² devices, however, provide limited

trange up to 2.2µm, chemical reactions in the atmosphere ("night/air glow" effect) provide illumination beyond what's available in the classical I² range below 1µm. By extending the spectral window up to >2.2µm, the illumination can be used most efficiently and even some faint thermal radiation is already available to improve imagery. These detectors are operated with very little cooling and thus provide minimum SWaP.

An interesting extension is to synchronize SWIR detectors, which can be gated to "see" only in a selectable short period of time with eye safe laser range finders (LRF), invisible in standard I² sights. Tun-

Photo: AIM



New generation of targeting sights: AIM HuntIR MK 2

performance in really dark areas where stray light of e.g. nearby cities is missing. Our troops thus can be faced with entire loss of vision.

For several years, a new I² technology has been developed, which operates in the shortwave infrared (SWIR) at a wavelength of approx. 1.0-1.8µm. In the spec-

ing the gate time after the laser pulse is equivalent to tuning the distance range, exclusively out of which the reflected radiation of the LRF is detected. This gated viewing technology allows to suppress any other radiation and thus to suppress e.g. smoke or fog obscuring the target area.

Information Technology Directorate (I)

The defining task of the Information Technology Directorate is to design, plan and introduce the mission-oriented C²-relevant information technology for the Bundeswehr as well as to ensure its operational maturity.

In addition, provisions for the design of commonly usable IT components (i.e. IT components applicable across organisational areas) are formulated to ensure uniform standards within the Bundeswehr IT System. Directorate I consists of six divisions.

Division "I1 – Economic and Technical Affairs" supports Directorate I with regard to interdisciplinary tasks. It is responsible for the planning, coordination and execution of R&T in the functional area of Information Technology as well as of the development, maintenance and refinement of basic procedures (V-Model) and technical standards for the national and international exchange of information concerning mission-related IT and Frequency Policy & Frequency Planning. Division I1 is also in charge of the project management and the course planning of IT training at the Information Technology Competence Center (ITCC), the Central Address & Directory Management and the technical supervision of the Bundeswehr Technical Center for Information Technology and

Electronics (WTD 81) as well as the Bundeswehr Information Technology Center. Division "I2 – Economic and Legal Affairs" concludes all contracts for Directorate I and takes care of the required processes, e.g. price negotiations.

Division "I3 – IT Security and Cyber Defence" deals with all project-related and operational issues regarding IT security and cyber defence. It monitors IT security during routine duty, exercises and missions abroad – always in close coordination with the military and civilian organisational areas of the Bundeswehr, with NATO and the EU as well as with partner nations. In addition, division I3 takes project and technical measures in order to ensure the protection of the Bundeswehr IT System. Division "I4 – Bw Joint CIS" aims at harmonising the existing service-specific command and control information systems. It supports these systems during the remaining service life and transfers them into the Bundeswehr Joint Command and Control Information System. Division "I5 – Specific IT" is responsible

for service-specific information technology throughout its entire life cycle. This includes, for example, command, control, information, and weapon control systems. These systems account for the specific mission spectrums and concrete requirements of the individual services. Thus, the use of interdisciplinary components is taken into consideration, but a harmonisation is not the intended aim.

Division "I6 – Wireless Communication" plans and introduces systems for tactical radio communications, tactical data links and satellite communications, and ensures their operational maturity.

With regard to all internal matters such as organisation, personnel and security, the Director of Directorate I is supported by a "Directorate Staff". Furthermore, the Director is advised by a "Directorate Controlling Element" on the technical control of the directorate. This element monitors and controls the utilisation and workflow within the directorate, the achievement of performance, scheduling and cost targets within the projects as well as the reporting.

The projects of Directorate I are manifold, ranging from radio equipment to satellite communications to IT network structures and topologies and highly complex command and control systems of the organisational areas.

ESD Spotlight

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Q&A

Interview with Commodore Dr Thomas Daum, Director of Directorate I

ESD: At the two IT Competence Centres (abbreviated as KIT), Bundeswehr specialist IT personnel undergo training in commercially available, commonly used information technology. Training courses for all users of office application software, on the other hand, take place at the respective user locations. Is the Bundeswehr going to adhere to this model?

Daum: With the KIT project launched in 2002 the Bundeswehr has successfully implemented a model for high-quality and market-oriented advanced training of its specialist IT personnel. With the training installations created in Koblenz and Dresden we have two extremely efficient training centres at our disposal, which have meanwhile earned themselves a firm place in the overall Bundeswehr training and education landscape. Likewise, „on-site“ training in the field of office application software has meanwhile become an integral component.

We take the steadily high course registration numbers as an indication that the training courses in their entirety are very well accepted by the Bundeswehr members. Based on the results of a cost-effectiveness analysis, the MOD decided as early as in 2012 to carry on with this model. Currently, we are in the process of newly assigning the training services for the period until 2019.

ESD: NATO has announced to „decertify“ crypto algorithms, which means that there will be restrictions regarding their usability for encryption. How is the Bundeswehr going to respond to this announcement?

Daum: NATO as an organisation implements what the NATO nations have decided. Indeed, NATO has announced its decision to decertify a number of crypto algorithms, that is to say determine a date from which on crypto devices must no longer use any of these algorithms for encrypting information up to the level of SECRET. The reason is, of course, that these algorithms are considered to be no longer technically secure. By the way, NATO has not published that date, since it is treated as secret information.

Thus, the NATO nations are faced with the huge task of renewing their crypto



landscape. Within specific projects, certain systems such as IFF (Identification Friend/Foe) Mode 4 or MIDS (Multifunctional Information Distribution System) LVT (Low Volume Terminal) are already being replaced with a follow-on system, that is to say IFF Mode 5 or, in the case of MIDS LVT, Block Upgrade 2 respectively. There are also commonly used crypto devices, however, for example the Elcrodatt 4-2, which is installed in many weapon systems, or the Elcrodatt 5-4 as desk telephone.

Crypto technology is a national key technology. Therefore, the commonly used crypto systems are planned to be replaced with equipment that has been newly developed at national level and, at the same time, implements the SCIP (Secure Communications Interoperability Protocol) and NINE (NATO Networked Information Infrastructure IP Network Encryption) NATO standards in order to meet the requirements of international interoperability, which, of course, remains indispensable. For this purpose, BAAIN-Bw has launched a crypto modernisation initiative. We are identifying – in cooperation with the Bundeswehr Planning Office – the necessary volume of efforts for developing, procuring and integrating such equipment in order to be able to find a financially viable solution or, in other words, incorporate the project into the budget planning.

ESD: What are the further steps of harmonisation of the CCIS systems of all military organisational areas and when are they planned to be implemented?

Daum: In a first step, the functionalities of the Air Force CCIS, Intelligence CCIS and the domestic Joint CCIS are scheduled to

be transferred into a new common data processing centre by the end of 2015. The latter will be supplemented successively from 2016 onward by incorporating other functionalities and user groups, e.g. the Multinational Joint Headquarters in Ulm. The next major step – we refer to it as the second part of migration – is planned to lead to the harmonisation of the deployable command post components of the armed services by 2018. Again, the Air Force with the equipment for Air Component Commands and the Multinational Joint Headquarters in Ulm will be the pacemakers. Additional commands and units will be provided with the necessary equipment from 2018 onward; however, as far as these plans are concerned, we are still in the phase of identification of requirements, and the same is true for the equipment of mobile or seagoing units.

ESD: How does this national approach fit into the framework of activities regarding Federated Mission Networking (FMN). After all, FMN was highlighted in the final declaration of the latest Wales NATO summit as a prerequisite for improving the Alliance-wide exchange of information.

Daum: Federated Mission Networking (FMN), that is to say jointly building up a command support network for a specific multinational mission, is the result of the lessons learned with respect to the Afghan Mission Network (AMN) used in the mission in Afghanistan. Right from the start, the NATO-wide plans for FMN have formed the design imperatives for harmonising our national command and control information systems, both regarding the standards and products used and regarding the conceptual framework, e.g. operating requirements.

The just mentioned equipment for the Ulm headquarters will enable the headquarters to form an integral part – even in the role as lead nation – of a future mission network. Our conceptual ideas on developments towards a German Mission Network, which have been elaborated in cooperation with the Bundeswehr Communication and Information Systems Command as the capability coordination command for the task of command support, have very much in common with the FMN approach – not only as far as the name is concerned.

ESD: Besides the harmonisation of CCIS systems, specific command, control and

(weapon) employment systems also fall into the Directorate's area of responsibility. What is the state of progress regarding Joint Tactical Fire Support in multinational operations?

Daum: With ASCA (Artillery Systems Co-operation Activities), which was successfully used during exercise COMBINED ENDEAVOR 2013, the artillery forces of Germany, France and the USA already have a capability at their disposal that covers command and control, reconnaissance and effect in multinational operations. In addition, Italy and Turkey are making use of the interface based on a NATO standard. Denmark, the UK and Norway are

planning to introduce the ASCA interface and are supported in this effort by Germany and the USA. The Netherlands have also expressed its interest in ASCA.

ESD: When will SAFES, the medical command, control and employment system, be available for use by the Medical Service?

Daum: SAFES is ready for use already. The software and the material are available; training started last year. The official approval for service use was issued in July 2014, marking the start of the in-service phase. Realisation is scheduled to be definitely completed by 2016.

ESD: When can the development of SVFuA be expected to be completed?

Daum: We have successfully accomplished the acceptance procedure for the first prototypes and are currently subjecting them to intensive testing. We expect that development of the SVFuA baseline unit can be completed by mid-2015. Delays caused by technical obstacles are always possible, though, in a technically highly demanding project like this one. A procurement decision will be taken after the development stage has been positively completed.

The questions were asked by Dieter Stockfisch.

Information Technology Directorate – Glossary

Project	managed by ...
ELCRODAT 5-4 crypto phone equipment	I 3.2
Bundeswehr's mobile communications system (MobKommSysBw)	I 4.2
Short-range terrestrial transmission system (TÜtrSys)	I 4.2
Participant network, deployable	I 4.2
Interdisciplinary Component of the Bundeswehr Communication Server (QUAKS Bw)	I 4.2
Army Command and Control Information System (ACCIS/FüInfoSysH)	I 4.3
ACCIS/FüInfoSysH – Lot 1 – Product improvement	I 4.3
Navy Command and Control Information System – Product improvement (PV FüInfoSysM)	I 4.3
Air Force Command and Control Information System – IT equipment expansion	I 4.4
Air Force Command and Control System, mobile (mobile AF C2 system/MobFüSysLw) – Implementation of core capability	I 4.4
Joint Command and Control Information System (JCCIS/FüInfoSysSK) – Configuration Level 1	I 4.4
Air Force Command and Control Information System – Product improvement (PV FüInfoSysLw)	I 4.4
Joint Command and Control Information System – IT equipment expansion – Configuration Level 1	I 4.4
Joint Analysis System for Military Intelligence (JASMIN)	I 4.4
Data Processing Equipment of the Medical Service's Command and Control System	I 5.1
Integrated Combat Unit Command, Control, Information and Weapons Control System (Integrated C ² I System/IFIS), initial equipment	I 5.1
Army Air Defence Surveillance and Command and Control System – Implementation Phase 1 (Army Aviation Combat Direction & Info Sys/FüWES HERGIS)	I 5.1
Branch/task-specific Command, Control, Information, and Weapons Control System/Command, Control and Employment Systems for land-based operations (FüW(E)S-LBO)	I 5.1
ACCS-ARS-National expansion and SMF (Software Maintenance Facility)	I 5.2
Air Command and Control System (ACCS/FüSysLuSK)	I 5.2
Air Operations Center – Air Command and Control System – GERMAN IMPROVED AIR DEFENCE SYSTEM (GefStd FüSysLuSK GIADS) – stationary	I 5.2
Data Processing Equipment of the Military Intelligence Data Station – Phase IIb	I 5.3
Ground-to-air VHF/UHF radio transceiver SATURN (Second Generation Anti-Jam Tactical UHF Radio for NATO) – stationary	I 6.1
HRM 7000/7400 radio series	I 6.1
Navy Adaptive High Frequency Radio for Boats	I 6.1
MIDS radio data transmission system (Multifunctional Information Distribution System)	I 6.2
Joint networkable radio equipment (SVFuA)	I 6.2
Joint networkable radio equipment – time-critical elements (ZKB SVFuA)	I 6.2
Bundeswehr satellite communications system – long-term solution	I 6.3

Information Technology Support Directorate (G)

With the establishment of the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (Bundesamt für Ausrüstung, Informationstechnik und Nutzung der Bundeswehr (BAAINBw)) on 1 October 2012, the BAAINBw's Information Technology Support Directorate (G) did not only assume the responsibility for projects and products that, before, had rested within the responsibility of the former Bundeswehr IT Office (Bundesamt für Informationsmanagement und Informationstechnik der Bundeswehr) but also took over material responsibility for the operational maturity of administrative and logistic information support applications from the organisational areas.

