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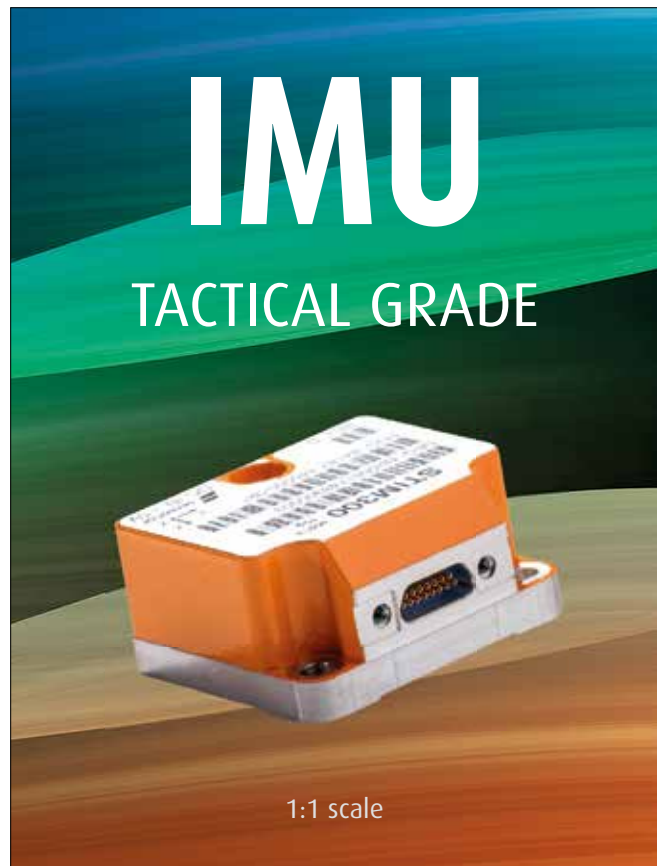


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Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support

The major organisational element of equipment, information technology and in-service support – in German abbreviated AIN – is responsible for satisfying the armed forces' requirements in terms of materiel and for managing the in service use of materiel fielded in the Bundeswehr with the aim of maintaining the operational maturity of that materiel.

Partner of the Armed Forces

The major organisational element is made up of the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) and its subor-

the procurement of such complex materiel takes time to develop the necessary technical solutions, prepare the contracts for such developments and conduct the related tests. Not every idea from the development phase passes the practical trials at the first go. It is

ited to technological and economic support from the moment the respective materiel was handed over to the user. Today's organisation, which uses a procurement procedure called Customer Product Management (CPM), is based on a comprehensive view of the entire life cycle of products (or services) and life cycle-related support management – this is commonly referred to as materiel responsibility for operational maturity.

Such a comprehensive view required a profound change of thinking with respect to the procurement and in-service support process in order to implement this integrative approach.

By taking over the materiel responsibility for operational maturity, BAAINBw has shouldered a new task that, in this integrative way, had so far been practiced, to a limited extent though, only by the former Federal Office of the Bundeswehr for Information Management and Information Technology (Bundeswehr IT Office). From this perspective, implications of the creation of BAAINBw were not only that the former Federal Office of Defence Technology and Procurement (BWB) and the Bundeswehr IT Office were merged but also that elements of other Bundeswehr offices which had been in charge of in-service support management tasks were integrated into this new Federal Office

As a consequence, specialists who had performed in-service support management tasks in the various armed forces offices were transferred to BAAINBw. Thus, the procurement expertise available in the above-mentioned two former offices of the armaments sector was complemented in an effective fashion. This transfer of proficiency and know-how made it possible for BAAINBw to take over its comprehensive tasks of materiel responsibility for operational maturity - ranging from the analysis phase to the time of disposal - on a sound basis of competence.

Armaments Agenda

With a view to optimising the management of armaments projects and further enhancing efficiency, the Armaments Agenda was initiated. This agenda showed the way, so to speak, towards a more transparent, more effective and



Photo: maxinfo-media

The Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) is located in Koblenz.

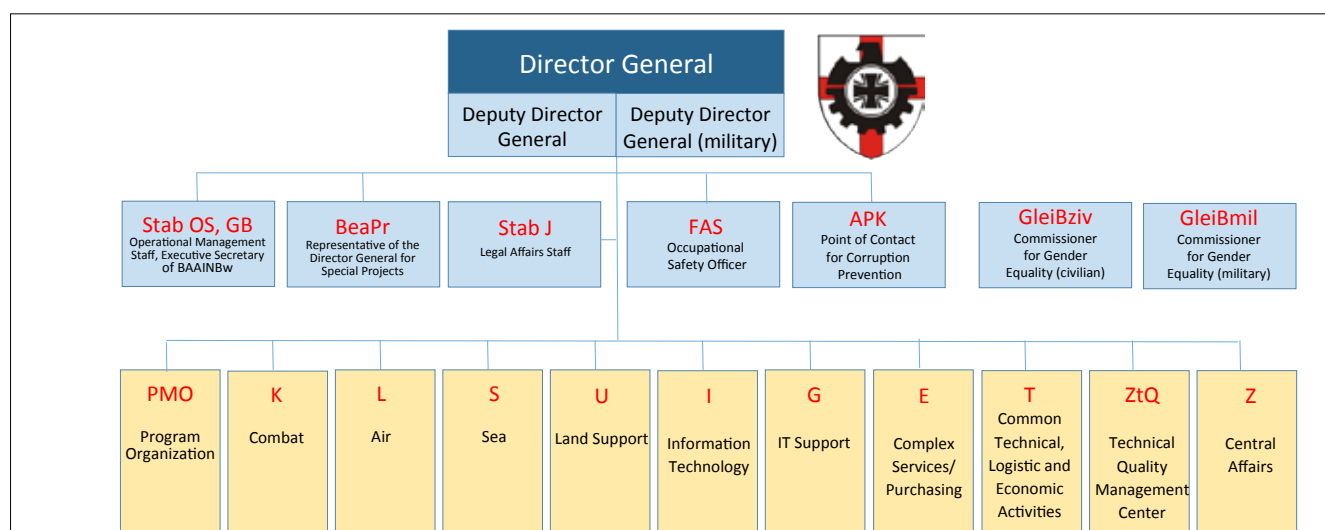
ordinate agencies comprising six Bundeswehr Technical Centres, two Bundeswehr Research Institutes, the Naval Arsenal and the German Liaison Office for Defence Materiel, U.S.A./Canada. It supports the armed forces as a reliable partner.

Ensuring that the Bundeswehr is supplied with state-of-the-art technology, efficient and safe equipment as well as defence-related services, in line with what the armed forces need and request and at economic conditions, is a demanding task. Although often commercially available equipment may be used, it is in many cases necessary to initiate the specific development or advancement of military materiel. This is why

of vital importance that realistic timescales are selected. What is more, the management of the armament projects has to be shaped in such a way as to create maximum efficiency.

Responsibility for the Entire Life Cycle

BAAINBw was set up on 1 October 2012 in the context of the reorientation of the Bundeswehr. Meanwhile, it can look back on a six-year history. Before the foundation of BAAINBw, the responsibility of the civilian Bundeswehr procurement organisation with respect to military materiel was lim-



Graphic: mawibo-media

more modern armaments organisation. The consequences of the Armaments Agenda also included organisational changes within BAAINBw and its area of responsibility. This "readjustment" was the result of the findings and the experience of recent years and aimed at operationally strengthening the Federal Office. Concepts for the organisational measures were developed from early 2016 onwards and their implementation has been pursued step by step since then. The following measures have been completed so far:

The first step was the creation of a Program Organization (PMO) at directorate level with effect from 1 April 2016 in order to ensure a largely independent performance of all project management tasks for the three armaments projects MKS 180 multi-role combat ship, tactical air defence system (TLVS) and European MALE RPAS.

The measures to strengthen the project and product portfolio of BAAINBw in a lasting way also cover the so-called complex services and the Bundeswehr purchasing sector. To this end, the Complex Services/Purchasing Directorate was created with effect from 1 July 2016, which formed the second step in the sequence of measures. The next step was the creation of a new element called Operational Management Staff, Executive Secretary of BAAINBw on 1 October 2016, which performs steering functions within close reach of the Executive Group. The Technical Quality Management Centre was set up on 1 April 2017 for the purpose of enhancing technical quality management and quality assurance. At the same time, legal expertise in the form of a Legal Affairs Staff was placed at the immediate disposal of the Executive Group. The Central Affairs Directorate and the Common Technical, Logistic and Economic

Activities Directorate were created on 1 July 2017, accompanied by the disbandment of the P, Q and Z Directorates.

Internal procedures were optimised as well. Thanks to the introduction of a risk management system, possible project risks are now identified and assessed early on. Not only does this provide transparency but also makes it possible to take appropriate countermeasures.

Further optimisation also includes the already ongoing implementation of In-Service Support Agenda measures. These measures aim at making the provision of spare parts and the maintenance and repair of large-scale systems more efficient in order to close gaps from the past.

Outlook

The trend reversals in the areas of personnel, equipment and financing initiated by Federal Minister of Defence Ursula von der Leyen of course had direct implications for the work of BAAINBw and its agencies. In order to achieve full equipment of the armed forces in the next decade as it has been promised,

significantly more urgently required materiel will have to be procured for the Bundeswehr.

As a basis for developing solutions, it was determined in the Coalition Agreement between the CDU, SPD and CSU of 14 March 2018 to examine by the end of 2019 "how the Bundeswehr procurement organisation is supposed to be adjusted at their respective locations as to their organisational form". To this end, a working group with the designation "Procurement and in-service organisation examination and procurement optimisation" was established, which took up its work on 4 May 2018. The working group is supposed to develop proposals for increasing effectiveness and efficiency of defence procurement and submit them to the Federal Minister of Defence in 2019. The aim is to continue the renewal and modernisation process commenced in the last legislative period, building on what has already been achieved and accelerating procurement processes as a whole.

The AIN major organisational element as customer, however, can only achieve full equipment of the Bundeswehr when supported by an efficient, quality-oriented and reliable defence industry. ■



The "Rheinliegenschaft" compound of BAAINBw

Photo: BAAINBw

Operational Management Staff

The Operational Management Staff currently comprises five divisions plus the AIN Press and Information Center (PIZ AIN). It is headed by an Executive Secretary and is structured according to its various tasks.

Division OS1

Division OS1 is in charge of central task management at BAAINBw level and coordinates all tasks related to Parliamentary/Cabinet affairs and German Audit Office affairs. OS1 is also the POC for all internal auditing affairs.

All Cabinet and Parliamentary inquiries (e.g. major and minor interpellations, petitions, correspondence with the Parliamentary Commissioner for the Armed Forces) are handled here in cooperation with the respective competent elements within BAAINBw and its area of responsibility. Division OS1 also prepares visits of Members of the German Bundestag and the parliaments of the federal states to BAAINBw and its agencies. This division furthermore compiles the information and documents which the BAAINBw Executive Group needs for participation in Defence and Budget Committee meetings.

With respect to German Audit Office affairs, OS1 has the primary responsibility for coordinating all incoming matters concerning planned auditing activities of the German Audit Office and the regional audit offices.

Division OS2

The tasks of Division OS2 include coordination of the cooperation with the Bundeswehr Office for Defence Planning, situation presentation and portfolio management regarding the activities and performance of BAAINBw in the sectors of projects, products and services.

In accordance with the central "Executing Integrated Planning" output process, the Bundeswehr Office for Defence Planning draws up the Bundeswehr capability situation picture and derives capability gaps from that. If these gaps are planned to be closed by means of material solutions or defence-related services, Division OS2 will trigger the work on initiatives, making use of the technological and economic assessment competence of BAAINBw. This will include coordination of the activities of the respective BAAINBw representatives in the Analysis Phase Part I of the CPM process. Division OS2 thus supports the Bundeswehr Office for Defence Planning right

from the start of the procurement process in determining the characteristic data of a project across the overall period of its existence (from creation to service use) so that they can be taken into consideration in the decision-making process - a fundamental contribution to portfolio management in the Bundeswehr.

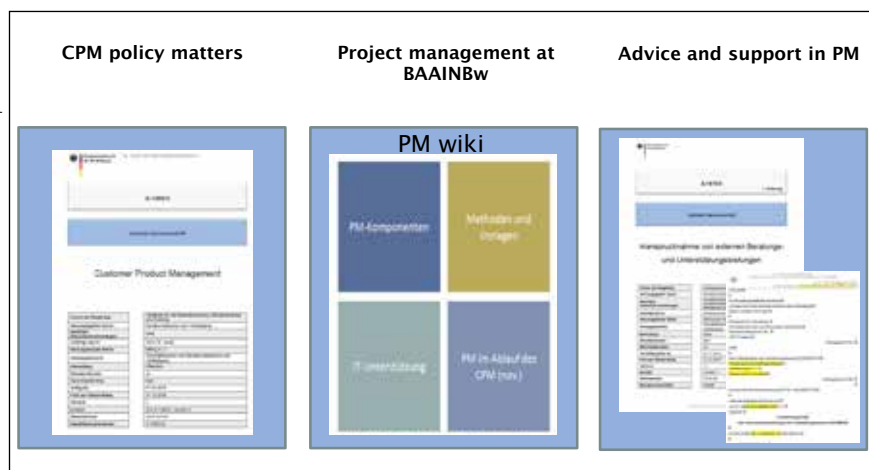
In the framework of portfolio management, OS2 seeks to provide a continuous survey of the status of current and already scheduled projects, products and services including their interfaces and interdependencies. To this end, the division compiles

smooth progress of the projects in all phases. This Steering Group acts comprehensively above the level of the single projects, using a common basis of information.

Division OS3

Division OS3 is in charge of central controlling at BAAINBw, which means controlling across directorate and agency boundaries. In this function, the division performs tasks of strategic controlling, project controlling, controlling of complex services, controlling of resources and agency-related controlling. It is also responsible for preparing the annual report on government participation as part of the continuous performance review for selected government-owned companies.

Graphic: BAAINBw



Customer Product Management

the information available on projects, products and services in all BAAINBw directorates to draw up a situation picture. Depending on the objective and concrete problem, a relevant selection of projects, products and services is made available in a sub-portfolio. The latter is analysed in order to propose alternative courses of action, which are then harmonised with the Bundeswehr Office for Defence Planning and/or other organisational entities or requesting entities involved, before they are implemented on the basis of the decisions that may have to be taken.

Finally, OS2 has the function of a central element within BAAINBw for portfolio management at the project/product/service level. In this context, the Project Steering Group established together with the Bundeswehr Office for Defence Planning is of importance, which is designed to ensure maximum transparency and

On behalf of the BAAINBw Executive Group, the division performs superior-level project controlling in the form of periodic or event-related analyses and assessments regarding the progress of armaments projects and complex services. This is done on the basis of IT-supported project documentation, which includes the systematic identification and assessment of the project-related risks. As regards the standing preparatory committees for the Armaments Board at the State Secretary level, the project-specific inputs to be provided by BAAINBw for the Armaments Board at the Minister of Defence level and the biannual Armaments Report to Parliament, the division performs a coordinating function. Likewise, risk management at the level of the Director-General for Equipment in the Federal Ministry of Defence (FMoD) is supported through coordinating work. The division closely cooperates with the Project

Controlling and Risk Management Division, which has been established in the FMoD as a body supporting the Commissioner for the Strategic Control of National and International Armaments Activities of the Bundeswehr.

In addition to Category A and B projects, Division OS3 extends the risk management method also to Category C projects. To this end, preparatory committee meetings chaired by the BAABNBw Director-General take place on a regular basis. Division OS3 also assists the FMoD through intensive involvement in the training of the personnel working in the projects concerned.

BAAINBw strategic controlling supports the BAAINBw Executive Group's management process, which is geared toward medium-term and long-term objectives. On behalf of the BAAINBw Executive Group, OS3 is also responsible for drafting, and monitoring compliance with, the Annual Directive, which contains, among others, the strategically relevant objectives of the Federal Office. In order to become a control tool, the directive is being continuously refined. In addition, derivation, cascading and operationalisation of objectives from the system of strategic objectives of the FMoD Executive Group and agreements on objectives are envisaged within the framework of decentralised controlling (extension of FMoD strategic controlling to the subordinate levels) in order to create the prerequisites for consistent top-down control. OS3 will provide assistance and advice in this regard.

Division OS4

Division OS4 is the central point of contact for BAAINBw project teams in matters concerning CPM and project management. To this end, the Division OS4 portfolio consists of policy matters related to the Customer Product Management (CPM) procedural regulation and management of the CPM output process, the Center of Expertise for Project Management, and control of framework agreements for project management support.

Customer Product Management

OS4 is responsible for implementing the requirements of CPM by preparing organisational procedures for BAAINBw and its area of responsibility. In addition, as part of process management, OS4 provides the manager for the output process called "Provision of Material Solutions in accordance with CPM", who is, among other things, responsible for modelling, maintaining and further developing the output process.

Center of Expertise for Project Management

The Center of Expertise for Project Management defines the standard for project management at BAAINBw. To this end, it provides (standardised) tools and advises the project teams on their selection and application in all project phases. The Center of Expertise is also responsible for further developing basic and advanced training of project team members. All activities are supported by consistent knowledge management.

Control of Framework Agreements for Project Management Support

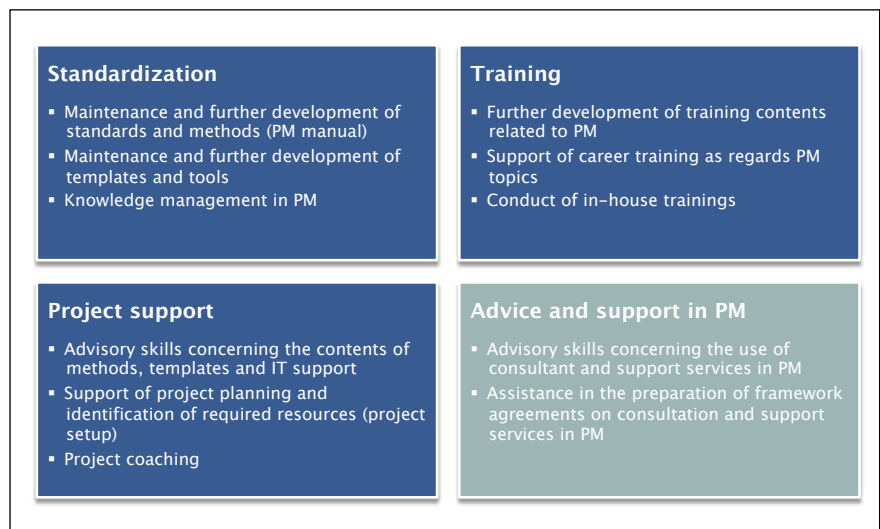
For the purpose of compensating for personnel shortages or (temporary) lack of expertise, BAAINBw makes use of external service providers. In order to be able to quickly respond to changing conditions and thus to ensure efficient armaments management, BAAINBw employs framework agreements. These temporary framework agreements to support projects may be concluded by BAAINBw or other agencies.

ucts and services. To this end, it performs a coordinating function within BAAINBw and, at the same time, ensures that the required assistance is provided to the Cyber and Information Domain Service. In addition, the division assumes the tasks of an Armaments Management Chief Information Security Officer.

AIN Press and Information Center (PIZ AIN)

The Equipment, Information Technology and In-Service Support Press and Information Center (AIN Press and Information Center), as part of the Operational Management Staff, is responsible for all internal and external communication of the AIN major organisational element, forming a part of the Bundeswehr Information Activities concept.

The AIN Press and Information Center acts as primary BAAINBw point of contact for questions that are raised by either media representatives or citizens and that concern the scope of AIN tasks. The task of press relations includes, among others,



Control of framework agreements for project management support

OS4 advises the project teams on the selection of the appropriate framework agreement, supports relevant requests and helps identifying the need for new framework agreements. In future, project teams at BAAINBw can refer to OS4 for advice on support services and external consultant services.

Division OS6

Division OS6, which is responsible for "armaments information security", fulfils cross project and interdisciplinary information security tasks with regard to armaments projects and BAAINBw prod-

active information of the media on matters of interest, daily evaluation of press reports and drawing up articles for various specialist journals in cooperation with the respective BAAINBw experts. In the field of public relations, the AIN Press and Information Center is responsible for, firstly, participation of BAAINBw in events that are important for visibility and external image and, secondly, the production of multimedia information material. The online editorial board of the AIN Press and Information Center maintains the BAAINBw intranet and internet websites and provides conceptual inputs to the online work of the AIN major organisational element. ■

Legal Affairs Staff (J)

Ever since legal affairs have become a staff element within the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) in 2017 (the Legal Affairs Staff), it has been in charge of quality assurance for legal documents of major projects and has also played an essential role in the modernisation of contract management as part of the Bundeswehr procurement system.

The Legal Affairs Staff (which evolved from the former BAAINBw Division Z3) is now subdivided into the Branches J1 (procurement law), J2 (contract law policy), J3 (intellectual property rights), and J4 (external support services).

Branch J1 is responsible for all general matters regarding procurement law. The tasks of Branch J1 also include advice on procurement law for the project divisions and the BAAINBw executive group as well as processing of the BAAINBw Procurement Procedure Work Instruction and the respective forms, such as the decision on the award procedure.

Branch J2 is responsible for contract law policy matters. Besides contract counseling for the individual contract branches in the field of civil law, J2's policy development work especially involves the continuous updating of draft contracts for contracts with an estimated contract value of less than €25M.

Branch J3 is responsible for the functional area of Intellectual Property Rights (IPR). In this connection, J3 provides advice on user rights regulations in contracts in individual cases and also especially in the context of quality assurance in major projects. These are, among others, regulations in the field of copyright, software, industrial property rights and/or technical know-how.

Branch J4 is in charge of processing external support services rendered by industry and consultant services.

One of the main tasks of the Legal Affairs Staff and its individual branches, which work in close cooperation with each other, is to perform quality assurance in their respective areas of expertise for projects with an estimated contract value of more than €25M ("major projects"). This task begins as early as with the decision on the contract award procedure and ends with the finalised contract. The Legal Affairs Staff closely accompanies the various stages of this entire process, such as contract preparation, invitation to tender, contract negotiation and contract conclusion. Further, it supports the project legal advisors in their tasks and advises the project managers on the preparation of the statement of work as the centerpiece of the contract award documents.

The Legal Affairs Staff is not only responsible for quality assurance but also for other tasks, especially with regard to general contracting policy matters. In this context, the Legal Affairs Staff's main task is to continuously modernise contract management within BAAINBw. An efficient procurement process must be able to guarantee timely availability of defence materiel and comply with all the quality requirements applicable to military equipment at economic conditions. Contract restructuring is therefore required to ensure adequate risk distribution and promote autonomous implementation by industry. This also includes a greater emphasis on more innovative approaches to contracting such as Performance Based Contracting (PBC) as well as on digitisation and simplification. The main goal is to improve availability, thereby promoting materiel readiness.

Based on medium- to long-term cooperative partnerships and a clear division of tasks between the parties involved, PBC aims to provide a result-driven rather than an input-driven statement of work, thus creating economic incentives for the contractor. In essence, PBC combines result-driven services with economic incentives ("PBC in the literal sense").

An intensive and trustful partnership between the contracting parties is the basis for the implementation of a performance-based approach. The responsibility for the contracted service must therefore be transferred to the contractor clearly and distinctly. The contractor can perform the service autonomously and exploit optimisation potentials within a predefined framework.

While the responsibility may be transferred to the contractor, the customer still needs to actively monitor and supervise contracts. This is particularly true in the case of key performance indicator (KPI) monitoring as these indicators serve as a yardstick for the performance of the contract. Ideally, customers should be able to determine KPI themselves; however, the obligation to provide information and accountability still need to be included in the contract. Otherwise, it might not be possible to rec-

ognise and remedy any deficiencies in the performance of the services in good time. As this short introduction proves, PBC is by no means a trivial, one-size-fits-all solution that works for any project regardless. Instead, it is important to understand that PBC is merely one of many different "tools" that – based on a thorough analysis – may be appropriate in certain cases and may then result in advantages for both the customer and the contractor.

Before the decision in favour of or against a performance-based approach is made, the project in question must be analysed to determine where deficiencies are likely to occur and how they can be remedied with a targeted performance based strategy, if necessary. If no deficiencies are determined, there is no need to modify the current approach. A performance-based approach does not necessarily have to cover an entire weapon system; a partial adaptation may be sufficient.

If one were to summarise the types of projects for which PBC is particularly suitable, such projects would include contracts concerning logistics or logistic services. The contractor takes on greater responsibility and receives guidelines (as well as limits set by the customer) to deliver and optimise the performance, if necessary.

Within the scope of the In-Service Support Agenda (subproject 5), the Legal Affairs Staff has delved deeper into issues in connection with PBC as well as other topics (i.e. negotiation of maintenance in stages, buy-back-provisions etc.) that primarily concern contract management optimisation in terms of in-service support. The goal has always been to integrate these insights as early as possible into the procurement process in order to ensure efficient and reliable contract preparation and implementation. Such accelerated procurement procedures offer advantageous contracts for customers and contractors alike and can increase the operational readiness of the Bundeswehr (especially with regard to in-service support), thus allowing the Bundeswehr to pursue far more ambitious goals than the "mere" optimisation of contract management. ■

PMO – Program Organization

The Program Organization (PMO) combines the project management for the key armaments projects MKS 180 multi-role combat ship, tactical air defence system (Taktisches Luftverteidigungssystem, TLVS) and the European MALE RPAS in one structure optimised for the specific tasks to be performed. Specialists from various fields with technical, economic and legal expertise are directly assigned to the respective project and can focus exclusively on their project by performing their project-related tasks in a largely independent manner.

A comprehensive modernisation of armaments procurement, known as the Armaments Agenda, was initiated on the basis of the 2014 “Comprehensive survey and risk analysis of major armaments projects”. The results included the decision in 2015 to set up a program organisation, which was implemented in 2016 within the scope of the restructuring of BAAINBw. This organisational structure shall serve the purpose of allowing for a better consideration of the differences and special characteristics of the three major armaments projects mentioned above.

On the one hand, the PMO responds to the demands of these strategically important projects by having specialists from various fields cooperate with a direct focus on the projects. The organisational consolidation promotes close information exchange and optimised coordination of technical, economic and legal aspects. On the other hand, the flat hierarchy in connection with the assignment to the “Selected Armaments Projects Functional Supervision Group”, which reports directly to the State Secretary for armaments at the Federal Ministry of Defence (FMOD), allows for an immediate and swift management. The PMO director's right to direct access to the State Secretary is a visible sign of this flat hierarchy.

The PMO is organised into four divisions and a staff element. Three divisions (PMO1, 2, 3) are responsible for the projects. A fourth division (PMOJ), which incorporates the PMO's legal and economic expertise, is led by the projects legal advisor. Each of these experts is permanently assigned to a particular project. The PMO currently has a total number of 113 posts, 14 of which belong to PMOJ.

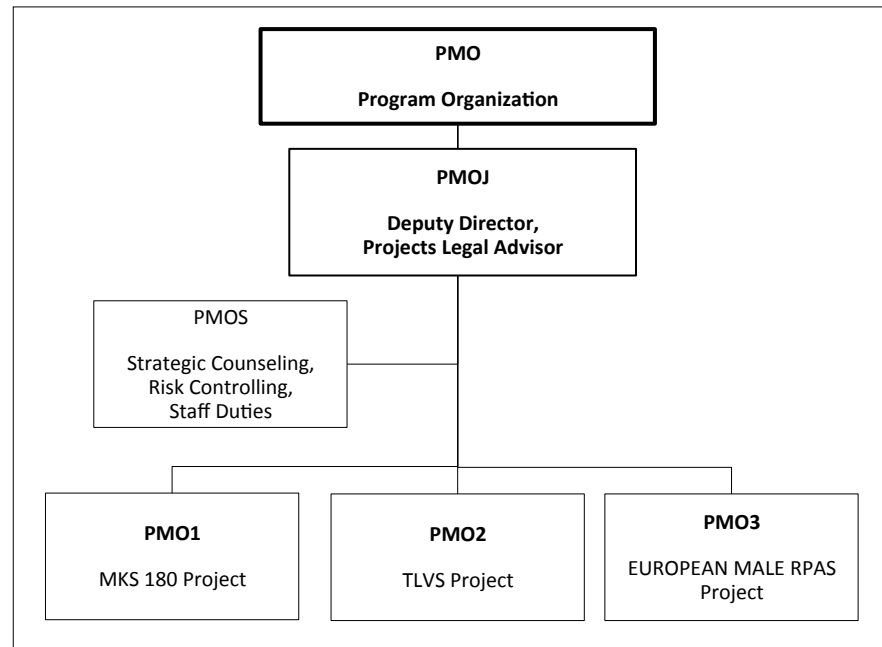
The position of the PMO director corresponds to that of a BAAINBw director, including the pertinent executive functions. He is in charge of providing an overview of the current situation of each project and is a member of the project-related steering bodies at the Federal Ministry of Defence (FMOD). The projects legal advisor supports him in his capacity as deputy direc-

tor and is thus not only responsible for the timely and proper legal management of the projects, but also has managerial responsibility in the PMO.

The establishment of this new organisational form has provided the foundations for modern armaments management methods to be implemented in the three projects.