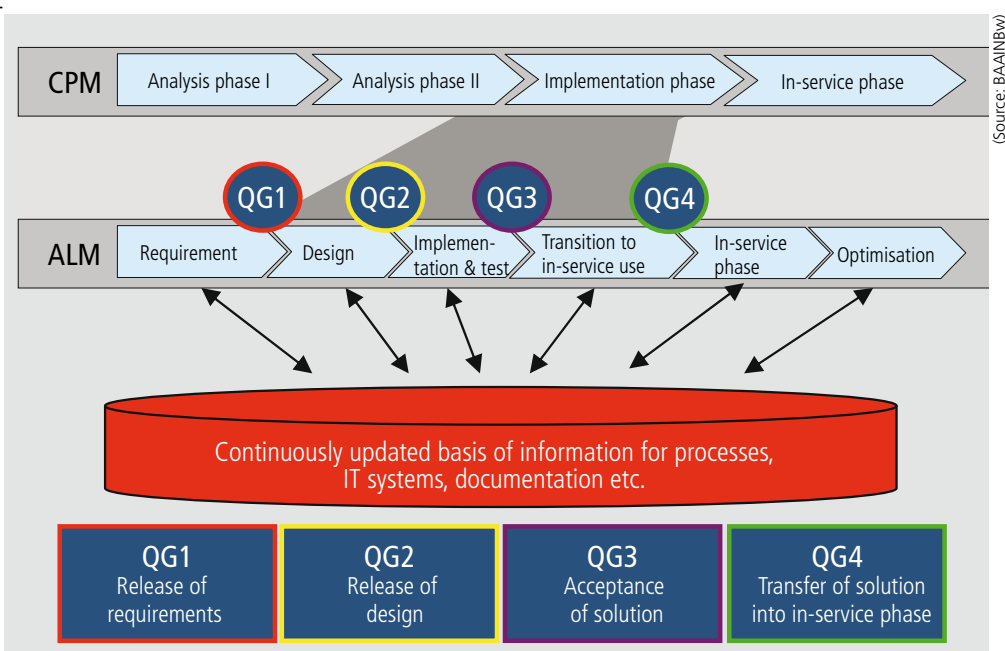
Modern Information Technology (IT) is a strategically important resource and supports all command and control as well as business processes of the Bundeswehr, which makes it an essential factor contributing to ensuring the Bundeswehr's performance and capabilities in the future. In accordance with the German Ministry of Defence's IT strategy issued on 16 January 2012, priority is placed on continuous improvement of the armed forces' operational capabilities. In this regard, IT implementation, further development and operation within the Bundeswehr are to be closely coordinated. The Bundeswehr's process of reorientation required the creation of a basis adapted to Bundeswehr structures and processes in order to provide the best possible IT support of Bundeswehr objectives while taking operational and financial framework conditions into account.

Starting Point and General Framework

In accordance with these requirements, the IT Support Directorate has taken over the responsibilities for the implementation and in-service use of administrative and logistic IT, two elements that had not been coordinated by the same directorate up to then, from the former Bundeswehr IT Office, the former Federal Office of Defense Technology and Procurement as well as other civilian and military agencies of almost all organisational areas. This comprises the standard application software product families (SASPF), the "systems in use" (SinN) as

well as other IT projects to support the Bundeswehr's main processes. The structural organisation of the new directorate reflects the close cooperation between project management and in-service management in terms of the overall material responsibility for operational maturity. The main tasks are designing concepts, planning projects, introducing

approximately 54,000 users are already working with this highly integrative system mainly based on the SAP standard software and a few other selected complementary products. On a global scale, the Bundeswehr is one of the largest commercial software users in this area. Not only by bringing together the responsibilities for implementation and use of



Relation between Customer Product Management (CPM), Application Life Cycle Management (ALM) and defined Quality Gates (QG)

and operating administrative and logistic IT for both operations and routine duty while taking into account relevant regulations and standards, e.g. ITIL®¹. Thus, the further development of IT service management processes on the basis of these best practices is of major importance also in the IT Support Directorate. HERKULES apart, SASPF is the Bundeswehr's central IT project. Approxi-

SASPF but also by technically integrating SASPF and systems in use into the endtoend² responsibility of the branch in charge will knowledge be pooled, knowledge transfer improved and synergies used. This approach of pooling responsibilities through the entire lifecycle of products and services facilitates their integration into the Bundeswehr IT system also with regard to economic aspects

and provides the basis for replacing other systems in use by SASPF.

In this connection, a continuous management (Application Lifecycle Management) ensures technical system know-how. In addition to demand analyses and solution selection, key elements are the implementation and in-service control by means of an IT service management that is adapted to the specific requirements of SASPF/systems in use while taking central requirements of the "Customer Product Management (amended)" regulation into account. The quality management ensures the overall system quality by means of defined Quality Gates.

This way, feedback from users, particularly from Bundeswehr missions, and experiences gained can be, better than before, efficiently integrated and implemented in new developments, further developments and adaptations of already fielded products.

Divisions and Bodies within the IT Support Directorate

The tasks assigned to the directorate are fulfilled by five divisions and different management bodies.

G1 Division (Economic and Technical Affairs) is the central planning hub for logistic and administrative IT support as well as the respective architecture and its updates. This division is also responsible for IT-related demand and IT service management and provides the necessary technical equipment and the common services related to the different applications which are necessary for the smooth running of the applications. The G1 division also serves as the central interface to the special organization HERKULES (H) as well as to other BAaINBw directorates, in particular to the directorates for Information Technology (I), Equipment Management and Strategy (P) and Quality/Logistics (Q), whenever interdisciplinary questions affecting these directorates occur.

G2 Division (Economic and Legal Affairs) is responsible for the contract management of Directorate G taking the services relating to the HERKULES contract into account. The G2 division

also centrally supports and monitors all resources for SASPF and systems in use including all funds for service providers from industry contracted regarding the implementation and use of SASPF and directly working within the directorate.

Divisions G3 (Personnel, Organisation, Individual Training), G4 (Armaments, Logistics, Infrastructure, Environmental Protection) and G5 (Bundeswehr Planning, Accounting, Controlling, Health Care, Special Areas) have been set up in line with the Bundeswehr process model. The branches of the individual divisions assess the requirements for the respective main and business processes together with the responsible process organisation, develop solutions, implement and roll out applications and ensure their operational maturity, including user support. They are technically responsible for the SAP modules and SAP components that are to be assigned to the respective main and business processes as well as for complementary products, systems in use and relevant interfaces.

Bodies that work across the organisational structure assist Demand Management and help to assume responsibility for the entire process and manage IT support based on the SASPF solutions/systems in use which are an integral part of the Bundeswehr IT system:

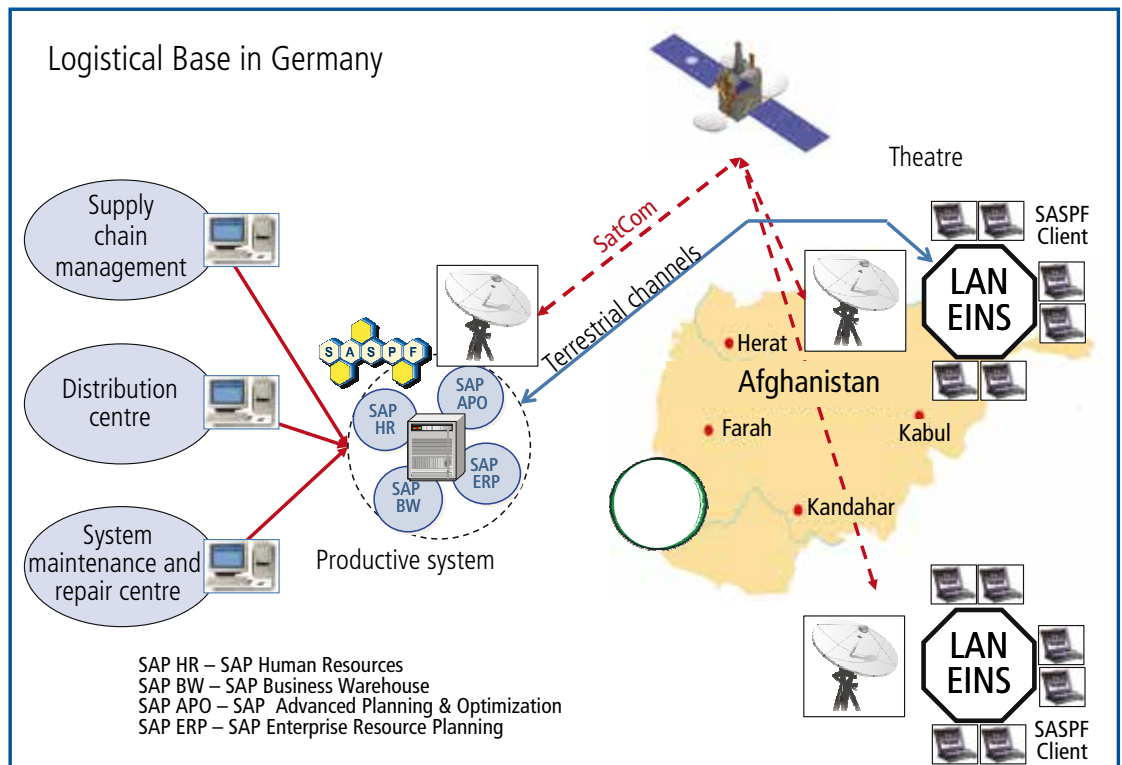
- **IT Service Management Board:** Layout, implementation and introduction

and/or updates of the IT service management model on the basis of operational processes;

- **Change Control Board:** Prioritizing, planning and authorising the implementation of Change Requests from Demand Management which will have a decisive impact on technical processes and systems technology for more than one division;
- **IT Architecture Board:** Development of architecture guidelines and standards for the application and system architecture;
- **Application-Specialised Working Group:** Monitoring the provision of services by the operating organisation (BWI) in line with the HERKULES main contract; this includes account management, operational support parameters, SASPF contract administration and software product changes of the systems in use.

SASPF in Theatre

The German contribution to current military missions is characterised by Germany's international commitment within NATO including a wide range of demands to meet and capabilities to provide. In this context, information processing and the availability of information in an interoperable setting play an essential role. SASPF has been available in theatre for



SASPF in theatre – terrestrial channels allow units to use the productive system in Germany; satellite communication is available as another option.

administrative and logistic processes of the Bundeswehr since spring 2011 and, since winter 2013, also for personnel processes.