As an integral part of BAAINBw, the PMO also requires the expertise represented in BAAINBw's policy and intersectional divisions for project and contract management. The profoundly different challenges to be faced in connection with the three projects have demonstrated that this new organisational structure offers enormous potential and ensures an efficient and effective project management.

the German Navy's entire range of missions and tasks. This includes defence against air attacks as well as surface and underwater warfare. In addition, the MKS 180 ships will be capable of conducting sea-based operations, including command and control of Special Forces, and performing support functions such as fire support, maritime interdiction and medical support. This mission spectrum will preserve the capabilities of the Class 122 and 123 frigates. In order to be able to use the MKS 180 ships during a period of up to two years on deployment while, at the same time, significantly reducing the crew size compared with units in service, the MKS 180 project builds on the existing concepts of the class 125 frigate. A



PMO organisational chart

PMO1 - MKS 180 Multi-Role Combat Ship

As the future modular, maritime capability platform, the MKS 180 is to help maintain and complete the capabilities required in the maritime engagement network within

contract for four units is planned to be concluded, with an option for another two ships.

One special feature of the MKS 180 project is the award procedure that was selected. For the first time, a maritime procurement project of this size was put out to tender

under a negotiated procedure after a request for interest had been published at European level (§11 para 1 of the Public Procurement Regulation for the Areas of Defence and Security, VSVgV). The procedure is designed in such a way that it allows an intensive exchange between the customer and the bidder to improve the content, e.g. the statement of work and the contract on the construction of the ship, in several bidding rounds.

The contract award documents place special importance on the processes to be installed at the bidder's and his subcontractors' organisations. These processes refer in particular to effective project management, which focuses on risk management jointly implemented by the future contractor and the customer. Another important process is the consistent application of life

lishment of operational viability, processes and common project tasks.

PMO1 aims at selecting an effective weapon system, which is cost-efficient throughout its life cycle, and implementing it together with an active and competent partner by means of a low-risk procurement process.

PMO2 – Tactical Air Defence System (TLVS)

A comprehensive stocktaking formally concluded the tri-national MEADS (Medium Extended Air Defence System) programme in 2014. One year later, the NATO MEADS Management Agency (NAMEADSMA) and the international development contract were discontinued. The results of almost ten years of development, with a total

the door open for an opt-out in case of problems with technical feasibility, within an acceptable cost benefit ratio. The relevant technical examinations have, in the meantime, been concluded.

The foreseeable high complexity of the future ground-based air defence system, which has a large number of different subcomponents, also calls for innovative approaches within the organisation of the contracting authority. At a very early stage it became clear that the team that had worked on the predecessor project MEADS would not be large enough to accomplish the upcoming tasks of the TLVS project in light of its scope and structure, not least because, unlike the MEADS program, the national TLVS project does not involve a comparable agency such as NAMEADSMA.

Currently, a total of 49 posts are allocated to the TLVS project, complemented by the permanently assigned legal experts from BAAINBw PMOJ.

The following five major specialist technical areas were set up:

- System engineering and system architecture
- Effectors and sensors
- CCI and weapons control systems
- Communication system
- Integration management and compliance demonstration

In addition, overall responsibility for technical implementation was transferred to a chief engineer and the post of a TLVS system engineer, who acts as a connecting link and coordinator between the technical areas mentioned above, was created.

An analogous approach was taken in the field of project management, resulting in the establishment of the following areas:

- Logistics and establishment of operational viability
- Quality and schedule management
- Budget planning, reporting and risk management
- Configuration and obsolescence management

Additionally, the high reliability of TLVS on the tri-nationally procured MEADS technology and the projected inclusion of other international partners in the project made it necessary to establish an independent "International Cooperation" element.

PMO3 – European MALE RPAS

On 5 September 2016, Germany, France, Italy and Spain started a definition study for the development of a European drone. OCCAR (Organisation Conjointe de Coopération en Matière d'Armement) was en-



Photo: Bundeswehr

The MKS 180 project is derived from the existing Class 125 frigate concepts and will initially be contracted in four units, with an option for two additional vessels.

cycle cost (LCC) estimates when selecting specific components in order to minimise in-service costs from the beginning.

The results from the bidding rounds underlined the suitability of the approach chosen for the MKS 180 procurement project. The strengthened position of the contracting authority allowed negotiations and cooperation to take place on an equal footing. At the same time, it became evident that the contract award procedure in this dimension was an "exceptional" challenge for all parties involved.

PMO1 has a total of 33 posts at its disposal to meet this challenge, complemented by permanently assigned legal experts from PMOJ. The MKS 180 project director makes use of a structure within PMO1 that is based on the following task areas: platform systems, employment system, estab-

value of around US\$4Bn, are available to the participating nations, USA, Italy and Germany, for follow-on activities.

A capability gap in ground-based air defence will arise at the end of the next decade. To close this gap, the Chief of Defence decided on 8 June 2015 in favour of a MEADS-based solution for a future tactical air defence system (TLVS). The first contract negotiations with industry started in May 2017 and resulted in a second request to industry in August 2018 to submit a modified, improved offer on the basis of the negotiation outcome in spring 2019. In the wake of this selection decision, the Chief of Defence imposed obligations on BAAINBw to examine the development risks regarding the implementation of the TLVS project, which were identified in the proposed solution, early enough to leave



Photo: MBDA

The necessary technical studies have confirmed the technological feasibility of the MEADS-based TLVS.

trusted with the management of the study. Currently, thirteen posts at PMO3 are assigned to perform national tasks. Germany has taken a leading role in this European project for an armed MALE class reconnaissance drone, which will be designed to carry modular payloads. In the definition study, the multinational requirements placed on the system to be developed were agreed. The study culminated in the successful Preliminary System Design Review which describes a system design tailored to meet the national demands.

Unlike in previous multinational development projects, the participating nations agreed on the development of one drone that will be certified according to common standards, but still at national level. This is what the directors of the respective military certification authorities of the partner nations determined in March 2017 in the so-called "Signal of Munich". Apart from that, the heads of the national military certification authorities decided to realise also the participation in general air traffic in Germany and Europe via a step-by-step approach with respect to the regulatory and technical possibilities. The objective is to overcome the limitations of the previous MALE systems regarding their operation and also regarding exercise activities in Europe.

A decision on the development, the procurement and the industrial support required at the beginning of the in-service phase will be made on the basis of sound cost estimates submitted by industry and

based on results from the definition study. This decision will then be submitted to Parliament for approval, in line with the requirement of parliamentary approval for contracts exceeding €25M. The development phase of the European drone could start at the end of 2019. The aim is to carry out an initial flight in 2023 so that the first production systems could be delivered in 2025, providing an initial operational capability.

In parallel with the definition study, the documents required by the nations were either prepared or are currently being prepared. For Germany, the required documents are laid down in the CPM (Customer Product Management) regulations and include the Capability Gap and Functional Require-

ment (FFF) document signed in June 2018 as well as the Selection Decision document which is expected to be signed in the first half of 2019. At the same time, industry was requested by OCCAR to submit a proposal for a contract on the development, the procurement and the industrial support required at the beginning of the in-service phase to allow for a continuation of the project work with the least possible delay after the evaluation of the bid and the subsequent contract negotiations. The lead nation principle which was successfully applied in the definition study is to be continued in the next stages of the project when Germany with its industry and government representatives will continue to act as lead nation.

The participating nations wish to seek financial support for the project from the EU Defense Industrial Development Program (which is part of the European Defense Fund) and are preparing the necessary steps together with industry, OCCAR and the European Commission. In addition, Germany has suggested the project as a PESCO (Permanent Structured Cooperation) project, with a particular focus on a joint, European operation of the European MALE RPAS. ■

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Combat Directorate (K)

The Combat Directorate (K) with its three project divisions and their branches comprises the BAAINBw expertise for land-based air defence, guided missiles for ships and aircraft, dropped ordnance, antitank defence (K4), armoured combat and transport systems, bridges and crossing equipment (K5) as well as artillery, infantry and engineer systems (K6).

The general task divisions Economic and Technical Affairs (K1) and Economic and Legal Affairs (K2), which are each also subdivided into five branches, support the three project divisions in performing tasks in the field of project and in-service support management and research and technology.

The K Directorate is supported by the Directorate Staff (KAS) and the Directorate Controlling (KAC) elements.

Division K1

The Economic and Technical Affairs Division (K1) supports the Directorate in all in-service support-relevant, logistic, technical and defence technological matters that affect more than one project. In addition, it is responsible for planning and realising all research and technology activities in the field of land-based weapon systems.

Branch K1.1 is the central armament, in-service use and logistics element for the Combat Directorate. This comprises all cross-sectional tasks in the fields of arma-

functional safety of defence materiel, in particular ammunition safety and central tasks as regards the use of ammunition. Another important task is the functional supervision of the Bundeswehr Technical Center for Protective and Special Technologies (WTD 52) in Oberjettenberg (Bavaria) and the Bundeswehr Technical Center for Weapons and Ammunition (WTD 91) in Meppen.

Branch K1.2 deals with innovative system technology-related investigations on land-based platforms. One of its main tasks is the modelling and assessment of ammunition effects against ground, air and ship targets as well as the assessment of risks for civilians as well as own and friendly forces. The increasing need for protecting vehicles and their crews against current threats is met by extensive technological studies, in particular with regard to active protection systems.

The optimisation of existing mobile platforms and the design of future ones is enhanced by concepts of future-oriented IT system architectures, including network centric operations ("systronics").

State-of-the-art technology is used in the preparation of Interactive Electronic Technical Documentation to support the users. In addition, K1.3 initiates and conducts R&T studies on fuse technology.

Joint Fire Support (JFS) is defined as the joint ability to provide mutual fire support to the tactical level of Army, Air Force and Navy assets as well as to Special Forces across all dimensions of the area of operations. Branch K1.4 implements JFS coordination elements like the Tactical Data Link Interface Team Module and the Joint Fire Support Coordination Group (JFSCG) and is responsible for the overall coordination of all JFS elements.

Research and technology (R&T), system technology activities as well as international cooperation tasks are pooled in Branch K1.5, which takes charge of these matters for the entire Combat Directorate. Among others, K1.5 handles and coordinates all fields of technology within its responsibility. The main focus is on protection, ground vehicles, autonomy, weapons, ammunition, missiles and rockets, extended air defence and the soldier as a system.

Findings from studies are fed back directly both into the project work during the realisation phase and into the work performed during the analysis phase. In addition, K1.5 represents BAAINBw in international R&T bodies.

Division K2

The five branches within the K2 Division for Economic and Legal Affairs are in charge of public procurement, contract management and contract award for the Combat Directorate. These branches prepare, 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 contracts on the in-service phase of defence materiel. Furthermore, the contract branches support the projects by concluding national and international agreements. Moreover, by way of administrative assistance for foreign nations which have acquired Bundeswehr materiel from the Federal Republic of Germany, contracts with Ger-

Photos: BAAINBw



As of 2035, the Main Ground Combat System will replace the German LEOPARD 2 and French LECLERC main battle tank fleets.

ments management, in-service use and logistics of Directorate-specific defence materiel. In addition, the task spectrum of K 1.1 also includes ensuring the operational and

Branch K1.3 is responsible for fuse technology projects and for the documentation of Directorate-specific projects. The latter are supported by materiel documentation.

man industry are concluded and managed. Branch K2.1 is mainly responsible for spare parts supply and repairs as well as R&T and supports the Bundeswehr Technical Centers WTD 52 and WTD 91 in contractual matters. Branch K 2.2 predominantly supports the projects of Division K5; Branch K 2.3 supports those of Division K4 and Branch K 2.4 those of Division K6. Branch K 2.5 is specialised in matters of pricing regulations for public contracts and in charge of negotiating prices with contractors.

Division K4

Division K4 Land-based Air Defence, Guided Missiles for Ships and Aircraft, Airdropped Ammunition, Antitank Warfare is the Directorate's centre of competence for guided missiles.

Branch K4.1 deals with antitank systems, aircraft-based guided missiles engaging targets on the ground and airdropped ammunition (guided and unguided bombs). In the field of antitank defence, the projects PARS 3 LR, MELLs, the weapon system WIRKMITTEL 90mm as well as the light weapon system WIRKMITTEL 1800+ constitute essential activities. At present, the MELLs project focuses on follow-on procurement and the introduction of a new weapon system. MELLs will



The FENNEK uses state-of-the-art sensor technology to recon the area. It is also used to direct artillery fire.

replace the MILAN and TOW systems by 2021. The weapon system WIRKMITTEL 90mm will combine some capabilities of shoulder-fired antitank missiles as well as of bunker busting weapons and short-range antitank guided missiles. The light weapon system WIRKMITTEL 1800+ will enable operational forces to employ a precise, long-range weapon also in mobile operations and in dismounted combat while avoiding duel situations.

The essential tasks in the field of aircraft-based guided missiles are the product improvement of the HARM system, the routine basic repair of the TAURUS system and the management of the Laser Guided SIDEWINDER and the Dual-Mode BRIMSTONE projects, thus fulfilling the requirement of short-range powered effectors for the TORNADO and the EUROFIGHTER. Current projects in the field of dropped ordnance are the Guided Bomb Units (GBU) -54

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The MELLs multi-role light guided missile system will be integrated in the PUMA vehicles. It has an effective range of up to 4,000 metres.

and GBU-48. The air-to-surface role of the EUROFIGHTER weapon system has been successfully realised by the GBU-48. This capability is supplemented by the Mk-83 TIP bomb body, a system used to counter hardened targets with reduced collateral damage potential. Fielding is scheduled to start in 2020. In order to significantly increase sustainability, a supplementary procurement of precision bombs for the EUROFIGHTER is currently being prepared.

The main focus of the tasks of K4.2 is currently on the ship-based missile systems RAM, ESSM, HARPOON and RBS 15 and the future-oriented activities for a new generation of long-range guided sea/land target missiles and an active self-defence system of submarines with missiles that can be fired from the submarine. Within the scope of the RAM project, the RAM Block 2B version is currently being developed. This successful bilateral cooperation with the US dates back to 1976. The development of the ESSM Block 2 missile is currently part of a multinational cooperation with eleven partner nations. Following the decision to build another five K130 corvettes, the number of RBS15 Mk3 is to be increased by a supplementary procurement in accordance with the demand. Within the scope of a bilateral cooperation project with Norway, the German Navy's future long-range guided sea/land target missile is to be realised on the basis of the Naval Strike Missile (NSM), which is in use in the Norwegian Navy, as an armament system for the MKS 180 and for the NOR and DEU frigates. In preparation of the mutual further development of the NSM in accordance with harmonised requirements of both navies, activities within the scope of a risk assessment phase are currently being performed. Realisation and in-service use activities (materiel maintenance) are required in almost every project.

Branch K4.3 deals with aircraft-based missiles for the engagement of air targets.