The SASPF rollout in the theatres of operations and the implementation of all measures were completed by the end of September 2014. This process was accompanied by the "SASPF in theatre" project team in coordination with the Bundeswehr Joint Forces Operations Command. An "SASPF in theatre" user group was set up as permanent successor body tasked with follow-on support and coordination responsibilities. This body continued to be managed by the IT Support Directorate executive group until the end of 2014 in order to ensure that the competences of the BAaINBw and its organisational areas were pooled in a targeted and operations-related manner. This group analyses all factors having an impact on SASPF in theatre, initiates necessary measures if required and upon request of the Bundeswehr Joint Forces Operations Command and supervises them. In order to ensure operation and logistic support of airborne weapon systems under SASPF, the "airborne weapon systems rollout in theatre" coordination project was set up. In the course of this, the entire supply management of the MES Air Wing at the locations of Mazar-e Sharif and Termez was transferred to SASPF at once. Afterwards, measures relating to the in-service use of the weapon systems TIGER support helicopter (since February 2013) and NH90 transport helicopter (Forward Air Medical Evacuation) (since June 2013) in the ISAF area of operations were coordinated from Germany. In spring 2014, SASPF was rolled out in the German MINUSMA³ contingent for the air transport base in Dakar, Senegal. At the same time, the rollout of the German ATALANTA contingent in Djibouti was prepared. In fall 2014, the SASPF rollout for all non-seagoing units was performed there, with the focus being on the P3C Orion maritime patrol aircraft. Likewise, the coordination project supported the rapid implementation of the decision to reduce the German ISAF contingent and the planned establishment of the RESOLUTE SUPPORT follow-on operation in SASPF by the end of 2014.

In addition to the support of operational logistics by means of SASPF, the IT Support Directorate developed a personnel "mission tool" within SASPF in accordance with the requirements of the Bundeswehr Joint Forces Operations Command. The "mission tool" comprises personnel planning and staffing of posts in

operational structures, the collection of personnel data required for the provision of support to family members of personnel deployed, the collection of operational data as well as the secure storage of these data in the Bundeswehr personnel management system.

Since April 2012, the "mission tool" has been initially available in Germany for all German contingents, observer missions under the auspices of the United Nations, standby commitments, such as the NATO Response Force and the European Battle Group, as well as national support forces in the mission personnel process. After a trial phase, the "mission tool" has been available on-site in all theatres of operations since the end of 2013. In addition to the mission personnel process, the processing of all personnel processes in the Bundeswehr personnel management system introduced with SASPF in Germany is now possible in the theatres of operations for the first time.

SASPF thus proved to be the central element regarding the provision of IT support to operational logistics as well as to personnel planning and management in theatre. New processes and operating procedures which, in most cases, are associated with organisational measures are reflected by means of SASPF adaptations.

Use of Automatic Identification Technology in the Bundeswehr Logistics System

The planning, management and supervision of an adequate and timely supply of globally operating force contingents as well as the efficient support of routine operations require a high transparency of material flows within a supply chain.

A machine-readable material identification supports the modern Supply Chain Management in the Bundeswehr. For the permanent marking of material by means of a standardised medium (e.g. barcode) of the automatic identification technology, the Bundeswehr uses the SASPF IT solution. Thus, the marking of material is ensured throughout the entire lifecycle – from production through the entire in-service period to condemnation or utilisation. The use of automatic identification technology allows for acquiring, identifying and locating material marked with a barcode in an IT based manner by means of mobile readers. The time-consuming and error-prone manual collection and output of data have become obsolete.

Material identification in accordance with a uniform standard – in this case GS1 – is a prerequisite for the efficient applica-

tion of automatic identification technology. By means of GS1, logistic processes are optimised through an accelerated and error-free processing of the material and the tracking of objects in the logistic process chain is ensured.

There are two application possibilities for automatic identification technology: The use of readers (hand scanners) as a means of input assistance for quick and error-free acquisition of data in the form of character strings as well as quick data acquisition with simultaneous initiation of certain other programme functionalities depending on the data content. This can result in significant efficiency gains within the process flow.

Within the scope of a first Bundeswehr introduction phase, the areas of material identification, process support and infrastructure identification were implemented in the main. By means of the machine-readable identification of the material as well as the Bundeswehr-unique identification of storage bins with coded bin coordinates, goods movements and associated stock postings can be processed in the SASPF system in one step.

This identification results in a significant simplification and optimisation of the internal warehouse processes "goods receipt, goods issue and inventory" when using the SASPF-based warehouse management system.

The direct online connection of the readers (scanners) to the SASPF system via a Wireless Local Area Network is an essential characteristic of the solution already implemented. By means of this connection, data is available "in real time" and represents the current stock and requirements situation of the logistic facility at all times.

Within the scope of the further development of functionalities, the Bundeswehr now focuses on the potential offline use of the scanners. The objective of the new solution is to keep incoming data in an intermediate file, transfer it on a case-by-case basis to a mobile handheld device via a docking station and – after processing – reload it to the system in the same manner. This offline solution is required in areas where the use of an open radio-based system is not possible due to safety regulations or infrastructure. In particular, this applies to ammunition and POL storage facilities as well as mission contingents.

The logistic efficiency of the Bundeswehr was increased by the effective and user-oriented application of automatic identification technology. By means of the associated transparency of process

flows, turnaround and picking times are reduced, personnel employment is optimised, data and material flows are synchronised, sources of error are avoided and operational costs are reduced.

The new solution provides a modern Supply Chain Management, which covers the requirements of the complex Bundeswehr infrastructure in a demand-, user- and future-oriented manner.

Improvement, Extension and Area-Wide Introduction of SASPF Based Cost and Performance Accounting

The Bundeswehr used the SASPF project as an opportunity to conceptually revise its cost and performance accounting and to change over, in principle, from absorption costing to variable costing. Unless certain elements have not already gone live due to integration requirements of past subprojects, the objective in the last year was to complement functions and reports still missing or to improve the existing ones within the scope of an own subproject.

Cost recording and cost monitoring regarding Bundeswehr operations are

among the most important goals of cost and performance accounting. To this end, the persons responsible are to be supported with relevant information for planning and decisionmaking processes. The previous corresponding reporting system was characterised by complex manual work steps; within the scope of the subproject, this was to be replaced by a manageable reporting process. As a result, all mission costs can now be represented – in a largely automated way – with regard to the phases of mission preparation, mission execution and post-mission activities in a time-related manner.

In addition to the IT developments perfecting the cost and performance accounting, a second – at least equivalent – focus of the subproject was on the harmonised Bundeswehr-wide introduction of the SASPF-based cost and performance accounting. To this end, organisational structures and procedures had to be redesigned, tasks and authorisations of approximately 300 officials had to be assigned and a uniform training had to be designed and performed. Thus, the cost and performance accounting subproject can, as a whole, be described as an organisational project rather than a mere IT project.

Conclusion

The current projects described more closely above only provide a small insight into the portfolio of the BAABW's IT Support Directorate. In addition to the 170 systems in use, more than 100 SAP modules and around 30 ongoing projects, the main focus is on in-service control – from operational logistics to salary accounting for more than 100,000 users. In Directorate G up to 650 BAABW staff and up to 250 employees from industry provide reliable, modern and efficient applications to all members of the Bundeswehr for their daily operations in all Bundeswehr areas. This poses huge challenges to the IT service management processes and the qualification of soldiers and employees, who successfully tackle them. ■

1 ITIL: Infrastructure Library

2 In this case, "end-to-end" describes the overall view of the systems involved in a process from the user's perspective. It is not the individual system that is relevant in this regard but the interaction of all systems involved. The "end-to-end (e2e) responsibility" comprises the coordination of all measures required for the provision and optimisation of services agreed in order to ensure continuous business processes.

3 This expression is an abbreviation of the French designation of the mission: "Mission multidimensionnelle intégrée des Nations Unies pour la stabilisation au Mali".



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The HERKULES Special Organization (SO H)

The HERKULES Special Organization of BAAINBw is not only responsible for the Bundeswehr's largest IT project; in addition to their main task of so-called "Customer Management" vis-à-vis the BWI IT company, the approx. 270 members of this organisation are also involved in more than 30 other IT projects outside HERKULES. Since April 2013, a new additional project division has been working towards a follow-on solution for the HERKULES project.

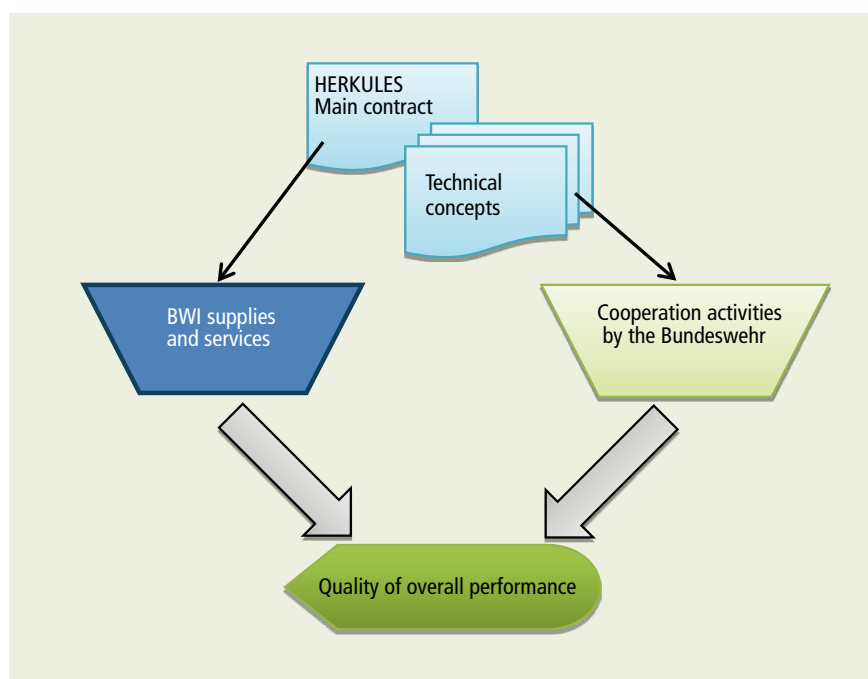
With a contract period of ten years, the HERKULES project has been the Bundeswehr's largest public private partnership since 2007. Its aim has been and still is to comprehensively modernise, standardise and economically operate the administrative information technology and the Bundeswehr communication networks in Germany together with a PPP operator company, the BWI IT GmbH, until the end of 2016. This includes more than 140,000 computer workstations, 300,000 telephones, the Bundeswehr data processing centres as well as a nationwide IT service organisation. Obviously, all measures taken by the "service provider" in order to implement the IT operations for the Bundeswehr have to be coordinated, supervised and improved. This also includes further developments, technical innovations and, last but not least, accounting.

The SO H, with its locations in Koblenz, Dresden and Strausberg, is subdivided into three project divisions and the HERKULES supporting staff. This staff element supports the head of the SO H in his command and control tasks in the fields of training, organisation, personnel administration, infrastructure and IT as well as controlling.

The HERKULES Customer Management

The **Project Division H1** is responsible for implementing the HERKULES IT project and other IT projects for central services and mobile work. This includes planning and implementing all IT-related activities (e.g. within the scope of IT relocations) as part of the reorientation of the Bundeswehr. Its main tasks are the so-called customer management and the daily cooperation with BWI IT in operating the IT home base, previously called routine operation.

Seven branches are responsible for tasks ranging from programme and quality management to IT services for central services and the adaptation of the Bundeswehr IT



(Source: BAAINBw)

Cooperation activities

system as part of the reorientation of the Bundeswehr through to central management responsibilities for the HERKULES system. The programme management is responsible for controlling the HERKULES project in bodies and specialised working groups. Moreover, it comprises the controlling reporting system within the scope of a continuous performance review.

The quality and IT service management branch measures and supervises the provided services based on the service levels defined in the HERKULES manual. This helps to identify and implement potentials for improvement also with respect to the cooperation activities of the users. The improvement of agreed services is a permanent task.

Other fields of expertise include IT security and data protection tasks. Expert personnel have to coordinate all IT security measures related to HERKULES between the Bundeswehr and BWI. Moreover, the pro-

ject division bears responsibility for the conceptual guidelines of all IT security products and configurations for HERKULES; currently for the connection of numerous networks with different preconditions and requirements (e.g. the Heeresinstandsetzungslastlogistik GmbH (HIL), the Bundeswehr Welfare Association or the Army Combat Training Center).

Another branch is responsible for the IT services provided for the Bundeswehr WAN, telephony as well as for the aspects of mobile work. Its tasks range from the responsibility for network expansion to measures relating to the Bundeswehr telephone network ("Next Generation Network") to establishing the prerequisites for secure network connections of "travelling users" with mobile radio and IT support.

The "Central Services" branch comprises numerous IT services. This includes the control of IT services for internet/intranet, Bundeswehr Lotus Notes Communications

Network, User-oriented Communication in the Bundeswehr and Bundeswehr Central Directory Service. Moreover, data processing centres and so-called "decentralised servers for systems in use" are supported. At present, the members of this branch are involved in the technical development of the Bundeswehr's online media, the public key infrastructure and the equipment of operational contingents with end-items for the User-oriented Communication in the Bundeswehr.

Apart from the financial planning and contractual implementation of the HERKULES project, the customer management also includes budget execution and the associated efficiency analysis. The contract branch conducts contract negotiations as part of the agreed change management, takes action in case of performance irregularities and demands contractual penalties. In addition, it processes requirements relating to IT materiel maintenance, IT open-end contracts and IT measures resulting from the Bundeswehr's reorientation.

Adaptation of the IT System to the Reorientation of the Bundeswehr

The effects of the Bundeswehr's reorientation on information technology were not foreseeable when the HERKULES contract was concluded. A separate project with additional resources – outside



Training of the users

HERKULES – was required for conducting the currently more than 200,000 IT relocations and modifications. Two branches of Division 1 form the "Coordination Organization IT-SysBw – Reorientation" (GE abbr.: "KOINBw") which centrally controls all associated modifications of the IT system: from planning to the use of separate budget appropriations to the support on site by the regional management teams of BAAINBw and BWI IT. These adaptations – including the closing down of facilities and integration of

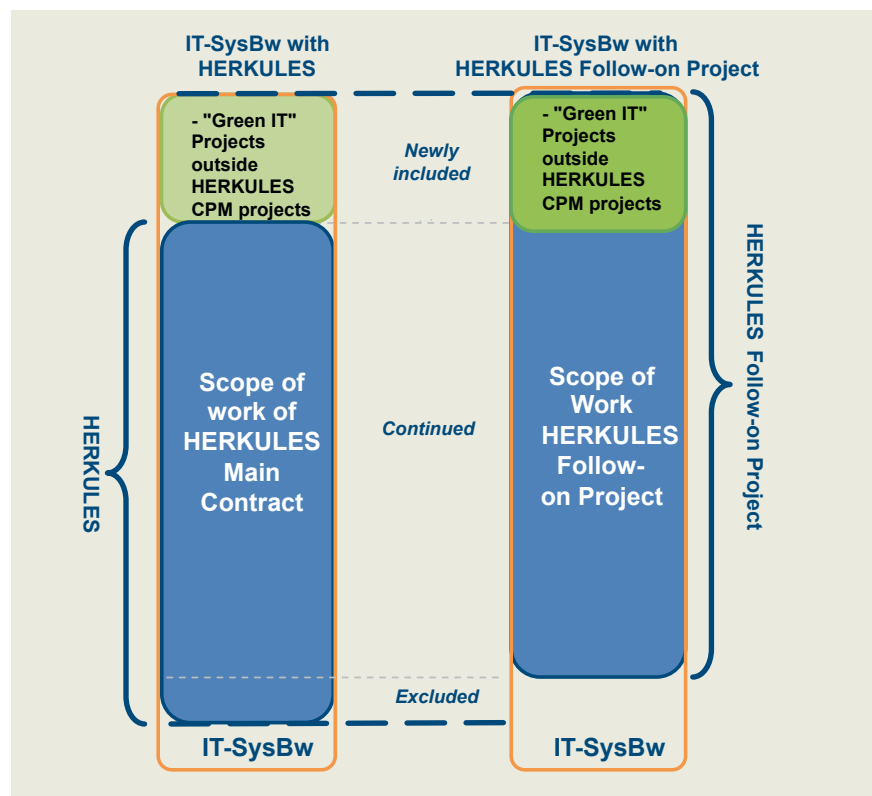
new facilities – include measures taken on IT networks, IT workstation equipment and services as well as IT procedures for HERKULES and Non-HERKULES IT. This includes command and control information systems, combat direction systems, SASPF (Standard Application Software Product Families), Systems in Use (i.e. "legacy systems" which are mainly required for administrative and logistic processes) and central services like internet/intranet, Email as well as IT security adaptations.

Apart from continuous IT relocation measures, the current priorities of KOINBw include the adaptation of approx. 30 systems in use, the support of SASPF and, in particular, other extensive projects like the activation of the new Bundeswehr Aviation Office with its IT elements.

HERKULES IT Platform Equipment, Desktop Management and Special Software

Project Division H2 with its four branches is responsible both for the equipment of the IT platform within HERKULES and for projects outside the HERKULES contract. The majority of the approx. 30 projects outside HERKULES is processed and controlled from here. The spectrum of tasks ranges from the procurement of COTS IT components to the support of other projects to the conceptual design and provision of IT solutions optimised for military applications.

The technical control of IT services for desktop management, associated servers and LAN within the HERKULES project is one of the main tasks of customer management. Particularly noteworthy is the support of the "software distribution" IT service,



Scope of work

which comprises the centralised, automated distribution of software programmes to the HERKULES computer workstations of all users and peripheral equipment.

Another branch supports the preparation and execution of projects especially in the field of technology. It performs research and technology (R&T) studies, market surveys as well as test and reference installations. A universally useable test and reference environment is available for this purpose. In addition, essential IT framework contracts in the field of commercially available IT are processed and supported. In addition, the branch is responsible for the central application tool for planning all technical and function-related IT equipment in Bundeswehr agencies.

The Special Software Competence Center, which has been operating as a cooperation project between BWI IT and the Bundeswehr since 2009, plays a special role. Here, special software and hardware are adapted to the standardised Bundeswehr configuration. More than 150 existing programmes receive continuous support and the required release management. The branch also provides advice on subjects like the end-of-life of software products as well as on alternative products and the compatibility of software products with new operating systems.

Preparation of the HERKULES Follow-on Project

The 10-year contract period of the HERKULES IT project will expire on 27 December 2016. According to the decision of the Budget Committee of the German Bundestag made in May 2014, the German government will become the sole partner taking over the business shares of the IT companies of the BWI service network on 28 December 2016.

An in-house company model has been identified as the most economical solution for the future IT tasks. The preparatory measures for this form of continuation are currently being developed.

Initially, the HERKULES follow-on project will have to fulfil one core task: the uninterrupted continuation of the Bundeswehr's IT operations. This will not be restricted to just continuing today's IT support in operating the home base. The progress achieved during the HERKULES IT project shall rather be applied to other elements of the Bundeswehr IT system as well; among other things, to operations-related IT elements (missions and exercises). This progress was made in particular in the standardisation of IT services, the standardisation of processes and the centralisation of IT operations with

the associated efficiency increase. The comprehensive IT support of teleworking activities and civil-military cooperation is also part of the intended enhancements expected from the HERKULES follow-on project.

The renewal of IT cable networks in Bundeswehr facilities, however, will no longer be part of the HERKULES follow-on project. Also some previous service elements, which will now be implemented in future CPM projects, are no longer part of the HERKULES follow-on project. This includes the extensive adaptations and further developments of Systems in Use (SinU), the implementation of SASPF functionalities (including roll-out and training for the further expansion of SASPF) as well as the work in other IT projects, e.g. in the field of Central Services.

In this context, the increased demands e.g. on the performance and protection needs of individual systems must also be considered. The extensive changes in the Bundeswehr IT system as part of the reorientation clearly show the importance of comprehensive and holistic planning in order to be successful. These changes within the scope of the reorientation of the Bundeswehr may very well extend until 2018 and thus end about two years after the expiry of the HERKULES main contract. With the consistent harmonisation of the Bundeswehr IT system in the home base operation, the FMOD has already today established a sound basis for a potential interministerial consolidation in the IT sector. The HERKULES follow-on project will thus have to be open for the next steps of an interministerial IT consolidation. Another focus of consideration is on the extended interoperability even up to NATO and EU standards.

HERKULES Interim Assessment

More than three quarters of the HERKULES contract period have elapsed: time to make an interim assessment.

The HERKULES project has reached the state of target operation. As a result, the Bundeswehr now has an excellent wide-area network, dependable data processing centres, a centralised user help desk, a 24/7 information and network service, modernised facility networks and an efficient IT



(Photo: ESO)

Server segment "large" with transport and storage container

workplace equipment which is replaced at regular intervals. After achieving the state of target operation, however, a few measures from the integration phase still have to be completed.

The launch of the HERKULES project did not go as smoothly as planned. After the BWI IT had taken over the existing IT operation, the Bundeswehr's IT landscape turned out to be far more complex than anticipated during the joint intensive preparation. In addition, a familiarisation phase was required during which the users and superiors had to come to terms with their new role and responsibility, administrators received different tasks and the BWI employees had to get to know the "Bundeswehr as a customer".

A standardisation generally entails that special user requests cannot always be fulfilled. Not everything available on the market is also required for official duties. And not everything that is nice to have is required for the overall system. And this will continue to be so.

Starting in 2012, the ideas on the future performance of the Bundeswehr IT system, to which HERKULES provides an indispensable contribution, have been formulated. The primary goal is to ensure the continuous operation after expiration of the HERKULES contract period at the end of 2016 in addition to the planned performance enhancements. The BWI personnel – which is more important than the individual technical element – with their know-how will continue guaranteeing a high-quality IT operation also in the future. This personnel constitutes the actual value of the later in-house company; they will be faced with a range of interesting new tasks.

HERKULES was, is and will be a task which hold true to its name. ■

Purchasing Directorate (E)

Within the context of the Bundeswehr reorientation the creation of a new, efficient and homogeneous procurement and in-service process was commissioned.

The new process structure of the Bundeswehr is characterised by clearly defined responsibilities and decision-making powers as well as reduced interfaces. The resulting new procurement and in-service process now consists of three pillars: The procurement of materiel solutions in accordance with the amended Customer Product Management (CPM), Bundeswehr Purchasing – non-project procurement – as well as satisfaction of demand via Complex Services.

The Core Tasks

The E Directorate is structured into four divisions and twelve branches as well as into the Directorate Staff and the Directorate Controlling/Purchasing Controlling Unit. It is responsible for two out of three pillars of the procurement and in-service process – Bundeswehr Purchasing and Complex Services – within the Bundeswehr. Other task areas of the Directorate are the disposal of Bundeswehr materiel as well as interdepartmental and equipment support.

Bundeswehr Purchasing Organisation

The Bundeswehr Purchasing Organisation is responsible for non-project procurement, i.e. for commercial and Bundeswehr-specific consumables and non-consumables in order to maintain Bundeswehr operations on deployments, in exercises and routine duty using a new, holistic approach. This includes the follow-on procurement of spare parts for weapon systems/equipment in the in-service phase, procurement via international procurement channels and interministerial procurement.

Based on a very heterogeneous procurement organisation, Bundeswehr Purchasing has established an economically optimised procurement system operating within the legal framework, using modern methods in a context which comprises the entire Bundeswehr, and has defined clear responsibilities.