Currently, this concerns the projects METEOR, IRIS-T, AMRAAM and SIDEWINDER. METEOR is implemented within the context of a European cooperation led by Britain. In 2016, the first METEOR missile arrived in a depot in Germany. Also in 2016, an implementation arrangement was concluded in which six nations participate and which regulates the joint use of the missile. The procurement will continue until 2019; in view of the small numbers procured so far a supplementary procurement will be prepared from 2019 onwards. According to current plans, the integration of the Meteor missile into the EUROFIGHTER weapon system is to be completed in 2019. The IRIS-T short-range air-to-air missile is currently in use. The project was implemented as a German-led cooperation programme in which six nations participate. Considerations for a further development that is based on threat development have already begun. Branch K4.4 deals with the PATRIOT projects and products, the Surface-to-

Air Missile Operations Center SAMOC as well as the mobile threat simulators POLYgone. The focal point of the PATRIOT project is the in-service support for a system that has been fielded in the Bundeswehr a long time ago and to handle the associated challenges concerning the elimination of obsolescence effects as well as necessary adjustments to new operational scenarios. The planned changes to the US core system will provide the German PATRIOT weapon system with the capabilities to counter present and future threats until it is being replaced by the future TLVS air defence system. Moreover, the modifications to the communication system will ensure interoperability with partner nations during exercises and on deployments. The Surface-to-Air Missile Operations Center (SAMOC) project presents similar challenges. The particular feature of SAMOC is the capability to connect individual systems and higher combat operations centres and to establish a common operational picture. POLYgone is used to manage different Russian air defence systems; some of them have been adopted from the East German Army. These systems are used to train German and allied aircrews in electronic warfare.

Branch K4.5 deals with short-range surface-to-air weapon systems. These include the Mantis NBS C-RAM system and the light air defence system (with the STINGER missile), which are both in use. In addition, the Branch manages the new armaments projects Air Defence System for Protection in the Short Range and Very Short Range and Weapon Laser for Naval Platforms.



METEOR is a long-range air-to-air guided missile produced by a European consortium of MBDA and Saab.

Division K5

Division K5 Armoured Combat and Transport Systems is divided into the following branches:

The main responsibilities of Branch K5.1 are the upgrade of altogether 104 LEOPARD 2 main battle tanks (MBT) to the latest LEOPARD 2 A7 variant as well as the implementation of a product modification in order to maintain the operational readiness of another 101 LEOPARD 2 MBTs. This measure includes the preparation of a uniform operating concept as well as the elimination of obsolescence effects. Additionally, the Dutch-German command and control capability will be established for all MBTs of 414 Tank Battalion while an active protection system will be implemented for a part of the fleet.

Branch K5.2 deals with the PUMA Armoured Infantry Fighting Vehicle (AIFV) taking into account the special requirements for availability in the Very High Readiness Joint Task Force (VJTF) in 2023 as well as the service life extension for the MARDER AIFV. K5.3 Heavy Weapon Carriers/Armoured Transport Vehicles is responsible for the BOXER multi-role armoured vehicle and the FUCHS armoured transport vehicle. Current



The BOXER armoured transport vehicle has been in service with the Bundeswehr since 2011.

tasks include the delivery of the second lot of 131 BOXER armoured personnel carriers, the preparation of new variants as well as the second lot for the product enhancement of the FUCHS armoured transport vehicle. With this second lot, another 96 vehicles will be upgraded, in particular with regard to their level of protection.

The main focus of work of Branch K5.4 has been on dealing with the extensive in-service support tasks of the FENNEK weapon system. An essential element is the realisation of further 30 FENNEK Joint Fire Support Team (JFST) vehicles. Furthermore, the Branch develops measures to extend the

service life of the WIESEL 1 fleet and works on an Airmobile Weapon Carrier system and function demonstrator as a replacement for the WIESEL 1 from 2025 on. Similar measures are conducted in the field of Bundeswehr Hägglunds oversnow vehicles. The regeneration of the Hägglunds Bv206D has been initiated and a concept for extending the service life of the Hägglunds Bv206S until 2035 is being prepared.

The task spectrum of Branch K5.5 comprises bridges, ferries, footbridges and boats and also the systems which are closely linked to them in terms of functional dependencies, namely systems designed to improve

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the trafficability of soils like the folding trackway. One particular feature of this Branch is that it also calculates and determines the Military Load Classes (MLC) of Bundeswehr vehicles. The Assault Bridge - Armoured Bridging System, which is to replace the BIBER armoured vehicle-launched bridge that has been in use for more than 40 years, has already been presented. Apart from quickly being used in service in the context of VJTF 2019, another focus in the realisation of the project is on close cooperation, especially with our European partners. As part of the reversal in material trends, a supplementary procurement is currently planned until the equipment level in the Army is complete and geared towards its tasks. Branch K5.6 focuses on establishing the organisational and technical prerequisites for bilateral cooperative measures with France with regard to the future Main Ground Combat System (MGCS), which is to replace the main battle tanks LEOPARD 2 and LECLERC from 2035 on. Upon signature of the pertinent intergovernmental agreements, the joint Franco-German project team is scheduled to be established in Branch K5.6 in the second half of 2019.

Division K6

Division K6 deals with small and large calibre guns of the Bundeswehr, including their corresponding ammunition.

Branch K6.1 is tasked with the PzH 2000 self-propelled howitzer, the 105mm saluting gun, the MARS rocket launcher and the mortars as weapon systems for indirect fire support. The large number of individual measures for maintaining and expanding the capabilities of the PzH 2000 self-propelled howitzer will ensure the in-service use of the system until 2040 and beyond. For the MARS II weapon system, which will remain in service until 2035, obsolescence management and the development of new fire control software constitute the emphasis of work conducted by this Branch. The 120mm mortar system installed in the WOLF and M113 carrier vehicles will remain in service until 2030. At present, the fire control computer is replaced and the last partial series is converted to support the firing of the new generation mortar ammunition. For the introduction of a 60mm mortar system, a comparison test of COTS products will start in 2019. Concurrently with tasks related to the in-service phase, plans for successor and supplemental systems are being prepared in close cooperation with the Bundeswehr Office for Defence Planning. Branch K6.2 is responsible for personal and small-arms weapons, their ammunition and sights, pyrotechnics and smoke agents, hand grenades and the ammunition elements of non-lethal weapons.

The current focus of this Branch is the regeneration of the Bundeswehr's range of small arms. This includes the Bundeswehr assault rifle project as a successor for the G36 rifle and the general pistol project as a successor for the P8 pistol. The new MG5 machine gun, the G95K assault rifle and the G29 sniper rifle for Special Forces as well as the upgrade for the G22 sniper rifle are already being delivered.

Branch K6.3 is divided into the four subareas Medium-Calibre Weapons, Base Mounts, Medium-Calibre Ammunition and Naval Ordnance. Focal points of the medium-calibre weapons subarea are the preparation and implementation of upcoming supplementary procurement projects for the heavy machine gun and the automatic grenade launcher. The service life extension of the MARDER AIFV requires that the Mk20 machine cannon is manufactured again. As far as gun mounts are concerned, the integration of the MG 5 into various gun mounts, the supplementary procurement of the remote-controlled light weapon station and various project-related



The MG5 will replace the outdated MG3.

product modifications and supplements (e.g. for training purposes) need to be managed. The Branch realises and manages medium-calibre ammunitions with 12.7mm, 20mm, 27mm, 30mm and 40mm cartridges and various lethal mechanisms. In 2017, all naval weapons with a calibre between 27mm and 127mm were consolidated in Branch K6.3 in a naval gun systems cell. This cell focuses on the product improvement of the naval recoilless gun (MLG 27)

and it further supports the MKS180, F125 and K130 (2nd lot) projects, which are to be equipped with calibre 12.7mm, 27mm, 76mm and 127mm ammunition.

A main focus of Branch K6.4 is the protection of Bundeswehr soldiers in theatre against improvised explosive devices (IEDs). The FUCHS KAI ATV project improves the capability of mechanised explosive ordnance and IED disposal from a protected position, in particular in the vicinity of roads

and infrastructure (buildings, bridges). At present, the first systems are at the Bundeswehr Technical Centers for compliance demonstration. After successful completion the delivery of the series systems is scheduled to begin.

Branch K6.5 deals with large-calibre ammunition for the Army and the Navy. In addition to conventional unguided ammunition, the introduction of guided gun ammunition is to achieve the capability of a precise engagement of medium-range targets. In addition to standard ammunition, the small-calibre INS/GPS-guided VULCANO ammunition for the 127mm weapon system is to be procured for the tactical fire support of Frigate 125 from sea to land. The connection of Frigate 125 to the ADLER Command, Control, Information and Weapons Control System will then also enable joint fire support. As far as the Army's capability of point target engagement is concerned, the VULCANO 155mm GPS/SAL (Semi Active Laser) is intended for use with the PzH 2000 self-propelled howitzer. At present, both ammunition types are undergoing a qualification process. ■



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Air Directorate (L)

The Air Directorate of the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) manages military aviation projects. Its project divisions L3, L4, L5, L6, L7 and L8 are responsible for implementing the projects in accordance with the CPM (Customer Product Management) process and supervising the in-service support management for the fielded products until the end of their life cycle. In addition, Directorate L exercises functional supervision of the Bundeswehr Technical Center for Aircraft and Aeronautical Equipment (WTD 61).

The Directorate's project portfolio ranges from highly agile fighter jets, transport aircraft as well as special aircraft, all helicopter systems, unmanned aircraft, tactical drones and space-based reconnaissance systems to rescue and protection systems for the crews, simulators and training equipment. Almost all large-scale projects are implemented in the framework of multinational, predominantly European partnerships and management agencies.

- preparing proposed solutions in the analysis phase, part II;
- and throughout the realisation and in-service support phases through:
- acquisition life cycle management,
- management of all in-service support activities in terms of maintenance of materiel readiness of all manned and unmanned aircraft as well as space-based reconnaissance systems fielded in the Bundeswehr,
- supervision of system engineering and

and Division L2 "Economic and Legal Affairs" as well as the Directorate Staff and Directorate Controlling support the Directorate's project branches by working on cross-sectional and common tasks.

Current Challenges

A significant challenge arises out of the Directorate's simultaneous management of mission-relevant, tried and trusted systems in the in-service support phase, such as TORNADO or C-160, as well as new weapon systems that are still in the realisation phase, such as A400M, and future projects, e.g. NTH SEA LION, the heavy transport helicopter or the Future Combat Air System (FCAS).

In the framework of the new projects it is vital to create efficient project structures that are fit for the future. Thus, Branch L4.4, previously responsible for managing the NH90 weapon system, has been transferred to the new Division L8 which is also in charge of project management for the NTH SEA LION.

In addition, L6.4 is a new branch which pools the activities for implementing the successor systems for the TORNADO multirole combat aircraft and the Next Generation Weapon System (NGWS).

The branches L5.5, L5.6 and L5.7 were established in order to manage new projects in the field of self-protection and electronic warfare of airborne weapon systems.

Apart from managing new projects, the Air Directorate is especially concerned with maintaining the operational viability of fielded systems, which is due to the high mission relevance of many of the weapon systems managed by the Directorate. This is why, in the framework of subproject 3.3 of the In-Service Support Agenda, a significant improvement of availability is required to be achieved on the basis of the work performed by the fixed-wing aircraft task force and the rotary-wing aircraft task force. This improvement is to be effected in a meas-



Photo: Bundeswehr

Airbus A400M of the German Air Force

The Air Directorate is in charge of ensuring operational viability throughout the entire life cycle of (weapon) systems that have been assigned to it. Prior to implementation, it does so through:

- applied basic research and user-focused defence research and technology (R&T levels 1 and 2) as well as system and solution-oriented studies (level 3),
- partaking in the analysis phase, part I by contributing to the field of planning and

the integration of subsystems, including armament,

- life cycle management including obsolescence management and
- risk management.

This also includes highly prioritised procurement in the context of "fast-track initiatives for operations".

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urable, resource-efficient and future-proof way in cooperation with industry and partner nations. The measures taken in this regard already show positive results and are illustrated by the two examples below.

Performance-Based Logistics for the EUROFIGHTER Weapon System

One of the major causes leading to limited availability of the EUROFIGHTER weapon system was the shortage of EUROFIGHTER spares and replacement parts, coupled with extremely long repair periods as well as inexplicable failure patterns that occurred during the repair of replacement parts.

In addition, the four EUROFIGHTER partner nations agreed to counter the continuously rising maintenance costs of the EUROFIGHTER programme by lowering them on a long-term basis.

When the existing international procurement and repair contracts for spares and replacement parts expired in mid-2016, the four EUROFIGHTER partner nations decided to modify the logistics system of the EUROFIGHTER weapon system in such a way that it meets the necessary requirements. They came to the unanimous understanding to ensure future materiel readiness through an availability contract in accordance with the requirements of a performance-based logistics (PBL) approach. This is intended to be achieved by directly involving the EUROFIGHTER partner companies and creating an incentive system. This, however, meant a considerable impact on the Bundeswehr central logistics system. On the German side, the chosen PBL strategy led to a complete transfer of



Photo: Bundeswehr/Habermeier

Two EUROFIGHTERs of 74 Tactical Air Wing

responsibility to Airbus D&S in terms of supply chain management, materiel requirements and stock management, stockholding and transport.

After two years of experience with PBL in the context of the EUROFIGHTER weapon system, the supply shortages have been eliminated almost entirely.

“Standardised Maintenance Services Contract” (Standardisierter Instandhaltungsleistungsvertrag – SILV) in the NH90 Project

The Bundeswehr intends to further the positive trend of the NH90 fleet availability by employing the standardised maintenance services contract (SILV). Within another performance-based approach, the industry partner yet to be chosen will per-

form maintenance activities of levels 1 and 2 either periodically, as scheduled, based on flight hours, or as required, and will do so over a contract period of ten years. The associated general management services (such as operations management and material management) also form part of the contractual performance within SILV. The core elements of SILV are standardised inspection packages that are performed for each helicopter within a fixed turnaround time period and at a package price. This standardisation is meant to increase the degree of industrialisation as compared to the existing maintenance contracts. The combination of these requirements, a minimum quantity of inspection packages and planning one year ahead enables the two contracting parties to plan in a more reliable manner, both in terms of time and funding. An office staffed with customer and contractor personnel will control and coordinate all activities of the two contracting parties. This is meant to ensure that the activities in the areas of maintenance planning, material management, operations management and technical support can be performed as seamlessly as possible. The current Europe-wide award procedure is set to end within the first half of 2019 when the required parliamentary decision has been made and the contract signed.

The HERON Family – a Successful Bundeswehr Operator Model

The Bundeswehr has been operating the HERON 1 unmanned aerial system in Afghanistan since 2010 and in Mali since 2016 in the framework of the Resolute Support Mission and the MINUSMA Mission, re-



Photo: Airbus Helicopters

The NTH SEA LION will replace the current SEA KING naval helicopters.

spectively. In both mission areas it is used as an interim solution to Imagery Reconnaissance in the Depth of the Area of Operations (SAATEG ZWL, Interim Solution). The HERON TP (TP meaning turbo propeller) is slated to be operated by the Bundeswehr as of 2021, after contract conclusion. HERON 1 and HERON TP are MALE class

with integrated sensors, the communication systems for flight control, aircraft radio and sensor data transmission, and the ground control station.