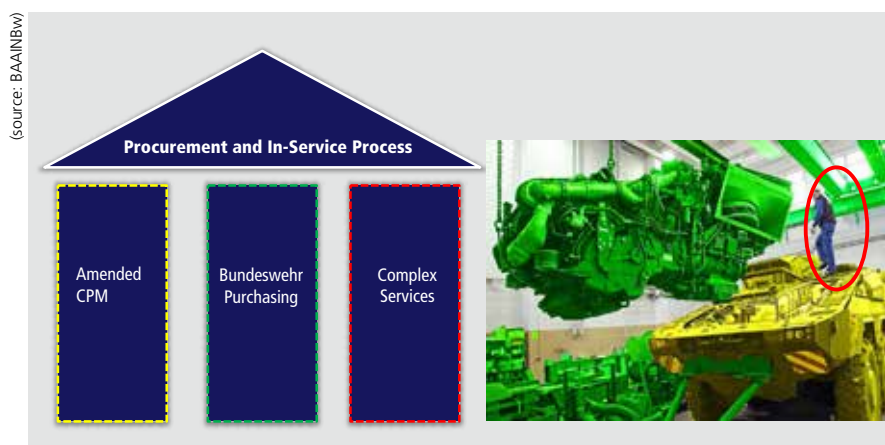
Important key principles of the newly established Bundeswehr Purchasing are the introduction of a strategic working method including an overarching central command and control, a stringent materiel segment management that is – in close cooperation with the user – geared towards the procurement market, as well as a process-oriented organisational structure.

By establishing Bundeswehr Purchasing the heterogeneous operational level of the procuring agencies is expanded by a strategic procurement level in the sense of an optimised purchasing policy exercising holistic control. The overall responsibility for the purchasing process is exercised by division AIN (Equipment, Information Technology and In-

This becomes evident in particular in the organisational structure of BAAINBw's E Directorate.

As regards the establishment of the Bundeswehr Purchasing strategic working method three systematic development stages are scheduled until the end of 2017. Development stage 1 "Set-up of Bundeswehr Purchasing", which comprises the three pilot materiel segments, i.e. automotive engineering, office consumables and medical technology, had almost been completed by 31 December 2013.

In particular with regard to the materiel segment of automotive engineering it can be considered a success that various "decentralised" individual contracts have been



The three pillars of the Procurement and In-Service Process and their interaction

Service Support) III within the FMOD. This is where the framework for Bundeswehr Purchasing is set, i.e. where the purchasing strategy is adopted and the appropriate guidelines are issued. The Director of the E Directorate is responsible for their development and implementation at agency level. The executive level of the Purchasing organisation ensures the implementation of the guidelines by all operational level agencies. The respective directive authority applicable across organisational boundaries is stipulated in the newly established procedural provisions.

As regards the items, the new procurement organisation is structured in accordance with so-called "materiel segments" which in turn are structured according to the eCI@ss (Multi-industry product data standard for the classification and description of products and services) classification. According to a new understanding the materiel segments combine supply items that have the same purchasing markets.

combined by means of a "central" open-end contract. Since considerable savings are achieved by this measure, it will be checked both in the automotive engineering materiel segment and in the other segments whether further decentralised requirements can be combined and fulfilled by means of centrally concluded open-end contracts and implemented – where possible and economically acceptable – in compliance with public contracting law. Another focus is on the optimisation of requirements planning in cooperation with the user. The aim here is to conclude successive delivery contracts for up to three years instead of frequently conducting tender procedures on the basis of recurring requirements that comprise only small amounts of items.

As regards the area of office consumables, it would also be possible to achieve savings by reducing the number of contracts on the procurement of paper and by centralising them. By simultaneously switching to recycled paper the current sustainability require-

ment of the German Federal Government is accounted for as well. The effects achieved by these measures are depicted in Figure 3. The current objective is to attain development stage 2 by the end of 2015. In this way, the standardisation and professionalisation of Bundeswehr Purchasing will be further promoted. For this purpose, decentrally managed creditor and open-end contract data in particular are transferred into a central data storage. An analysis conducted with regard to the heterogeneous data landscape predominant to date clearly identifies potentials for optimisation by cutting back redundancies and using synergy effects. This way, for the first time a transparent and standardised Bundeswehr database will be generated, without which the development of overarching purchasing strategies will be impossible.

Moreover, in 2015 further materiel segments (e.g. electrical engineering, energy and secondary raw materials, housekeeping) will be transferred into the newly established purchasing process. By means of an additional and final development stage 3, Bundeswehr Purchasing will be established in all materiel segments as of 2017.

The Bundeswehr Purchasing concept, the related continuous further development

mately 2 million items, 500,000 of which are almost constantly in demand. The procurement ranges from small parts such as screws, nuts, sealing gaskets, also including commercial material, to specific materiel for equipment and complex weapon systems such as the CH-53 medium transport helicopter, the frigates or the LEOPARD main battle tank.

E2 concludes contracts on POL supply i.e. fuel, lubricants and other comparable products including storage, handling, pipelines etc. for the Bundeswehr in Germany and abroad and other federal authorities and facilities in the context of demand pooling at federal level, as well as contracts on office consumables (e.g. printing and photocopying paper) and print products (service regulations, forms etc.), individually issued expendable items, medical supplies (medical consumables and drugs).

The E2 Division is organized in materiel segments in accordance with the eCl@ss structure.

This permits placing a targeted demand on the procurement markets due to the development and implementation of specific purchasing strategies for each materiel segment. Each materiel segment is headed by a materiel segment manager who has directive authority across organisational boundaries. This facilitates a standardised Bundeswehr procurement in the materiel segments by establishing procurement experts for specific materiel segments and leads to pooling and synergy effects.

Generally, Bundeswehr Purchasing has initiated a paradigm shift in non-project procurement.

This constitutes a move away from thinking in terms of cost in decentralised structures originating in the past and towards a focus on added value in the context of centrally defined procurement strategies.

Individual contracting authorities across the Bundeswehr thus lose their primacy in the procedural organisation and become an integral part of the materiel segments. Their integration as early as during the development of materiel segment strategies facilitates the implementation of different procurement levers taking the legal framework into account.

It will be essential to establish a changed basic understanding within the Bundeswehr without jeopardising the supply itself. It will not be possible, though, to break down structures "overnight" that have evolved over decades. The core elements of a new strategic working method including an overarching central command and control, materiel segment management and process orientation form the driving force for longer-term organisational development.

Complex Services

The PPP (public private partnerships)/Complex Services constitute the third pillar of the procurement and in-service process and comprise the following core elements:

- Comparison of the options regarding the satisfaction of demand within the whole spectrum from the sovereign implementation of public tasks through to complete outsourcing in the sense of a contract award to external contractors;
- Development and evaluation of these different solution models, if necessary by additional, overarching use of personnel and
- Planning of migration periods (connection to Bundeswehr business processes and transfer to a third party) in order to ensure the transition from the realisation to the in-service phase.

BAAINBw's E Directorate has had awarding, contracting and economic authority concerning complex services in the field of equipment, IT and in-service support for a long time.

An additional organisational element for project management which assumes the technical-logistic management as well as the overall management of projects has been created with branch E3.1. It systematically develops and implements complex service projects. Interdisciplinary cooperation across organisational areas and agencies is not just possible but already envisaged. This will be implemented by a specific form of cooperation – similar to the amended CPM. The aim is to develop adjusted and economic capabilities for our armed forces with due regard to the legal framework, in time and in cooperation with industry.

Currently, branch E3.1 assumes project management tasks for the following projects: package 1 NBC materiel (supply management for personal NBC protective equipment and clothing of the Bundeswehr), package 2 NBC materiel (supply management of the common and weapon-system specific materiel for the Bundeswehr's NBC defence) and Central Bundeswehr spare parts logistics (ZEBEL – supply of Bundeswehr-owned spare parts by a private service provider to civilian and selected military maintenance facilities).

Branch E3.2 manages the contracts for the above NBC projects, the ZEBEL project and the basic driver training project (KfGA – acquisition of the license to drive service vehicles class D "bus license" from a private company). Another E3.2 task is contracting and contract management in the field of Bundeswehr transportation (with regard to road, rail, sea and air transport), which it took over from

Core principle of disposal: Materiel cognizance throughout the entire life cycle

and the required change management will be conducted by the E1 Division of BAAINBw's E Directorate. A "Bundeswehr Purchasing Info Portal" which serves as a control and information tool has been established on the intranet. The collection and target group-oriented provision of the data required in this context will also be effected by the E1 Division.

Moreover, the following tasks will be performed by the E1 Division:

- Generating and providing basic purchasing information (e.g. ordering catalogues) as well as purchasing statistics and reports for BAAINBw;
- Drawing and design office for BAAINBw and
- Collection of company proposals for BAAINBw.

The E2 Division procures the entire follow-on spare parts required by the armed forces for weapon systems and equipment during the in-service phase. A considerable share of the contracts are awarded on a competitive basis and with the involvement of medium-sized enterprises. The range of supply items to be procured amounts to approxi-

the Federal Office of Bundeswehr Infrastructure, Environmental Protection and Services (BAIUDbW) in January 2013. So it assumes the role of central contracting agency for meeting Bundeswehr transport requirements both for routine duty and operations (e.g. follow-on supply and redeployment as regards ISAF, EUTM Mali, follow-on supply ATALANTA etc.).

In this context, Division E also participates, in cooperation with the Logistics Working Group and within the framework of international bodies (e.g. at NATO level), in initiatives aimed at the improvement of cooperation with trade and industry and alliance partners.

Since the beginning of 2014, E3.2 has also assumed support of the project "air traffic control training of the Bundeswehr" in matters of contract award and contract law.

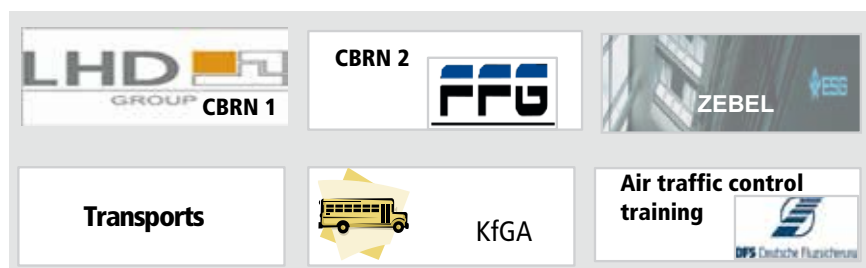
The project management for the projects "Optimiertes Bekleidungsmangement 2016+" (Optimised Clothing Management (OBM 2016+)), "Bundeswehr Fuhrparkservice" (Bundeswehr vehicle fleet (BwFPS)) and Heeresinstandsetzungslogistik (Army maintenance logistics (HIL)) is currently conducted by the temporary work organisation "PROFHI" (project organisation for OBM 2016+, BwFPS and HIL).

Branch E3.4 has the economic competence in the purchasing directorate. This branch is responsible for price negotiations for Division E3 as well as for Divisions E2 and E4. Apart from supporting implemented projects, Division E3 is closely involved in the development of follow-on projects and solutions. Its particular responsibilities are project management, conducting expression of interest procedures, awarding procedures as well as contract implementation and support.

Thus, the technical-logistic, legal and economic expertise for a large part of the complex service projects in the Bundeswehr is concentrated in Division E3. The "one source" processing concept creates access to optimisation and acceleration processes in project work.

Decommissioning and Disposal of Bundeswehr Materiel as well as Interdepartmental and Equipment Support

The E4 Division deals with a broad range of tasks that is mainly characterised by the disposal of materiel no longer required within the Bundeswehr, government-to-government purchases (Foreign Military Sales – FMS), interdepartmental and equipment support for friendly nations, cooperative logistics and contract management which



Directorate E is in charge of the contract management for the above-mentioned projects.

cannot be assigned to another area within BAAINbW.

Branch E4.1 supervises the disposal procedure with the objective of relieving the Bundeswehr of unserviceable or surplus materiel at an early stage, minimising costs caused by condemnation, disposal and utilisation of Bundeswehr materiel and achieving maximum proceeds from sales of the materiel. In this context, special attention is paid to compliance with aspects of the War Weapons Control Act, the Closed Substance Cycle and Waste Management Act and the environmental law; moreover, demilitarisation and elimination of disposal obstacles are ensured. Materiel for which there is no recycling requirement will, if appropriate, be sold to third parties via the VEBEG company (government-owned trust company for the disposal of decommissioned assets for the federal government and other public customers). The proceeds will be returned to the federal budget. This does not apply to war weapons and materiel that contains radioactive substances. Apart from that, transfers of materiel to other countries, equipment aids and humanitarian support services are performed.

An important forum in this context is the Integrated Project Team (IPT) for Condemnation and Disposal, which is not an IPT in accordance with the amended CPM. The IPT for Condemnation and Disposal was founded with the aim of accelerating condemnation and disposal of surplus materiel produced during the Bundeswehr's restructuring.

Within the context of this IPT and with regard to the entire materiel spectrum the process chain is managed and supervised across organisational boundaries from identification of surplus stocks to condemnation through to disposal or utilisation. By means of this concerted course of action the burden on the Bundeswehr will be reduced both in individual cases as well as across organisational areas. Current priorities are measures taken with regard to the disbandment of agencies, the disposal of materiel of US origin for which end use certificates are available as well as the transfer of workload of fixed logistic facilities by

accompanying measures of the recovery organisation.

By the successful work performed by the IPT an important contribution is made towards reducing the burden on logistics and the re-orientation of the Bundeswehr.

Branch E4.2 is responsible for the contractual implementation of decisions taken with regard to disposal. Following condemnation within the Bundeswehr, attempts are made to put surplus materiel to another use by handing it over to friendly nations, manufacturing companies or museums, preferably by selling it. In addition to the transfer of materiel to other countries (handing it over to friendly nations) agreements for friendly nations are negotiated and concluded within the context of administrative assistance on procurement (e.g. spare parts or accessories) and services (e.g. maintenance of the contractual items). If another use is not possible, the respective materiel will be recycled. For this purpose respective disposal contracts will be negotiated and concluded with companies subject to a charge.

In addition to these recovery functions additional tasks such as the contractual implementation of the German Federal Government's equipment aid program, the support of approximately 50 government quality assurance contracts or the processing of government-to-government purchases within the context of the US Foreign Military Sales (FMS) process are assumed. Approximately 300 FMS contracts represent a contract volume of more than US-\$4 billion. Further tasks are the preparation of contributions to information exchange on international arms control treaties (CFE contract, Vienna Document, United Nations Register of Conventional Arms), the negotiation of contracts for the Scientific Collection of Defense Engineering Specimens and the Technical Information Center as well as the support of the liaison offices and the Canadian procurement office, among others by providing legal advice within the context of problems related to contract awarding. The in-service support of the LEOPARD MBT and the settlement of accounts for services rendered to the partner nations supplement the task areas of the E4 Division. ■

Quality/Logistics Directorate (Q)

The Quality/Logistics (Q) Directorate rests on three "pillars", namely Divisions Q1 to Q3. These divisions focus on providing comprehensive system-related and interdisciplinary support to project directorates and Government Quality Assurance Offices and assist in performing conceptual and operational tasks which are all brought together in the Logistics Directorate so it can assume responsibility for the maturity of materiel.

The technical systems that the Bundeswehr uses as well as the services provided to the Bundeswehr are characterised by a high level of complexity. Incorporating various components into the smallest of spaces poses major challenges at system level.

Individual weapon systems are responsible for ensuring that these requirements are met. The engineers and scientists of **Division Q1** "System-Specific Protection Tasks, Defense Materiel of Other Nations" provide support and advice in the fields of "occupational health and safety, environmental protec-

magnetic fields and lasers) and from the working conditions they find themselves in (e.g. high workplaces, working in the dark or in bad weather). Complex weapon systems also require an increasing level of software safety.

The hazardous substance management department specifies the hazardous substances requirements as regards the development and procurement of products and non-project procurement and checks the available hazardous substances information and safety data sheets for substitution requirements and plausibility.

As part of public procurement, the Bundeswehr technical supervisory body may task and authorise engineers to inspect and examine material handling systems, pressure equipment, cranes and lifting gear that require monitoring.



(Source: BAAINBw)

Occupational health and safety and environmental protection in a Bundeswehr armoured transport vehicle

As a matter of principle, the German Occupational Health and Safety Regulations also apply to the workplaces of soldiers during routine operations and deployments as well as to the civilian personnel carrying out trials or performance tests. Bundeswehr personnel, therefore, are entitled to health protection in the workplace and to humane working conditions in the same way as employees working in trade and industry. Also, Bundeswehr weapon systems must not have any adverse impacts on the environment.

Apart from these traditional task areas and because of the strong dominance of intelligent system parts in Bundeswehr weapon systems the area of "Functional and Software Safety" will increasingly be in the focus of the activities conducted within the context of system safety assessment. The project managers assigned to the indi-

tion and ergonomic design, meeting of requirements in the area of weapon system safety and design safety of ammunition." The division chief is the safety engineer of BAAINBw.

Occupational Safety

Occupational safety covers the areas of occupational and radiation safety, technical and electrical safety, fire protection, ship safety and the safe handling of hazardous material as well as of weapons and ammunition safety with regard to the procurement of products in accordance with the new Customer Product Management (CPM (amended)).

Risks in the workplace of soldiers arise from handling defence materiel (e.g. risks arising from moving parts, noise and vibrations, hazardous substances, radiation, electro-

Environmental Protection

This area of work analyses and assesses the dangers arising for the environment from defence materiel and, above all, keeps them at as low a level as possible. To this end, the negative impact that a piece of equipment has on the environment during its entire life cycle – from its development to its disposal – is, first of all, to be identified and then minimised. As a general rule, preference is to be given to the material with the lowest risk potential.

Ergonomic Design

Ergonomic design is about designing defence materiel that follows ergonomic principles and is easy to operate. The aim is to improve the commandability, operability and usability of items, paying particular attention to stress factors in military operations. In this context, demographic change, i.e. changes in socio-physiological population parameters, needs to be taken into account, too.

The set-up of the workplace in particular, operability, seats, space to move and hand grasp area as well as the ways in which information is perceived and processed contribute to user friendliness.



Government Quality Assurance Representative from the Government Quality Assurance Office in Manching attending an operational test during production of the EUROFIGHTER TYPHOON

Flaws in ergonomic design add to the operator's or user's physical and mental stress level and must be avoided. The Q1 Division also coordinates and manages interdisciplinary research and technology projects in the fields of materials, fuels and lubricants, occupational health and safety, environmental protection and ergonomic design.

Furthermore, Q1 has the important task to analyse foreign defence materiel, thereby obtaining valuable knowledge to identify the Bundeswehr's capability gaps or to adapt the already fielded technical systems to new threats. Research and technology is carried out in this field as well.

The main responsibility of the **Q2 Division**, which is also known as the "Bundeswehr quality assurance authority", is to assure the quality of defence, mission relevant or fiscally relevant items and complex services provided to the Bundeswehr, NATO partners or friendly nations.

Q2 consists of a policy branch, four technical branches and 26 Government Quality Assurance Offices (GPS), located mainly at the respective defence materiel contractor's premises.

The policy branch is responsible for basic quality assurance tasks and national and international cooperation. The technical branches cooperate closely with the project directorates or the respective non-BAAINBw agencies, devise contractual quality assurance requirements and provide technical assistance to the Government Quality Assurance Offices. They also perform central certification and quality assurance monitoring tasks.

The 26 Government Quality Assurance Offices carry out quality assurance activities at the contractor's site. They do not only carry out contractual quality assurance activities,

i.e. making sure the contractor credibly fulfils contractual quality requirements, but also perform quality assurance tasks for other government agencies.

The Government Quality Assurance Offices base their work on NATO quality assurance requirements, the Allied Quality Assurance Publications (AQAP). The intensity and depth of quality control with which the Government Quality Assurance Representative monitors manufacturing depends on the identified individual quality risk.

The Government Quality Assurance Offices are not only responsible for quality assurance, they also take care of maintenance work to be carried out by industry on Bundeswehr defence materiel, starting with defining the scope of maintenance to issuing maintenance orders and auditing invoices. Within the new "Quality/Logistics" Directorate (Q), the Bundeswehr quality assurance



Government Quality Assurance Representative from the Government Quality Assurance Office in Kassel monitoring the factory trials on the PUMA IFV overall system demonstrator

authority works independently of project directorates and the bodies managing the contract. It exclusively answers to the executive level. This reflects BAAINBw's political will to further strengthen government quality assurance.

With the in-service tasks that have now been assigned to BAAINBw, the aspect of logistics and its entailing responsibilities have been placed on a completely new footing.

To this end, for example, the **Q3 Division** has been structured in a way as to cover, with its seven branches, all the aspects of logistics relevant to BAAINBw. Q3, therefore, is the direct point of contact for the Bundeswehr Logistics Command in all matters of logistics.

Q3 is now taking on new tasks but also pooling responsibilities which before were scattered along various user agencies/military commands, the former Federal Office of the Bundeswehr for Information Management and Information Technology (Bundeswehr IT Office, in particular its Directorate A) and the Service Branch T2 of the former Federal Office of Defense Technology and Procurement (BWB).

The spectrum of logistics encompasses conceptual work and policy matters, support of project directorates and BAAINBw agencies as well as operational and logistic tasks for that particular organisational area.

As a result, Q3 in particular taps synergies by bringing together the areas of armament and in-service use.

A few examples are:

- Bringing together logistic technical and requirements planning for maintenance and Bundeswehr depot level maintenance which has so far been handled by the agencies of the organisational areas;
- Bringing together in one branch the conceptual responsibilities of "Equipment/In-

Service Use/Logistics Procedures and Processes", the "Logistic Process Manager" of the organisational area of Equipment, Information Technology and In-Service Support within the Armaments/Logistics main process and "Standardisation" including their respective representatives in international bodies;

- Bringing together logistic expertise from the areas of Armaments and In-Service Support to ensure that the material manager for operational maturity can fulfil his responsibility for conceptual matters and is able to act in all CPM (amended) phases.

Q3 is responsible for determining logistics guidelines in addition to performing policy work for individual tasks in the Logistics project element (e.g. material management, Integrated Logistic Support-ILS/Logistic Support Analysis-LSA), material information and basics, obsolescence management, configuration and change

management, technical reliability and the application of Automated Identification Technology.

In the fields of import, export and transport, Q3 is also in charge of defining technical responsibilities, end-use control and the Documentation Center for Loans and Government-Furnished Equipment within the organisational area of Equipment, Information Technology and In-Service Support.

Q3 serves as the central point of contact for Bundeswehr software licenses to ensure that software is used in a legal and efficient manner.

To put it in a nutshell, Q3 "Logistics" is responsible for four main areas:

Conceptual Tasks

- Equipment/In-Service Use/Logistics Procedures and Processes;
- Logistic Process Manager for the Armaments/Logistics main process within the

organisational area of Equipment, Information Technology and In-Service Support;

- Standardisation.

Policy Matters

- Equipment/In-Service Use/Logistics terminology;
- Automated Identification Technology (AIT);
- Software license management;
- Material information and basics;
- Configuration and change management;
- Obsolescence management;
- Technical reliability;
- Individual tasks in the Logistics project element (e.g. material management, Integrated Logistic Support-ILS/Logistic Support Analysis-LSA).

Support Tasks

- Technical and requirements planning for maintenance;
- Depot level maintenance planning and follow-on requirement for individually issued expendable items;
- Material condemnation officer, import and export matters, end-use;
- Transport matters;
- Bundeswehr IMP Office (Information Procedure Material Planning Designation);
- Codification, preparation of logistic master data;
- Provision of expertise for logistic projects;
- Transport matters.

Operational Logistics (Equipment, Information Technology and In-Service Support)

- Technical supervision of order processing, material management and maintenance of agencies;
- Equipment of BAAINBw and its agencies;
- Infrastructure of BAAINBw and its agencies;
- Documentation Center for Loans and GFE within the organisational area of Equipment, Information Technology and In-Service Support and agency-furnished equipment.