HERON 1 and, in future, HERON TP will be used under the operator model approach. This generally means that the customer does not purchase the product, and instead

The contracts cover the use of HERON 1 and HERON TP in order to be able to execute the public task of imagery reconnaissance, which is ensured by a specified number of flight hours required by the customer in the mission areas or during routine duty. The customer provides the German Air Force pilots and payload operators that



Graphic: ADAS

HERON TP

(Medium Altitude Long Endurance) reconnaissance drones designed for medium flight altitudes and longer operation periods over the respective mission area. Israel Aerospace Industries (IAI) is the manufacturer of these two drones.

The HERON systems are generally controlled by German Air Force pilots and payload operators in the ground control station.

The HERON systems consist of the airborne platform (remotely piloted aircraft, RPA)

pays for using it. This way, the contractor is comprehensively and actively involved, for a fixed period of time, in providing mission-ready defence materiel.

In the case of the HERON family, the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw), which is the customer, has concluded several service contracts with ADAS (Airbus Defence and Space Airborne Solutions in Bremen) as the main contractor; in turn, IAI is a subcontractor of ADAS.

are required for controlling the HERON systems, takes care of furnishing the infrastructure required in theatre and at training sites and ensures satellite communication (SatCom) required for flight control, aircraft radio and sensor data transmission. The customer's range of government-furnished services also includes individual services from the Bundeswehr logistics system in terms of material and personnel transport as well as the transport of material from Germany to the mission areas and back.

1

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A HERON 1 UAV takes off in Mali.

The HERON systems have been or will be made available for use to BAABW. Through service contracts within the operator model framework, the BAABW project manager thus assigns some tasks of the "material manager for operational viability" and of the "in-service and supply manager" in the in-service support phase (defined in the CPM procedure) to ADAS/IAI. However, the project manager is the person who has full responsibility for operational viability and, in this special case, for serviceability and operational readiness. Thus, his/her tasks in the context of this full responsibility remain the same, i.e. planning, controlling and coordinating all measures that are taken in order to maintain and restore operational viability; he/she is also responsible for ensuring that all measures are taken to maintain the serviceability and operational readiness of the Bundeswehr HERON family.

- This involves the following tasks for the project manager and his/her project team (examples):
- planning and reporting the required budget funds,
- risk management,
- coordination with Bundeswehr agencies (e.g. Bundeswehr Joint Forces Operations Command, Bundeswehr Logistics Center, Federal Office of Bundeswehr Infrastructure, Environmental Protection and Services) in the context of the coordination/continuation of the processing of project elements,
- coordination with interconnected projects (SATCOM, data distribution system, etc.),
- contract management (e.g. contract amendments in the case of extensions of mandate for theaters of operations)

- harmonizing and monitoring the provision of services on the part of the contractor (e.g. review of equipment history record),
- acquiring the approvals required for operation,
- furnishing equipment, fuels and lubricants, infrastructure, IT connections, transportation services, information, services, military protection,
- operator training (through separate training contracts),
- controlling and coordinating tasks that are relevant for inspection and certification between ADAS/IAI and the Federal Office of the Bundeswehr for Military Aviation.

Within the framework of the tasks of the material manager for operational viability and the in-service and supply manager that BAABW has assigned to ADAS/IAI, ADAS and its subcontractor IAI contractually agree to provide technical and logistics personnel, maintenance support facilities and material (airborne platforms, ground control stations, data transmission systems, training simulators, spares, technical documentation, ground support equipment, tools, etc.) as well as ILS management services (Integrated Logistic Support). In addition, ADAS/IAI is responsible for performing all material management activities.

This involves the following tasks for the company (examples):

- controlling the HERON system's technical operation,
- performing all maintenance and repair activities of all maintenance levels (1-4),
- performing updating services for the technical documentation,
- logistic requirements planning,

- documented technical and logistic demonstration of compliance,
- conducting check flights,
- material management (except fuels and lubricants) and stock management,
- reports and returns as well as recording of failure reports,
- configuration control and obsolescence management,
- type support.

The HERON family service contracts contain provisions that ensure that the project manager can take on full responsibility as material manager for operational viability and in-service and supply manager. If requested, the project manager has access, at any time, to information from the contractor that enables him/her to monitor the provision of services on the part of the contractor. This information is also used to perform the required risk management and to ensure that contract performance is officially supervised and that all project elements are monitored, controlled and managed.

The HERON family operator model (currently of HERON 1) is a success story. Since 2010, more than 40,000 flight hours have been accomplished without any major problems.

The interaction between ADAS/IAI, as operating company, and BAABW in conjunction with the German Air Force, as user, is a reasonable alternative in situations where public tasks are performed in the military sector within a fixed in-service support period. When in-service support tasks (maintenance, material management) are performed by an external service provider, the user can focus on his main tasks. At the same time, the user must always be able to transparently access the tasks delegated to the external service provider. This is meant to ensure throughout the entire contract period that the project manager can take on full responsibility as material manager for operational viability and in-service and supply manager. In addition, the user's ability to make assessments, state requirements and gain knowledge regarding the product vis-à-vis the external contractor must be preserved in the long run so that service contracts within the framework of an operator model can be negotiated on equal terms now and in the future. The above-mentioned principles were also applied in the case of the service contract for the HERON TP operator model on the grounds of the experiences made with the HERON 1 operator model. It can be assumed that a mostly trouble-free performance as well as high availability can be achieved again due to the improved functional capacity (e.g. all-weather ability, speed, flight altitude, loading capacity), despite the increased complexity of the HERON TP system in comparison to HERON 1 ■

Sea Directorate (S)

Directorate S is responsible for matters related to the realisation and in-service use of Navy ships and boats, the Navy-specific shore-based systems, communication systems, training installations and other Navy-specific equipment. It supports the units from the first stages of realisation to the disposal of de-commissioned units and their subsequent handover to the disposal organisation. Thus the Sea Directorate is responsible for maintaining and restoring the operational maturity of the products assigned to it and therefore bears the material responsibility for these products "from the cradle to the grave".

Directorate S consists of a total of six divisions, each with a different focus of activities, the Directorate Staff and Directorate Controlling. Within this organisation, three project divisions support the units afloat: S3 (frigates and corvettes); S4 (submarines, mines, mine counter-measures, subsurface weapon systems); and S5 (support units, auxiliaries and support systems).

For every ship class, there is one project manager in charge of the armaments and/or in-service support management tasks. Starting with part 2 of the CPM analysis phase, the project managers are in charge of "integrated project teams".

Apart from the project divisions, Directorate S has three specialised divisions that support the projects. These divisions are: Economic and Technical Affairs (S1), Economic and Legal Affairs (S2) and Navy C2 Systems (S6).

In addition to its specialised tasks, Division S6 is also in charge of the project management of the shore-based systems, training installations and operational training centres of the Navy, as well as of the project management for the integration of the enhanced RAM missile system into the combat systems of corvettes and frigates. Branch S6.4 is the qualifying authority for combat direction systems software

and releases IT system configurations for use on the Navy ships and boats and associated shore-based systems and training installations. The following is an outline of the current status of selected projects of Directorate S:

F124 Long-Range Sensor Obsolescence Removal and Air Defence Capability Enhancement

With its three F124 class frigates the German Navy operates ships specifically designed for force air defence and joint air defence. The main sensor for generating

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Photo: Bundeswehr



The BADEN-WÜRTTEMBERG, FoC of the class F125 frigates, was commissioned in June 2019.

a wide-area air picture is the SMART-L air surveillance radar, which is, however, heavily affected by obsolescence. The main aim of this project, called "Obs WuF LV F124", is retaining the F124's air surveillance capability by removing the obsolescence of SMART-L. Additionally, the F124 will be enabled to contribute to NATO Ballistic Missile Defence (BMD) in a manner that reflects Germany's leading role in Cluster Air and Missile Defence (AMD) in the fields of early warning and target cueing.

range sensor will also be conducted at the TRT facility, in conjunction with a derivative of the Combat Direction System (CDS) F124. The CDS F124 version available at the TRT facility will already have been adjusted to the new long-range sensor at that time, especially in terms of sensor simulation and sensor control. The long-range sensor will not be released for integration on board of the F124 until the demonstrations at the TRT facility have been completed successfully.

Photo: Bundeswehr



Class 130 corvette BRAUNSCHWEIG at sea

The realisation will consist of two stages: **Stage 1** includes the removal of obsolescence by procuring a new long-range sensor and integrating it into the F124 class frigates. Apart from the three ship systems, in order to minimise risk, a test, reference and training (TRT) facility will be set up at the Naval School of Technology in Parow and later also be used as a maintenance training facility. The first tests and demonstrations of the long-

This means that a total of four long-range radars will be procured. The schedule for fitting and integrating the new long-range radars into the F124 class frigates is strictly based on the scheduled maintenance intervals so as not to impair the availability of the F124 class. The stage 1 supplies/services are awarded on a competitive basis (negotiated procedure with a call for competition in accordance with Art. 11 of the procurement regu-

lation on defence and security (VSVgV)); the call for competition was published in January 2019, marking the start of the competition for participation in the award procedure. Expressions of interest were received in March 2019. After thorough quality assurance by BAAINBw, the tender documents (contract draft, statement of work and evaluation matrix) and the Request for Proposal were sent to suitable bidders at the end of April 2019. The bid evaluation is set to be completed by the beginning of 2020; the submission for parliamentary deliberations as required for projects with a volume exceeding 25 million euros is intended to be prepared by the end of the first quarter of 2020.

The contract is planned to be concluded in the third quarter of 2020.

All manufacturers of radar systems suitable for this particular purpose employ the AESA (active electronically scanned array) radar technology and use semiconductors made of gallium nitride in their products. It is important to make use of the advantages this technology offers, such as the flexibility of the transmission diagrams (waveform). These software-defined radars can be adjusted and improved much more easily simply by changing the software for, e.g., control and processing.

Stage 2 includes the implementation of the sensors' basic BMD capability, in this case early warning and target cueing. The F124 class frigates are not intended to use weapons to engage ballistic missiles. This future contribution of the German Navy to BMD has been included in the "Territorial missile defence" concept. For stage 2 a supplementary solution proposal in accordance with CPM is to be prepared by March 2020.

In order to be able to make a meaningful contribution to NATO BMD or the US-European Phased Adaptive Approach (EPAA), the entire functional chain, from the long-range radar on F124 to a missile (e.g. SM-3 as interceptor) used by a different ship (such as a US destroyer), must be taken into account. The sensor performance of the long-range radar selected in stage 1 regarding range and range resolution considerably contributes to achieving the required quality of the target information gained (track quality in accordance with STANAG 5516). In addition, extensions in the Tactical Data Link (TDL) segment are required, among other things. In order to keep the required adjustments to the CDS F124 to a minimum and thus as low-risk as possible, the intention is to integrate a separate ballistic missile defence (BMD) module in the F124 combat direction system.

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The BMD module takes care of the BMD mission planning and will also “control” the long-range sensor. The required threat database for ballistic missile classification must also form part of the BMD module. In this context, a risk reduction analysis is to be performed together with the US Missile Defence Agency (MDA) in order to assess whether the US AEGIS BMD (HW/SW) is suitable. This offers a valuable opportunity to share in the US’s 30 years of experience in the field of ballistic missile defence. The risk reduction analysis was started in April 2019; the partial results will be included in the supplementary solution proposal for stage 2 of the ObsWuF LV F124 project. If the supplementary solution proposal for stage 2 is approved and then implemented, the German Navy will cross the threshold to an entirely new warfare area. The impacts on operational training must also be taken into account.

Stage 2 of the ObsWuF LV F124 project will significantly contribute to minimising risks for the future Next Generation Frigate (NGF) ship class, for which the Bundeswehr Office for Defence Planning is currently preparing a project outline. The NGF is intended to be capable of Integrated Air and Missile Defence (IAMD), meaning that BMD sensor and shooter capabilities are required.

Class 125 Frigate Project

The four new class 125 frigates (F125) have been designed for long-term low and medium-intensity joint and combined military operations. 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 stabilisation



Photo: thyssenkrupp Marine Systems

212CD design concept

missions, the F125 was designed to allow for in-theatre deployment periods of up to two years without scheduled yard periods and a considerably increased number of 5,000 underway steaming hours per year. At the same time, the manning level was reduced to about half the size of what it had been for classes F122 to F124, i.e. to a permanent crew of approx. 120 persons. This new concept is realised by selecting robust and low-maintenance systems and equipment, a high degree of automation and various other technical and organizational measures. ARGE F125, a joint venture of ThyssenKrupp Marine Systems (TKMS) and Fr. Lürssen Werft, builds the vessels. The first ship of this class, the frigate BADEN-WÜRTTEMBERG, completed the yard trial in April 2016 and began the test and evaluation programme at sea. The sea acceptance trial for the marine engineering systems was successfully completed in

July 2016. The trials for the combat system were confirmed by the completion of the acceptance trial in August 2018. On 30 April 2019, the frigate BADEN WÜRTTEMBERG was the first unit of the F125 class that was successfully accepted. The Navy will now perform an operational suitability test that lasts twelve months. Acceptance of the rest of the F125 class ships is intended to be achieved by the end of 2020. The second F125, the NORDRHEIN-WESTFALEN, started sea trials in January 2017. The SACHSEN-ANHALT, being the third ship, successfully completed the sea acceptance trial for the marine engineering systems in February 2018. In May 2017 the fourth frigate of this class was named RHEINLAND-PFALZ.

Second Lot of K130 Corvettes

With the first K130 lot, a very modern, highly complex weapon system with high technical standards was procured. The initial defects in some components, such as the gearing or the air-conditioning, were successfully corrected some time ago. The Navy’s current and future requirement for additional maritime platforms is explained by increasing operational commitments and, simultaneously, declining availability of naval platforms. This requirement is met by the procurement of five more K130 corvettes. By continuing the successful corvette K130 concept, the realisation risk is minimised. The tried and tested basic design of K130 will be retained for the procurement of ships 6 to 10. This way, the supplementary procurement of ships 6 to 10 is the most economic and efficient solution:

- new surface vessels will be commissioned in the near future,

Photo: BAABW



BRANDENBURG, FoC of the German Navy’s four Class 123 frigates

- compared to a new design it is more cost-effective and available sooner,
- it reduces the realisation risk that a system this complex would carry, and
- it uses synergies within the Navy; only a high degree of system homogeneity will permit the use of existing training assets (personnel and infrastructure) as well as an identical logistic chain.

To make the in-service use possible for another 30 years, the obsolescence which have occurred after a 10-year service life must of course be removed, and adjustments must be made to comply with currently valid laws, regulations and standards. Taking these requirements into account, the construction contract with ARGE K130 was signed in September 2017. Ships 6 to 10 are planned to be commissioned from 2022 onwards.

New Submarines for Norway and Germany

In February 2017, the Norwegian government announced that it was going to procure new submarines for its Royal Norwegian Navy together with Germany as strategic partner. The cooperation is based on a joint memorandum of understanding concluded by the ministries in June 2017. Five

areas of cooperation have been agreed in the "Naval Defence Materiel Cooperation" memorandum of understanding between the defence ministries of the Kingdom of Norway and the Federal Republic of Germany, also including common design, being the cornerstone of the U212CD project.

The partners have agreed upon a profound long-term cooperation that is not just limited to the procurement of the submarines but also includes their in-service support. After a common catalogue of functional requirements had been prepared, TKMS, formerly known as HDW, was invited to prepare an offer in July 2017. In the subsequent work-intensive phase, the project teams of the two procurement agencies and TKMS harmonised their efforts.

Procurement Cooperation

A total of six identical boats are meant to be procured from TKMS, as prime contractor, on the basis of a common catalogue of functional requirements. The boats are scheduled to be delivered from 2026 to 2031 so as to enable the Norwegian Navy to seamlessly transition from the ULA class submarines to U212CD. The fact that a common requirements catalogue can be interpreted differently, due to national or cultural

differences, poses quite a challenge in this context. Despite all differences, the parties agree that the boats must be equipped with modern technology before their commissioning so that they are prepared for the upcoming decades. Further partners to the U212CD project are highly welcome, regardless of whether a long-standing partnership of 20 years already exists or a new partnership will be entered into.

The design of the new U212CD class is based on the class 212A boats in service with the German Navy since 2005. In light of the anti-submarine warfare (ASW) systems, which are continuously becoming more advanced, the requirements the navies are faced with have adjusted accordingly. The challenging signature requirements of U212A are combined with a greater range and speed as well as increased deployment periods at sea. An essential point is that the U212CD can use missiles to defend itself against airborne threats. Reducing and optimising a submarine's target strength is more relevant than ever, in particular so since the frigate BAYERN managed to detect the extremely small U206A class submarines at an outstanding range using the LFTAS low-frequency towed active sonar in the Bay of Biscay. Reducing the target echo strength is essential in every

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In-Service Support Cooperation

In order to avoid duplicate structures and ensure maximum availability of the units, the partners agreed to closely cooperate in terms of logistics and maintenance. Apart from common spare parts management, which had previously already been performed with other partners, the cooperation will include materiel maintenance and in-service support management specifically geared towards U212CD in the future. The German side intends to repair the submarines at the planned new Navy shipyard in Norway. This is not an entirely new situation for the German submariners: several class 205 and 206 boats have already been repaired in Norway. The fact that the submarines are identical offers new possibilities in terms of joint and reciprocal training or even operation with mixed crews. So far, it is planned to preserve the training capacities in the two countries. Despite all the excitement sparked by the new boat class it should be remembered that the 212A class

submarines still remain in service. Germany thus faces a special challenge to equip the first lot of U212A submarines with as much CD technology as possible in the context

of midlife refits; this is necessary in order to prepare the submarines for the future and allow for training across classes. It is these synergies that make it possible to put the available personnel resources to efficient use and tackle the obsolescence across the different classes. There is a lot of work to do.

Class 123 Frigate – Service Life Extension up to 2030

In order to maintain operational maturity until the currently intended end of service life has been reached in 2030, extensive measures are required to remove obsolescence of the four BRANDENBURG class frigates (F123) that were planned in the 1980s and commissioned up until 1996. All measures that inherently impact operational maturity will be considered by the F123 project manager in the system context within a so-called master plan; the project manager will also be responsible for continuous updates. The focus of the measures taken to maintain operational capabilities is currently on tactical radars, fire control systems, the integration of RAM Block 2 and HARPOON but also the modernisation of marine automation systems.

These measures will be implemented and integrated on board of the four frigates during scheduled maintenance intervals in the upcoming years in order to use synergy effects and the resulting financial planning to maintain a high level of operational availability. The tactical radar systems SMART-S (3D, short and medium range), LW08

(medium-range and long-range sensor) including VEX (video extractor) and MWCS (Multi Weapon Control System - fire control system for NSSM missile firing operations) were originally planned as individual measures, and obsolescence were removed by the redesign of parts in conjunction with appropriate final stockage.

To create a holistic, generic solution these measures will now be combined in the measure "Obsolescence removal of the tactical radars and fire control systems of the class 123 frigates".

Mine Countermeasures (MCM)

Germany assumed command of the "Maritime Mine Countermeasures – Next Generation" (MMCM – NG) European Defence Agency (EDA) Cat B project in order to harmonise its national planning concerning naval mine countermeasures capability maintenance with the planning of other nations. Within the framework of the EDA project, the operational requirements were made consistent among the nations and common business cases were developed. The project was completed in October 2018.

The whole endeavour revealed the different future ambitions of the individual nations as well as the different pertaining specialisation levels that are to be achieved in terms of naval mine countermeasures. Belgium and the Netherlands, for example, intend to use their unmanned combat systems in theatres of operation that have been reconnoitred with regard to the risk posed by mines; they also plan to launch these systems from platforms that are only lightly protected against mines.

The German project is, in addition, meant to ensure the protection capability against threats posed by naval mines; the goal is to maintain operational freedom of own and allied or friendly armed forces across the entire spectrum of threats originating from explosive ordnance and naval mines. This also means that operational freedom within the context of naval mine countermeasure operations must be ensured in initial operations and in unsafe situations, which can be achieved by using specialised platforms that are mobile and highly protected against threats posed by naval mines.

The German project is assigned to the NATO planning goals. Within this context, NATO requires Germany to provide eleven specialised platforms as of 2030 as well as ensure the capability maintenance and implementation of advanced capabilities in

the field of naval mine countermeasures. With the newly introduced Regional Naval Mine Warfare capability cluster and the Naval Mine Warfare Regional Competence Centre project, Germany expressed its claim to serve as a framework nation in terms of naval mine countermeasures.

The project is intended to be implemented in the form of highly protected seagoing special capability platforms and a naval mine countermeasures (NMCM) toolbox, which enables the capability platforms to cover different areas of naval mine countermeasures in a manner that is geared towards the situation and the threat. This also includes the approach to operate unmanned systems from these capability platforms in the future.

In principle, this project makes it possible to cooperate beyond the specialisation level of the platforms and, especially, within the context of the toolbox.

Combat Support Ship 2.0

The three combat support ships (CSS) are the main logistic and medical support units of the German Navy due to their large capability spectrum. To ensure this at all times, a wide range of measures is continuously being conducted to maintain operational maturity. This will result in the three CSS being substantially different from their former selves, turning them into "CSS 2.0", so to speak.

Several adjustments due to changed requirements as well as obsolescence removal measures have been and will be conducted by Branch S5.1. On the two CSS of the first lot, the regeneration of the entire ship automation, which is basically the nervous sys-

tem of the CSS, was exceptionally successful and was performed without exceeding the planned costs. Now, the focus lies on three measures in particular: the replacement procurement of the integrated mobile naval surgical hospital, the integration of the new SEA LION on-board helicopter to be fielded and the regeneration of the replenishment-at-sea facilities.

Replacement Procurement of the Integrated Mobile Naval Surgical Hospital

After the complete loss of the integrated mobile naval surgical hospital II on the FRANKFURT AM MAIN CSS, a solution based on long-standing operational experience was developed together with the Navy Medical Service. So far, a container concept has been used, but the new solution essentially provides for the use of an integrated mobile naval surgical hospital that is fully integrated and connected to the ship. Now that the design is not dependent upon the containers anymore, the room layout can be ideally geared towards the medical treatment processes. Patients can safely be moved from the helicopter hangar to the hospital now that the hospital is firmly connected to the CSS deckhouse. In addition, after the patients have been treated there, they can be transferred to the ward inside the ship using a bed elevator. So, for the first time, an entirely protected transfer is possible now. Not only is the new design favourable due to the considerable weight reduction of more than 50 t, which will benefit the maintenance margin of the CSS, but it will also reduce maintenance efforts in the long run. The integrated mobile naval surgical hospital will be manufactured and completely equipped independently of the

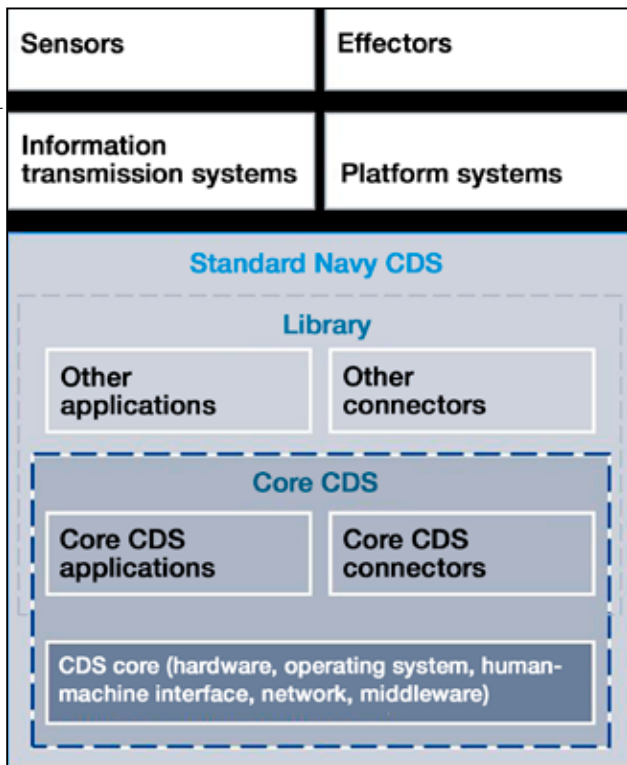
CSS and must be subjected to functional tests. The goal is to cause as few restrictions as possible to the operational availability of the CSS FRANKFURT AM MAIN when the hospital is placed and set up on the ship. Realisation risks concerning the CSS are thus reduced to the achievable minimum. The contract conclusion in April 2019 marked the beginning of the procurement of the hospital, which ensures that the soldiers can receive the best possible medical care on the CSS in the future, even far from home.

SEA LION on Combat Support Ships

Soon after the beginning of 2020, the new SEA LION navy helicopter will be delivered. Preparations are in full swing to make the CSS BONN the first unit to host and operate the new helicopter in 2020.

The operational spectrum of the SEA LION on board the CSS is generally identical to that of the current SEA KING on-board helicopter, with the focus being on maritime tactical air transport of personnel and equipment and on search and rescue tasks. However, a multitude of different aspects must be taken into account for a successful embarkation. Apart from current regulations and a considerably bigger volume of embarkation equipment, linking up the IT systems is a particular challenge in the context of the integration. The flight deck will be fitted with a high-strength landing grid, and adjustments to the lighting of the flight deck and the power supply will be made. For the first time, a remote-controlled low-floor aircraft tow that is independent of the ship will be used. The costs of its procurement and maintenance are significantly lower while the tow's availability is considerably higher than that of the previously used fixed





traversing system for on-board helicopters. The prerequisites necessary for maintenance and repair work are ensured by adjustments to the hangar crane system, maintenance platforms, air conditioning system, tie-down points and material holds. A connection to the on-board communications facilities must be set up and the additional IT equipment must be integrated in order to take care of the operational mission planning and plan and control the technical flight operations.

Regeneration of Replenishment-at-Sea Facilities (RAS Facility)

The 18-year old replenishment-at-sea facility of the first lot of CSS must be entirely re-

generated due to advanced obsolescence. The existing port/starboard replenishment-at-sea facility is designed as mechanical, hydraulic, pneumatic, electrical facility with electronic system components for transfer of liquids and solids, which makes it highly complex to control and operate. The failure rates of the in-service RAS facilities keep increasing the older these systems get. It has also turned out that the maintenance costs and time frames are an incalculable risk. For this reason, the existing RAS facility will be removed and, instead, a solely elec-

POL Supply for Ships and Boats

trically operated replenishment-at-sea facility with the simplest possible design will be integrated. The main goal of this work is to significantly increase the RAS facilities' availability during in-service use.

The two support tankers RHÖN and SP-ESSART are owned by the Navy and have been in use for more than 40 years. Originally, they were built for Terkildsen & Oldsen A/S, a civilian Danish shipping company, under the names of OKENE and OKAPI. Then, on 18 March 1976, the German Navy took over the two support tankers and,

after necessary alterations, commissioned them in 1977.

Capability Spectrum of the Current Support Tankers

The support tankers RHÖN and SP-ESSART fulfil the supply mission for national and international naval units at sea. With their three on-board RAS systems, they can supply other ships with fuels and freshwater at any time of the day and night. This significantly increases a naval unit's sustainability. Always remaining in the background, the two support tankers reliably perform their duties up to this day and provide a major contribution to the fulfilment of the German Navy's task within the context of mandated missions, such as ATALANTA.

Age Takes a Toll

A large number of missions coupled with the old age of the support tankers has caused the maintenance costs to rise over the past few years. This circumstance and the fact that environmental protection regulations have become more stringent over time, such as the requirement for a double hull, as well as stricter requirements regarding the emission of nitrogen oxide make it necessary to procure two new support tankers to replace the support tankers RHÖN and SP-ESSART, which will meet the projected end of their service life in 2022+.

Plans for the Future

The capability to supply seagoing units with POL products is an essential part of the German Navy's portfolio and must be ensured beyond the service life of the Navy support tankers RHÖN and SP-ESSART. The requirements catalogue containing the indispensable capabilities of the new support tankers was compiled and handed over to BAAINBw for the preparation of possible solutions. Apart from the operating profile and the fuel quantity to be transported, it includes requirements concerning the military communication equipment, operation in different climates, helicopter operation and protection of the crew, among others. The goal is to provide an efficient product with which the future operational scenarios of the Navy can be mastered.

Building a Navy Support Tanker

The submitted functional requirements were transformed into functional performance values and translated into different proposed solutions. The project team is looking into various approaches (e.g. procuring commercially available equipment, leasing or developing a product from scratch) to take into account economic efficiency factors. The findings gained from

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market research and information from other nations (i.a. Norway/Great Britain) were also included in the considerations on how to continue. In the end, the analyses showed that, under the current conditions, the development of a new ship design is the only possible way to meet the requirements of the catalogue.

As part of the search for a solution for the procurement of the new Navy support tankers, one major task of the project team was to present the Navy with a selection of various solutions that differed in how they would meet the requirements.

When the Bundeswehr Chief of Defence has selected one of the solutions, the project will enter the realisation phase, in which the chosen solution will be translated into a statement of work. The delivery of the first unit will ensure that the Navy can seamlessly continue to supply seagoing units with POL products while the support tankers RHÖN and SPESSART can enter their well-deserved retirement.