The Directorate Staff (QAS) is responsible for all organisational and personnel matters. QAS also manages initial and extension training, security and official trips.

The Directorate Controlling Unit (QAC) assists the director with strategic controlling. The QAC aims to provide information supporting the decision-making process so as to enable the executive level to fulfil the tasks attributed to Directorate Q in the most effective manner.



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Central Affairs Directorate (Z)

The Central Affairs Directorate (Z) is responsible for central administrative matters of the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw). Six divisions with a total number of 26 branches deal with the multi-faceted spectrum of interdisciplinary and general administrative matters. Directorate Z is thus the central service provider for the BAAINBw and its agencies.

Division Z1

Division Z1 consists of the branches "Organisational Structure / Organisational Procedures, Supervision (Z1.1), "Commercial Policies, Accounting, Organisational Studies, Manpower Requirement Calculation" (Z1.2), "Security, Alerts, Security Officer" (Z1.3) and "Internal Services" (Z1.4).

This division deals with the organisational and procedural overarching and general administrative matters of the office. Not only does it determine the organisational structure of BAAINBw and its agencies but it also develops regulations with respect to both the administrative area and project management. Furthermore, this division is responsible for organisational studies, manpower requirement calculation and commercial policies (cost and performance accounting). Moreover, division Z1 is responsible for personnel and materiel safety. The Administrative Data Protection Commissioner also belongs to division Z1. The liaison office with the Bundeswehr Service Center (BwDLZ) for coordination and general tasks with respect to real estate and accommodation affairs is also part of this division. Postal and messenger services, registry and BAAINBw inventory management complement the division's task spectrum.

Division Z2

Division Z2, Finance, is characterised in its structure and allocation of responsibilities by the special tasks of BAAINBw, which is not only a large procurement agency of the Federal Republic of Germany and thus an important public purchaser but also – since its establishment on 1 October 2012 – has the single-manager responsibility for the operational maturity of defence materiel. In 2013, BAAINBw had a total of €7.18 billion at its disposal for these tasks. Apart from that, the division manages the budgetary funds required for the administrative need of the office. In 2013, a total of approximately 94,000 invoices was processed for payment by means of available budgetary funds.

Division Z2 consists of the following branches: Z2.1 "Budget Policy, Government Claims and Allocations, Tax Affairs, Federal Audit Office Affairs", Z2.2 "Funds Management, Investments", Z2.3 "Funds Management, Operation" as well as Z2.4 "Contract Accounting".

Branch Z2.1 not only processes fundamental tax and budgetary law issues but also contributes to contract review and consulting in accordance with Articles 58, 59 and 63 of the Federal Budget Code (Bundeshaushaltsordnung, BHO). In addition, it monitors all government claims (e.g. contractual penalties, interest charges), posts them accordingly and centrally pays taxes due for BAAINBw and its agencies. Besides the review of allocations (Art. 44 of the BHO), Z2.1 also conducts unexpected materiel tests in BAAINBw and its agencies in accordance with Art. 78 of the BHO. Within the scope of utilisation, Z2.1 is responsible for the task of the budget officer. With regard to funds of partner countries to be administered on trust within the scope of binational or multinational agreements, Z2.1 concludes account keeping agreements with commercial banks, manages them and authorises the required payments. Also, primary responsibility regarding the processing of all audit projects initiated by the Federal Audit Office (Bundesrechnungshof, BRH) and the federal regional audit offices rests with this branch.

The main task of branch Z2.2 is to manage the funds for research and technology as well as for development and procurement of defence materiel. In addition, the shares of the funds required for fast track initiatives for operations as well as the German shares of the administrative budgets of the NATO agencies are managed here. Since 2013, the branch executes the tasks of budget item management (investments). During the implementation of procurement actions, the budget item managers serve as interfaces between the user and the project manager on the one side and planning and budget on the other. Besides the budget item management, branch Z2.2 is also responsible for cen-

trally authorising all payments of the office. In addition, specially assigned members of the branch ensure smooth processing of existing budgetary IT procedures, contribute to the conceptual development of these procedures or specify associated new budget processes.

The responsibilities of branch Z2.3 comprise the management of the funds required for maintaining the operational maturity as well as of the funds necessary for maintaining and conducting routine duty in BAAINBw and its subordinate agencies. In addition, Z2.3 manages the funds for information technology and for the Bundeswehr information and communication system. The task spectrum of the branch also includes the management of funds for private operator models regarding clothing management (LH Bundeswehr Bekleidungsgesellschaft mbH), army maintenance logistics (HIL GmbH) and fleet management vehicles (BwFuhrparkService GmbH).

In addition to the accounting of contracts concluded by BAAINBw, the tasks of branch Z2.4 comprise delivery date monitoring, final pricing agreements and recovery of and interest on possible overpayments after the price review has been performed.

Division Z3

Division Z3, "Legal Affairs", addresses the legal issues of procurement procedures and public contract awarding policies and exercises functional supervision of BAAINBw agencies' award activities as well as the control of the Bundeswehr companies with regard to accompanying contract award law. Further tasks include civil law aspects of contract consulting and contract review. The division is also responsible for lawsuits with contractors in contractual matters, for executions against property, insolvency proceedings and for liability and damages investigations. Furthermore, Z3 assumes tasks relating to employee inventions / service inventions, industrial property rights (patents, trademarks, utility models and designs) and copyright matters within the

(Photo: mawibo)



Directorate Z is the central service provider for the BAAINBw and its agencies.

Bundeswehr. Moreover, the division concludes licensing agreements covering the marketing of Bundeswehr rights as well as contractual agreements on user rights. Z3 is also responsible for the conclusion of project-related departmental agreements (Memorandum of Understanding, MoU) within the scope of international armaments cooperation.

Division Z4

Division Z4, "Coordination of Personnel, Parliamentary and Cabinet Issues, Scientific Collection of Defense Engineering Specimens (WTS), Technical Information Center (FIST)" consists of five branches and is responsible for the tasks of an employing agency for the civilian and military personnel.

Branch Z4.1 is in charge of coordinating BAAINBw civilian personnel affairs and is thus central point of contact for Bundeswehr personnel management agencies. In particular, its responsibilities include personnel management for the BAAINBw as employing agency.

In the context of personnel matters, this branch also works in coordination with and supports the Federal Office of Bundeswehr Personnel Management (BAPersBw) and the Bundeswehr Service Centers (BwDLZ).

Branch Z4.2 is in charge of coordinating military personnel.

The spectrum of tasks covers the traditional tasks of Innere Führung (leadership development and civic education), for instance the military disciplinary system and all administrative complaints proceedings, as well as the entire range of military personnel affairs, reserve duty soldier management and military training.

Branch Z4.2 is the most important link between BAAINBw and the central personnel management agencies for military personnel and all military and civilian training facilities. The tasks in the area of training are, amongst others, planning and conducting all measures to maintain the individual basic skills, i.e. maintaining military skills and the physical fitness of soldiers.

Branch Z4.3 is responsible for coordinating and answering all cabinet and parliamentary inquiries (e.g. major and minor interpellations, petitions, correspondence with the Parliamentary Commissioner for the Armed Forces) in cooperation with the competent elements within BAAINBw and its area of responsibility. The branch also compiles the information and documents required by the BAAINBw Executive Group for participating in

Defence and Budget Committees meetings as well as for visits (by members of parliament, the Executive Group of the Federal Ministry of Defence, etc.) to the office or its agencies.

The Scientific Collection of Defense Engineering Specimens (WTS, branch Z4.4) is a part of the training and advanced training programme for many Bundeswehr units and for young defence engineers working in the equipment, IT and in-service support area (AIN). The scientific collection shows which possible solutions in terms of design, function and concept are incorporated into a piece of equipment and how technical know-how is used for new and further developments within the scope of a specific project.

With its 3,000 exhibits and a size of 7,200 square metres the scientific collection also accomplishes the task of information and education.

The Technical Information Center (FIST) of BAAINBw (Z4.5) researches, acquires, processes and archives technical information needed for official purposes (e.g. study and final reports with respect to defence technical tasks, publicly available literature, regulations and standards) and centrally provides them to members of BAAINBw and its agencies. Bundeswehr contractors obtain technical information

on the basis of contractually warranted government-furnished material. Just like Bundeswehr contractors, Bundeswehr units deployed abroad are provided with service regulations via the Internet Regulations Portal DvWeb. Furthermore, the FIST centrally assumes administrative tasks relating to Technical Manuals for BAAINBw project directorates. This includes keeping equipment history records, storing file copies, initiating decree processes and the editorial review and publication of special directives to maintain operational maturity.

Division Z5

Division Z5 is divided into the following branches: "Price Audit Policy/Common Issues" (Z5.1), "Price Audit Airframe/Engine" (Z5.2), "Price Audit Maintenance for Armed Services, Missiles, Other Aeronautical Equipment" (Z5.3), "Price Audit Electronics, Sensors" (Z5.4), "Price Audit Weapons and Ammunition, Tracked and Wheeled Vehicles, Ships and Boats, Other Equipment" (Z5.5) and "Cost Competence Center" (Z5.6).

The tasks of branch Z5.1 range from central control of price audit requests to

dealing with policy requests regarding aspects of pricing legislation, business administration and cost audits, developing work instructions and guidelines for the BAAINBw price audit branches and price negotiations, model contract price and cost arrangements to cooperation with the pricing agencies of the German states, support to NATO Programme Offices and official assistance for foreign governments. The operative price audit branches Z5.2 to Z5.5 technically and economically evaluate, in accordance with price law, if cost prices are appropriate. For this evaluation they use detailed cost data and documents and assess the quantities and valuations.

The Cost Competence Center supports the economic execution and implementation of projects and organisational measures in all phases of the CPM procedure (amended) by means of parametric cost estimates, cost-effectiveness evaluations, assessments of alternative forms of procurement and review and staffing of phase documents. In addition, Z5.6 is the central point of contact in BAAINBw in terms of life cycle cost management matters.

Division Z6

With division Z6, "IT Coordination AIN, IT Security Officer AIN/IT Security Officer BAAINBw, SASPF Introd./In-Service Org. AIN, SASPF Main Process Management Rü (Armaments)", Directorate Z also takes over IT equipment demand coordination as well as the SASPF Introduction and In-Service Organisation (Introd./In-Service Org.) and the SASPF Main Process Management Armaments/Logistics, armaments portion. The division with its three branches is the central service provider to the organisational area AIN regarding the use of IT resources, in particular future Standard Application Software Product Families (SASPF solutions).