Operational Training Centre for Frigates/Combat Support Ships

Within the scope of training modernisation, the efficiency and advantages of simulation systems are becoming ever more apparent. They make it possible to practice complex military scenarios in a reproducible manner and without putting the soldiers' lives and health at risk. There is no harm done to the environment, and the costs are lower as compared to the training at the original facilities. In addition, the Navy has more ships and boats available for operations instead of them being occupied for training purposes. In order to account for this modern and professionalised training, operational training centres will be set up that enable the crews to be trained and prepared for missions on land and without their units. The F125 frigates, with their rotational crew concept, are intended to be the first ship class to benefit from this. The first operational training centre for frigates/ combat support ships will be established at the base of Flotilla 2 in Wilhelmshaven. It will mainly consist of a complex integrated simulation system which makes it possible to practice on individual stations as well as in the form of a "total ship training" with the entire crew. This way, the training participants can experience and practice internal and external battle situations in true-to-life environments and within the context of common scenarios. A realistic exercise concerning fire and flooding control will be established, and, for the areas of NBC defence and the medical service, simula-

tions that are identical to the situations on board will be created. These exercises serve to supplement the integrated simulation system. Stationary training aids will also be procured. Branch S6.3 of BAAINBw is responsible for the operational training

progress, among other things. This approach resulted in a fragmented landscape of combat direction systems, which poses some challenges for training, personnel, system maintenance and modifications. In order to significantly reduce the complexity



Image: MTG Marinetechnik GmbH

Artist impression of a possible future support tanker design

centre for frigates/ combat support ships project, which is currently in analysis phase part 2. This extensive project is intended to be implemented as of 2020.

Outlook on Future Projects

Medium Support Unit

Considering that the core requirements of units afloat include mobility and sustainability on missions around the globe, the replenishment-at-sea capability is of vital importance. Smaller and medium-sized units, such as corvettes, mine countermeasures units and submarines, are currently supplied with POL products by six class 404 tenders, of which one was specifically refitted to serve as submarine support unit. The class 404 tenders, which were commissioned at the beginning of the nineties, will reach the end of their service life within the next decade, which is why considerations are already made in part 1 of the analysis phase to ensure that the replenishment capability is seamlessly maintained. Changing operational scenarios, such as increased threat levels, must be considered, just like future developments within the fleet and dependencies on other projects, e.g. new submarines, helicopters and mine countermeasures units.

Standardisation of Maritime Combat Direction Systems (CDS)

In the past, a combat direction system was developed for each new class of surface combatant to account for technological

of system maintenance and modifications, which is caused by the numerous systems, as well as the pertaining costs and obsolescence, a standard combat direction system fit for every ship class is intended to be implemented in the Navy. Additionally, the term "standardisation" was defined as:

- identical structures as well as controls and functions of the user interface (human-machine interface) of the combat direction systems across all capability platforms to improve operational safety, and
- the possibility to increasingly have the Bundeswehr determine the way ahead to be followed for future developments and how such developments are to be implemented.

The intention is to perform the integration into the ship, as overall system, with the help of integration projects that are specific to individual ship classes.

The basic technical principles for the standard combat direction system are meant to be established by implementing a core CDS around a CDS core.

The standard CDS supports all functions and processes in the areas of command and control, effects, reconnaissance and support, which are, so far, implemented in class-specific CDSs.

The standard CDS will be available in different types that each meet the requirements laid down in the task and operation profiles for the various capability platforms. ■

Land Support Directorate (U)

The BAAlNBw Land Support Directorate (U) has a very broad spectrum of tasks, ranging from individual equipment for Special Forces over security technology, military camps, medical equipment, CBRN protection, military wheeled vehicles, special vehicles and equipment to EW (electronic warfare), reconnaissance, air traffic control, robotics and training/simulation.

In addition, the Land Support Directorate exercises the general functional supervision over the Bundeswehr Technical Center for Land-Based Vehicle Systems, Engineer and General Field Equipment (WTD 41) in Trier, the Bundeswehr Research Institute for Protective Technologies and NBC Protec-

The U Directorate is supported by the Directorate Staff (UAS) and the Directorate Controlling (UAC).

Project work is done in five project divisions with altogether 23 branches, and they receive support from the Economic and Technical Affairs (U1) and Economic and Legal

- **U1.4** Expert team coordination and support of master data processing, master data process control for systems in use/ SASPF

The Economic and Legal Affairs Division (U2) with its five Branches is responsible for contract management and price negotiations for the project divisions, and is organised into Branches U2.1 to U2.4 responsible for contract management for project divisions U3 to U7, and Branch U2.6 responsible for price negotiations.

The five project divisions carry out project work in accordance with CPM throughout the entire life cycle of the materiel (implementation, use, condemnation), as follows:

- **U3** Camp technology, camp protection and supply, CBRN protection, Mountain infantry and Military Police equipment, Special Forces individual equipment
- **U4** Protected wheeled vehicles, Special vehicles & equipment, Integration, Protection, R&T processing
- **U5** Electronic warfare, Reconnaissance, Air traffic control, Identification
- **U6** Training technology, Simulation, Robotics
- **U7** Military pharmacy, Medical treatment facilities and medical equipment

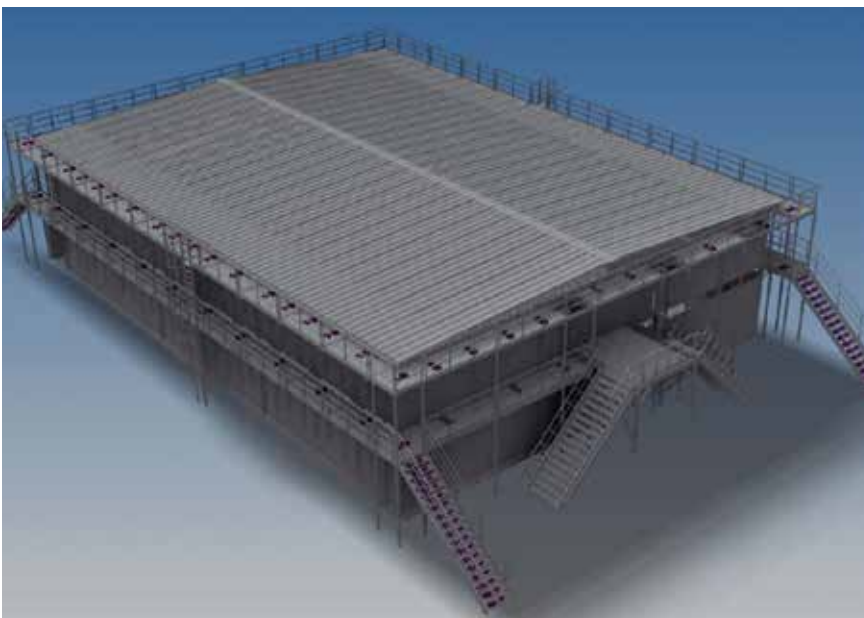
The following will provide an overview of selected projects of the Directorate.

Deployable GAF Combat Operations Center, Mission Counter DAESH (U3.1)

Since December 2015, the Bundeswehr has been supporting the Counter DAESH mission and the combat against the Islamic State in Syria with TORNADO reconnaissance aircraft and A310 MRTT refuelling aircraft.

To safeguard the command and control capability of the German armed forces abroad in a sustainable fashion in the long run, it was decided to replace the tent-based command post with a modern combat operations centre on the basis of HF-proof two-storey container blocks, comprising additional functions. In addition to the existing functionalities which were migrated to the new combat operations centre, it was also intended to procure and integrate support

Graphic: G5S+



Design layout GAF COC MCD

tion (WIS) in Munster and the Bundeswehr Research Institute for Materials, Explosives, Fuels, and Lubricants (WIWeB) in Erding.

As in other directorates, the core tasks of the Land Support Directorate include project management in accordance with CPM (Customer Product Management) throughout the entire life cycle of the materiel, systems engineering and integration; research and technology (R&T); technical support during in-service use, and contract management and price negotiations.

Compared to the other directorates in which project work is carried out, specific characteristics of the Land Support Directorate are an unusually broad spectrum of technology-related tasks, the large number of projects, many of them small-scale projects, and distinctive procurement activities, in particular fast-track initiatives for operations.

Affairs (U2) Divisions.

The Economic and Technical Affairs Division (U1) performs general, overarching tasks for the projects and the leadership of the Directorate. The U1 Division with its four Branches serves as the Directorate's central point of contact for the following:

- **U1.1** Situation picture equipment, in-service support and IT, POC in analysis phase I towards the Bundeswehr Office for Defence Planning, operational and user support SASPF, coordination and IT architecture support across projects, IT security concepts and databases
- **U1.2** Central process support and control within the U Directorate, IETD support, terminology
- **U1.3** Functional supervision of WTD 41, WIS and WIWeB, R&T coordination (AB 50), coordination legal regulations, in particular REACH



Photo: GSS+

View inside a room made up of two containers



Photo: GSS+

View inside the hall containers with the functional containers to the left and right

und functional elements of the ground exploitation reconnaissance system and the communication centre. In this process, requirements of military and IT security were to be met by providing so-called black and red information domains. Also, encrypted air-ground communication (known as red radio) had to be implemented. As a result, new/additional power generation and supply units are required to operate the facility autonomously.

On 6 September 2016, approval for the procurement of the GAF combat operations centre for the Counter DAESH mission in Incirlik (Turkey) was granted. Due to its high level of criticality and political significance, this fast-track initiative for operations was the only one to be prepared under the project authority of U3.1. The project involved substantial risks; they could however all be solved continuously and successfully in the course of project implementation.

The three directorates involved - specifically the U, I and L Directorates - concluded 15 individual contracts within four months to implement the project. Following the invitation to tender by the U Directorate in December 2016, the main contract with GSS+, the company set up by the consortium and

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Photo: BAANBW

PRS receiver: P3RS-2 (left, GSA order) and PROOF (right, R&T study by WTD 81)

comprising ESG GmbH and STEEP GmbH, was concluded on 28 April 2017. Since the German contingent relocated from Incirlik (Turkey) to Jordan, subsequent changes to the contracts became necessary which were all implemented successfully.

In mid-May 2018, the important milestone "acceptance by the emission control service of the Bundeswehr Centre for Cyber Security" was reached. The system was then presented to the Bundeswehr as the customer.

After that, the system was disassembled completely and packed into containers for redeployment to the Bundeswehr Communication and Information Systems Sector 1 in Fürstenfeldbruck to carry out IT system integration and testing (operational testing). The overall system comprises in total 86 functional containers, each 20 ft long: 71 containers for the facility including equipment and an additional 15 containers for self sufficient power supply. The actual two-storey building block is made up of 40 HF proof functional containers and 20 HF proof hall containers.

The implementation of the field infrastructure measures in Jordan and the subsequent in-service support took place in close coordination with the Bundeswehr Joint Forces Operations Command J4, the Federal Of-

fice of Bundeswehr Infrastructure, Environmental Protection and Services Infra IV as well as the field accommodation project group. The construction project includes the foundation of the combat operations centre including connections to media and antennas, the supply with additional commercially available units and further comprises a fence surrounding the facility where access control is carried out.

The GAF COC MCD was erected from December 2018 onwards in Jordan on the Al Azraq Muwaffaq Salti Air Base (MSAB), in the German Camp Sonic. Upon completion, operational readiness was established.

Thanks to the excellent cooperation between those involved (industry, GAF, federal offices) and the high level of commitment, the implementation of the GAF COC MCD is on schedule. Cooperation is exemplary and characterised by mutual trust, the willingness to deliver on schedule and in accordance with the budget, and also by an excellent team spirit.

Future Generation of GPS and GALILEO Receivers (U5.4)

The only way to provide the Bundeswehr on a global scale with a common capability to determine positioning, naviga-

tion and timing (PNT) for its many tasks is the Global Navigation Satellite System (GNSS). In this context, reliable PNT operators/sensors are taken into consideration for Bundeswehr equipment so as to ensure protection against false signals. For this purpose, only encrypted services by GPS and - in future - GALILEO can be considered.

The Bundeswehr has so far used US-manufactured encrypted P(Y) code GPS receivers. Following the modernisation of the GPS system, a new M code will be introduced. The next generation of encrypted GPS receivers will become available in 2022/23. As a result, the GPS P(Y) code currently in use will not be available indefinitely.

This fact alone calls for conversion plans for the Bundeswehr systems. What is more, the European satellite navigation system GALILEO with PRS (Public Regulated Service) also offers encryption services (protection against deception attacks) and controlled access for sovereign tasks. Both GPS M code and GALILEO PRS feature a modernised cryptology with additional operational NAVWAR capabilities, including a higher robustness. The robustness of the Bundeswehr systems will increase significantly with the future use of GALILEO PRS, which will be introduced at the same time as the M code. Also, there will be less dependency on US deliveries (US ITAR GPS receivers, GPS encryption material).

As part of the encrypted GALILEO PRS service under the control of the EU council and the necessary cyber hardening of systems (including GNSS), cryptology (encryption modules) will be developed and manufactured at the national level. The European GALILEO system shall ensure that the EU is independent in this key technology.

The GPS M code equipment, by contrast, will be developed for the US Department of Defence (DoD) by approved US manufacturers. The Bundeswehr cannot define any requirements in this process.

On the basis of initial EU receiver studies, the Bundeswehr ordered first demonstrators of GALILEO PRS receivers in the context of an R&T study. In addition, the Bundeswehr defines the basis for the use of GALILEO PRS both at the inter-ministerial and the international level. Together, requirements with regard to standards and key distribution will be defined.

To ensure that the new combined receivers are included in the budget planning according to demand as well, a demand analysis has already been performed. A first project for maritime and land systems is currently in the analysis phase. ■

Photo: GSS+



View from outside on the COC with balustrade, stairs and air conditioning modules



SEPTEMBER 24TH -26TH 2019, MALMÖ, SWEDEN



Organized by Swedish
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We welcome old and new participants to yet another informative and stimulating symposium in Sweden, this time in Malmö, a beautiful city in the southern part of Sweden.

The symposium will be initiated by The Supreme Commander of the Swedish Armed Forces; General **Micael Bydén**.

The opening ceremony features Mr. **Fernando Arias**, Director-General of the OPCW, who will give a presentation titled: Prohibition of the use of chemical weapons and overcoming the disarmament challenges in the area of CBRNe. Additional presenters in the opening session will soon be announced.

Selection of keynotes:

- Future biological weapons threats
- Hazard management at the Salisbury event 2018
- Detecting the threat: challenges and trends of CBRNE field detection
- Nuclear emergencies: a challenge for science and society

The symposium program consist of keynote lectures by distinguished speakers together with parallel thematic sessions in scientific and operational areas held throughout the symposium.

Exhibition of CBRNe Protection Equipment

An exhibition of CBRNe protection equipment will be arranged in connection with the symposium. As of today, more than 45 exhibitors has already signed up. The exhibition will offer symposium participants the opportunity to make themselves acquainted with commercially available state-of-the-art equipment related to CBRNe protection.

All participants are invited to visit one of the Swedish Coast Guard combination ships prior the symposium dinner.



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Information Technology Directorate (I)

The Bundeswehr, too, is a driving force behind digital transformation. The goal of its efforts is to achieve superiority of effect through improved and faster processes in terms of command and control as well as planning. And this is where Directorate I of BAAINBw plays an important role.