The tasks range from IT equipment coordination, IT user support, operational support for the intranet/internet to process/technical specifications of future SASPF solutions (Process Organisation). Another focus lies on coordination efforts during the on going introduction/use of SASPF functionalities in the organisational area AIN. The task spectrum of division Z6 is complemented by exercising the functions/roles of the IT Security Officer of BAAINBw and the IT Security Officer for the organisational area AIN. ■

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The Agencies of BAAINBw

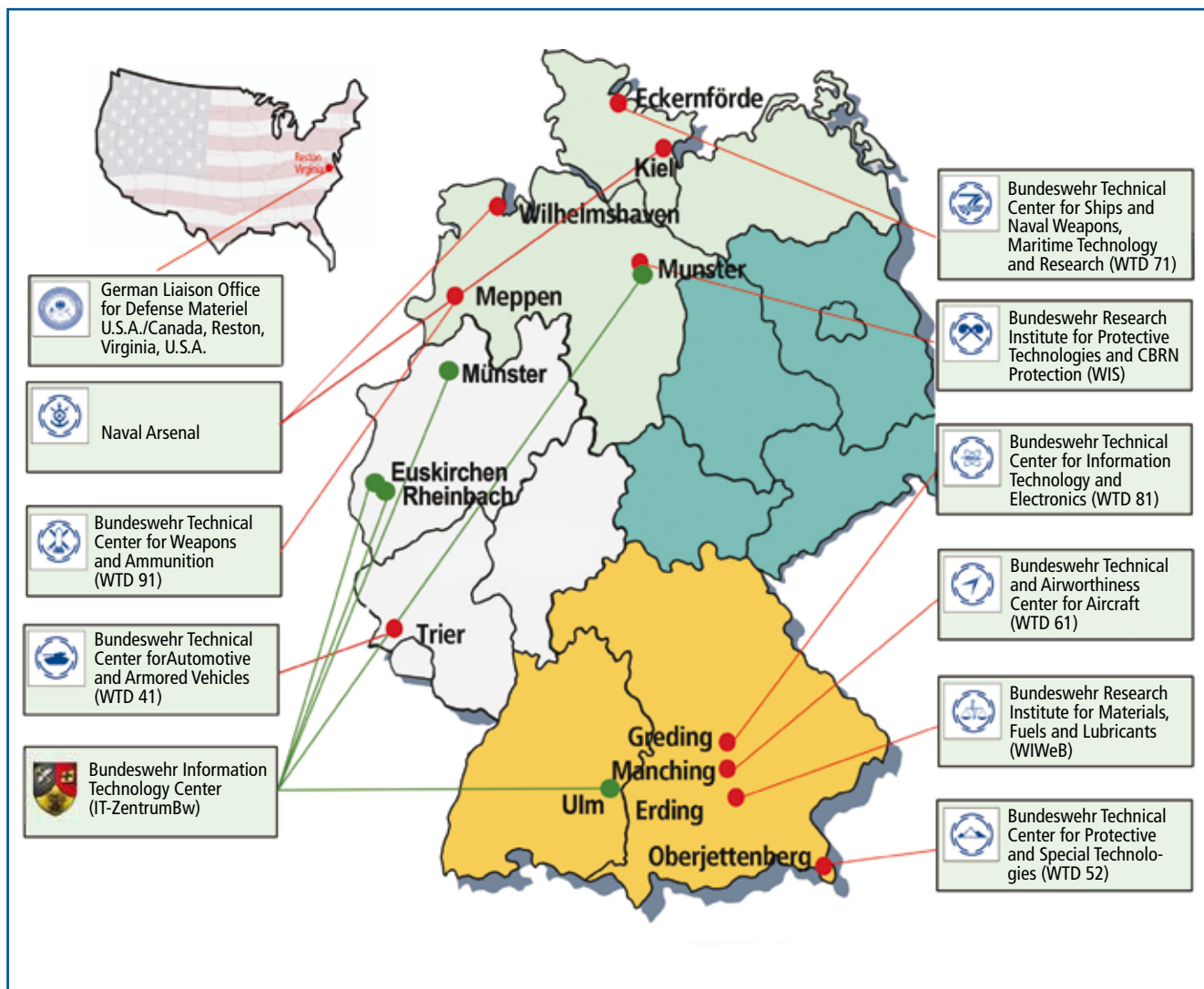
The key task of the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support, in German abbreviated BAAINBw, is to ensure that the Bundeswehr's needs and requirements in the field of material resources are met by supplying it with state-of-the-art technology and safe equipment while observing the principle of cost-effectiveness. Development, testing and procurement of defence materiel form the core of its activities.

For the implementation of this highly complex task the BAAINBw project management relies on technical and scientific investigations, tests, studies and market analyses. This specialist technical support is provided by six Bundeswehr Technical Centers and two Bundeswehr Research Institutes. The Naval Arsenal, the Bundeswehr IT Center and the German Liaison Office for Defense Materiel USA/Canada complete this range of agencies that contribute essentially to accomplishing the BAAINBw mission.

A Manifold Spectrum of Services

The spectrum of services provided by the agencies of BAAINBw includes specialist technical inputs to all phases of the defence materiel development cycle and the testing/examination and specialist technical evaluation of defence equipment in the course of integrated compliance demonstration. Preparation of expert reports in the event of accidents, damage and warranty cases is another task to be mentioned here. Work on research and technology projects opens up advanced

technologies for the Bundeswehr. Specialist technical support of BAAINBw project management helps to minimise project risks and provides inputs in the form of findings from test activities. Participation in national and national armament programmes is an important factor shaping the flow of work activities. Both at the national and international level, close cooperation with other technical and military agencies, test centres, industrial companies, research institutes, universities and programme offices is, quite



(Graphic: mawibo-media)

naturally, part of the work performed. The range of activities of the BAAINBw agencies is supplemented by training courses and other training activities offered to technical personnel from the entire Bundeswehr, in some cases using own training facilities.

Survey of the BAAINBw Agencies

WTD 41, the Bundeswehr Technical Center for Automotive and Armored Vehicles in Trier, is responsible for technical investigations, evaluations and trials of all vehicles (wheeled and tracked vehicles, special application vehicles as well as vehicles with various add-on structures) and vehicle components of the Bundeswehr.

To handle its comprehensive tasks, WTD 41 has numerous test tracks and terrain courses of various soil compositions and degrees of difficulty, which are used for the conduct of mobility trials and permit a broad spectrum of different investigations with the aim of yielding the highest possible amount of reproducible values. This WTD furthermore operates a technology competence centre for engineer and general field equipment used by the Bundeswehr. Apart from specific technical tasks in the fields of hydraulics, mobile power supply systems, compressed-gas technology and air-conditioning engineering, this centre is in charge of testing armoured vehicle-launched bridges, dry gap bridges, floating bridges, amphibious bridging systems, ferries, assault boats and amphibious land vehicles – to the extent that their amphibious capabilities are concerned.

Situated in the Bavarian Alps, **WTD 52, the Bundeswehr Technical Center for Protective and Special Technologies**, has unique infrastructure at its disposal in the form of a mountain trial site located at an altitude of more than 1,700 m above sea level and an underground complex with an extensive tunnel system. Current key tasks of the agency are the design and evaluation of passive protection measures for Bundeswehr installations in deployment areas and their adaptation to a constantly changing threat situation. As far as indirect protection is concerned, products such as camouflage patterns, camouflage sets, models or comprehensive signature adaptation concepts for worldwide use are being developed. Another issue of operational relevance are non-lethal weapons, of which WTD 52 is also in charge. Furthermore,

(Photo: WTD 81)



Fire extinguishing vehicle subjected to an electromagnetic compatibility (EMC) test.

this WTD handles route clearance tasks as one aspect of the Counter-Improvised Explosive Devices (C-IED) range of tasks.

WTD 61, the Bundeswehr Technical Center for Aircraft and Aeronautical Equipment is the Bundeswehr authority tasked to ensure that – in the interest of both the aircrew's and the population's safety – all aircraft in service are safe and mission-capable.

Thanks to its facilities and equipment (airfield with two runways, a drop zone and test aircraft fitted with state-of-the-art metrological equipment), WTD 61 is in a position to perform most of its test and evaluation tasks on site at Manching.

WTD 71, the Bundeswehr Technical Center for Ships, Naval Weapons, Maritime Technology and Research with its Institute for Underwater Sound and Geophysical Research, provides defence-related technical and scientific expertise in the field of maritime research and development for the Bundeswehr. For the specification and testing of maritime weapon systems the agency has technical installations – some of which are unique – at its disposal such as facilities for magnetic measurement and degaussing of ships, underwater and surface range tracking systems, torpedo firing position and range, naval engineering test stands and a fleet of modern trial ships including the "Planet" research ship.

Within the scope of activities of **WTD 81, the Bundeswehr Technical Center for Information Technology and Elec-**

tronics in Greding, the emphasis is on tasks in the fields of information transmission and processing, information collection and electronics.

The facilities which WTD 81 uses to accomplish its tasks include Europe's largest fully shielded building for the study of electro-magnetic compatibility (EMC) and electro-magnetic effects and the Center for Interoperability, Network-Enabled Capabilities and Simulation, in German abbreviated **ZINS**, which carries out experiments across project boundaries on interoperability and efficiency in integrated systems. Furthermore, the agency operates a centre for multispectral target and scenario simulation in one of the largest dome structures worldwide.

WTD 91, the Bundeswehr Technical Center for Weapons and Ammunition (WTD 91), is the central test and evaluation centre for weapons and ammunition of the Bundeswehr. Its test range is located near the town of Meppen and covers an area of almost 200 km², thus forming the largest instrumented ground firing range in Western Europe. Firing tests with gun and artillery weapons of all calibres can be carried out there. WTD 91 is responsible for testing and evaluating weapons and weapons systems, ammunition of any type, rockets, missiles, unmanned aerial vehicles, airdropped ammunition, optical and optronic equipment for reconnaissance and fire control, acoustic equipment, meteorological, oceanographic, geological and geodetic equipment. Moreover, it is in charge of the issues of protection of armoured vehicles, crew protection and camp protection.

WIS, the Bundeswehr Research Institute for Protective Technologies and CBRN Protection in Munster, is the national centre of competence regarding CBRN and fire protection in the Bundeswehr. Use of its wide scope of technical expertise is also made to the benefit of other issues such as protection against electromagnetic effects, environmental protection, occupational safety & health and radiation protection. The services of this research institute are available not only to the defence sector but also to other government departments.

WIWeB, the Bundeswehr Research Institute for Materials, Fuels and Lubricants in Erding (with branch office in Wilhelmshaven) is the only agency within the armaments organisation with responsibility for all technical issues related to materials including fuels and lubricants. This includes the fields of surface technologies, material protection, safety of chemicals, occupational safety and health and environmental protection. WIWeB also plays a key role in the field of clothing and personal equipment of Bundeswehr military personnel, giving inputs based on its technical expertise.

The **Naval Arsenal**, another subordinate agency of BAAlNBw, takes care of the repair of naval ships and boats. Besides performing maintenance tasks, the planning and execution of technical modifications to Navy systems is another core responsibility of the Naval Arsenal. Furthermore, the Naval Arsenal uses its capacities to support Navy seaborne missions all over the world. The Naval Arsenal installation in Kiel will be closed down with effect from 31 December 2015, with the result that all tasks of the agency will be performed in Wilhelmshaven.

The **Bundeswehr IT Center**, with offices in Euskirchen, Munster, Rheinbach, Munster and Ulm, is responsible for tasks of IT security, system integration, project support and tasks related to field trials. Furthermore, it provides pooled capabilities of cyber defence within the Bundeswehr in the form of the Computer Emergency Response Team (CERTBw), which acts as a central instrument for monitoring, maintaining and restoring IT security within the Bundeswehr IT system.

The **German Liaison Office for Defense Materiel, USA/Canada**, with headquar-

ters in Reston, Virginia, represents the German interests in matters of defence technology or armaments when dealing with US or Canadian government agencies or industry.

Summary

The aim of all activities of the BAAlNBw agencies is to ensure that the military equipment handed over to the Bundeswehr military personnel is both safe and efficient. In addition, they provide expert support to the armed forces during the in-service phase of the equipment. In doing so, these agencies make use of a unique infrastructure with state-of-the-art measuring equipment, which has been adapted to the specific requirements and optimised over the years. The wide scope of demanding tasks is fulfilled by highly specialised engineers and scientists of various disciplines and highly skilled technicians working at these agencies. Thus, the Bundeswehr Technical Centers and the other technical agencies of the BAAlNBw organisation are highly modern research and testing sites marked by a high level of specialist expertise, which enjoy an excellent reputation, both nationally and internationally. ■

European Security & Defence · Issue 5/2015

Preview

- **Country Focus: United Kingdom**
- European Security and Defence Policy – Results of the EU Summit
- Frontex – Capabilities and Operations
- The Polish Armed Forces
- A400M Programme Status
- NATO Federated Mission Network
- International MBT Developments
- Current Trends in Simulation & Training
- Logistic Vehicles
- Geo Information Systems
- NATO Military Engineering CoE
- Israeli-European Defence Cooperation

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