It manages the projects concerning information technology relevant for operations and command and control. This includes everything from data processing centres and software developed for specific purposes to entire signal teams. The Directorate even has its own communications satellites and cryptographic equipment in the product portfolio. A current example of how products of Directorate I are used is the IT equipment of the GAF combat operations centre (COC), which has been in use in Jordan since May 2019. This COC ensures the safe flight operation of the Tornado reconnaissance aircraft and the A310 MRTT transport/tanker aircraft within the scope of the Counter Daesh mission. Directorate I implements products and keeps them in service in the context of different projects, and, in the end, they must all be compatible with each other in the Bundeswehr IT system. Division I1 bears control responsibility and takes care of different cross-sectional matters. Two current examples illustrating the work of Division I1 are presented below; this will be followed by news regarding the project work of Divisions I4 to I6.

Introduction of the IT Service Owner Role

The MoD's IT strategy requires that the Bundeswehr IT system is further developed until a service-oriented architecture is achieved. The IT service management that is needed for such a development is introduced in the areas of equipment and in-service support by the Bundeswehr IT service designer, who is part of Directorate I. The cross-sectional nature of its products and IT services is another reason for the importance of Directorate I. When a service-oriented architecture is to be introduced, one of the success criteria is to clearly determine the responsibilities, apart from designing and introducing IT service management processes and connecting them to the existing core processes of requirement identification and procurement. The IT service owner role is especially important in this regard. The IT service owner ensures that the IT services can be reused beyond the original pro-



Photos/Graphics: Bundeswehr

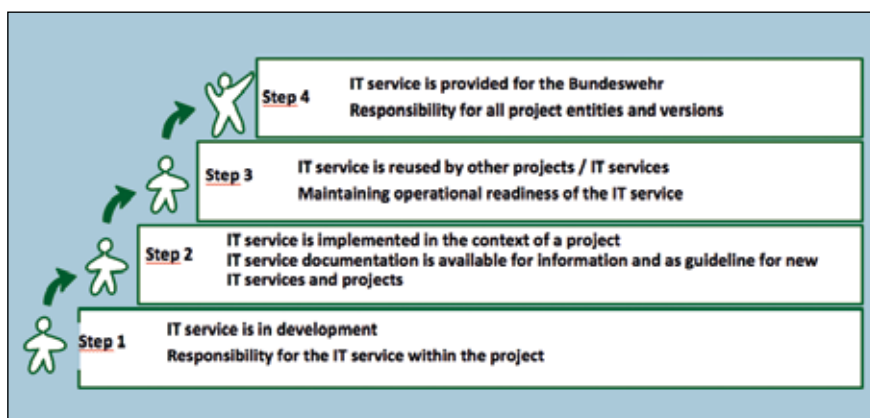
A large combat operations center for the Air Force, which was implemented in the framework of a fast-track initiative for operations for the Counter Daesh mission; Directorate I is responsible for the implementation of IT for one hundred workstations that can be used for different IT services required for the mission.

ject scope. In addition, he manages the interdependence between the IT services and other IT projects and IT services. The Bundeswehr IT service designer exercises overall control over all IT services, which results in an optimised Bundeswehr IT system. In the case of projects in which only one IT service is implemented, this responsibility lies with the project manager/IT service owner as one single person. When more IT services are implemented within a project, however, a proper IT service owner will be assigned to each one of them. It is challenging in this context to switch from the former project landscape to a service landscape. The IT service owner can take over the increased responsibility only step by step and in line with the available personnel, especially in the case where an IT service has so far been integrated in a single project only, but is now meant to be used in several different projects. Preparations are currently under way to designate the first IT service owners on the basis of a step model. One main point of ef-

fort are the IT services at infrastructure and platform level that are provided through the Harmonisation of the Command and Control Information Systems/German Mission Network program (HaFIS/GMN) and the HERKULES follow-on project. There is a high potential for reuse in this context. Other than that, the focus lies on IT services relevant for the Digitalization of Land-Based Operations (D-LBO) program so as to ensure reusability right from the start. This will provide the organizational groundwork required to achieve the service-oriented IT strategy goal.

Internet Protocol Version 6 for the Bundeswehr IT System

The Internet protocol version 6 (IPv6) is a standardised protocol developed by the Internet Engineering Task Force and has been used for data transfer within computer networks since 1998. IPv6 has become more prevalent on the Internet since the assignment of IPv4 addresses came to



Step model for the introduction of the IT service owner role

an end. Although still widely in use, IPv4 will increasingly be replaced by IPv6, especially because IPv6 serves as the standard for new products and, in addition, IPv4 is not supported anymore.

The IPv4 addresses consisted of 32 bits; with Version 6, however, it is possible to use 128 bits for the addresses.

Back in 2003, the Bundeswehr considered for the first time to migrate its IT system, step by step, from the then standard IPv4 to IPv6. This was formulated more clearly in the FMod's IT strategy, stating that the goal is, by 2017, to generally use IPv4 and IPv6 side by side (dual stack operation); in the long run, however, IPv4 is not intended to be used anymore.

The hardware and software must support the intended dual stack operation as much as possible. This is important for the migration of existing systems or the procurement and development of new IT systems. IPv6 characteristics must already be implemented in a way that conforms to the standard, especially in the case of characteristics that are not yet meant to be used.

The past has shown that the testing of functions and, if required, a certification in accordance with accepted standards is indispensable. The Bundeswehr Technical Center for Information Technology and Electronics (WTD 81) supports Branch I1.3 of BAaINBw in these inspections.

HaFIS is Up and Running

In the field of command and control information systems, it was customary to implement monolithic, proprietary individual systems based on projects that were required in terms of planning. Each one of them perfectly fulfilled the user requirements, but the way in which these systems interacted with each other was less than ideal in most cases. This approach is rather unfavourable, both in the context of realisation and especially during operation, because different technical solutions are used in multiple ways to implement functionalities. In addition, the operating personnel and users must be trained on different systems.

The solution is to combine and further develop the projects within a programme for the harmonisation of the command and control information systems (HaFIS). The HaFIS programme provides the different users who employ common technology with the required IT services in the form of a single system, while also ensuring information security. The services comprise, among other things, situation, email, document handling, chat, classified registry and user-specific applications. The HaFIS platform is generally accepted to be a modern and highly secure work tool.

Despite all the issues, it can now be said in good conscience that "HaFIS is up and running". The geo-redundant data processing centre located in Germany is used by thousands of persons involved, for example, in operational reporting, military intelligence and Air Force specific services. Thus, the main work focus of this stationary data processing centre currently lies on service use. A lot of expert knowledge and detail work is required to keep the system permanently up to date and in a highly secure state in cooperation with the operator.

The connections to the mission areas can only handle limited data rates, which is why it is necessary to operate data processing centres on location in which mission-specific data stocks are kept. In this context, considerable progress was made regarding the implementation. Generally, there are two ways of implementing these kinds of data processing centres: either fitted in regular containers or in transport and operating containers. Both options have advantages and disadvantages; but, all in all, they cover a large operational spectrum. The transport and operating container version is currently about to be put into service for the Joint Forces Air Component Headquarters (JFAC HQ) in Kalkar; the same solution will also be used for the Multinational Joint Headquarters Ulm.

The German Mission Network (GMN) stands for the continuation and extension of HaFIS. The GMN Block 1 project will implement the HaFIS solutions across the Bundeswehr. First and foremost, this means building up capacities in the data processing centers located in Germany, and it also means a higher number of transportable units. Within the Integrated Project Team (IPT), a small core team of Directorate I has made a proposal regarding the further approach for GMN1 in which HaFIS serves as the basis and will be improved on the grounds of the gained experience. To give an example, a highly integrated container type is implemented in order to reduce risks and to be able to minimize the effort required for the transportation to the mis-



Laboratory test setup for the verification of functions



HaFIS is mobile; depicted is the transport and operating container version.

sion area, which is done by reducing the number of containers per data processing centre to a minimum. On the other hand, it is intended to simplify the mission-specific IT preparation for the user and to make it more flexible.

GIADS Regeneration

The German Improved Air Defence System (GIADS) is an Air Force combat control system that is employed within a system of national air defence sites. It was already fielded in the Air Force at the end of the 1990s and has been continuously adapted to the relevant requirements in multiple cycles.

German military air surveillance is currently based on one transportable and two stationary national air defence sites. The stationary air defence sites are part of NATO Integrated Air Defence and exchange data with other allied air defence sites and agencies in continuous operation.

This system enables the Air Force to ensure, at all times, the command and control capability in air operations as well as to perform airspace surveillance by way of air situation pictures and to identify objects within the national and international context.

The fast-paced nature of IT systems nowadays leads to obsolescence effects in next to no time. If not identified in good time, they result in limited materiel maintenance and availability, leading to increased follow-on investments and operational costs. A regeneration project ensures that the systems can be supported.

The complexity of regeneration measures is often underestimated. High demands are placed on engineering when systems

are ported to modern hardware environments and full functionality is to be maintained at the same time, especially because technically outdated interfaces must be implemented and maintained with modern hardware. This was also the case within this project. In the end, the second regenerated combat centre was handed over to the user in April 2019, and thus the project was completed successfully.

Joint Networkable Radio – First Procurement Contract

The introduction of Joint Networkable Radio Equipment marks the beginning of an activity in the context of D-LBO. As part

of this, outdated radio equipment will be replaced, among other things, so as to be able to provide the IT services required for network-enabled operations (NEO). The information exchange classified up to SECRET and NATO SECRET forms part of these IT services. In future, this will be handled with networkable radio equipment in order to meet the requirements of continuous IP-based communication and to ensure confidentiality, integrity and availability of digital information.

Networkable radio equipment essentially is Software Defined Radio (SDR). The functions can be configured as desired with the help of software rather than having to adapt or exchange the hardware. This gives the users the possibility to operate multiple radio networks in different frequency ranges with a single radio; all they have to do is to load software. While it was so far necessary to install several different radios in a given vehicle platform, it will now be possible to control a lot of applications with a single SDR for quite some time to come.

The modular design makes it possible to cover a large frequency spectrum; hence, by using networkable radio equipment expensive and complex platform and weapon system rework can be avoided.

The advance procurement of networkable radio equipment for 23 PUMA battalion command vehicles and 27 BOXER battalion command vehicles is currently underway, representing the first element of D-LBO.

Apart from the networkable radio equipment of those 50 command vehicles, the procurement contract also covers the entire operational environment required for use (network management system, safety



A modern GIADS workplace

management system), the training sites, the initial spares requirement and servicing float.

The delivery of the first networkable radio production units has been agreed for 2020.

Outlook

The digital transformation is crucial for the future of the Bundeswehr. The activities in this regard provide the possibility to increase the robustness of the Armed Forces and, at the same time, to render the Bundeswehr's administrative practices more efficient.

On the one hand, digital transformation means a change in processes and work culture. This affects BAAINBw internally, and Directorate I in its day-to-day work routine as well. One example is how our processes are supported by SASPF. So far we have made good progress; however, we still have far to go and we hope that we will profit considerably from the digital transformation, which would enable us to support the Armed Forces in an even better way.

On the other hand, the activities in the context of digital transformation naturally also have an impact on current and future CPM projects, for which BAAINBw, as provider,



There is only little space for the networked radios, as shown here on the wheeled GTK BOXER armoured transport vehicle.

is responsible. This affects many projects of Directorate I. In this regard, we will increasingly face the challenge in the upcoming years to implement the project adjustments and new projects to be specified by the Cyber and Information Domain major organisational element. The goal is to keep old systems in use while also tackling new projects. This has already led to a considerably

condensed workload for Directorate I. And this is why the future success will largely depend on an ideal balance between the tasks of the Cyber and Information Domain organisational element, BAAINBw, and BWI as an in-house company. Within this context, Directorate I will continue to bring its expertise to bear, always in the best interest of the Bundeswehr. ■



OPERATIONAL SYSTEMS

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Information Technology Support Directorate (G)

The SASPF Programme – an effective contribution to the digitisation of the Bundeswehr

The initiation of the SASPF project (Standard Application Software Product Family) has marked a paradigmatic shift in IT support in the field of administrative and logistic tasks away from individual, task-specific applications and towards an economically oriented, uniform IT-solution for all areas of the Bundeswehr. The standardisation, harmonisation and optimisation of processes, procedures, sequences and the organisation in the remit of the Federal Ministry of Defence (BMVg) is the established objective of this major project.

The SASPF programme strategy and its update as well as the architectural requirements and projects contained in them have not only increased the speed at which technical innovations are implemented by Directorate G in BAAINBw and accelerated them by agile methods; they have also introduced a new phase of digitisation in the Bundeswehr.

It is crucial to employ a foresighted strategy to develop complex processes, coherent projects and IT systems in the Bundeswehr, use the opportunities for standardisation and simplification and prepare the existing SASPF systems landscape for the future and ever shorter innovation cycles.

As a consequence the Bundeswehr intends to change its SAP system landscape to S/4HANA. The product change contributes significantly to the armed forces' digitisation and thus to their long-term ability to act.

Is the current IT system supporting the Bundeswehr in an ideal way? Are the processes lean, can the solutions be handled intuitively in missions abroad, are mobile applications up to date and is data available in real time? These are some of the challenges that the Bundeswehr intends to find solutions for with SASPF X.0. The concept SASPF X.0 stands for the introduction of S/4HANA in the Bundeswehr. It is the successor of the current core product SAP Business Suite on which the Bundeswehr's logistic-administrative information system is largely based.

Changeover to S/4HANA

S/4HANA grants the Bundeswehr access to new functions and processes which the current SASPF system only offers in a very limited way. This includes the mobile and networked use of data as well as analysis and simulation options based on real-time information. SASPF X.0 will help create a sustainable and future-oriented digital platform to create the basis for dealing

SASPF



Graphic: SAP

U-EBL thus supports the provision of operationally ready forces and assets in the Bundeswehr's entire task and mission spectrum with the aim of providing the BMVg executive group and director level, the chiefs of staff and/or the major organisational elements as well

as the Commander of the Bundeswehr Joint Forces Operations Command with a comprehensive situational picture both for routine duty and operations.

The measures implemented in 2018 focused on service-specific evaluation requirements such as the inclusion of the fleet management of the Air Force and Navy OPREP reports. Subsequent to the activation in December 2018 and further final measures it is planned to complete the digitisation of the operational readiness situation generation at the end of 2019.

Reporting System for the Internal and Social Situation of the Bundeswehr

In parallel to the operational readiness situation, the digitisation of the Reporting System for the Internal and Social Situation of the Bundeswehr (ISoLaBw) was initiated under the technical leadership of BMVg FüSK (Directorate-General for Forces Policy) III 1. In the current SASPF solution the dashboard supplies an up-to-date and georeferenced situation overview concerning reportable processes in the Bundeswehr so that evaluations can be accessed via standard reports at the push of a button.

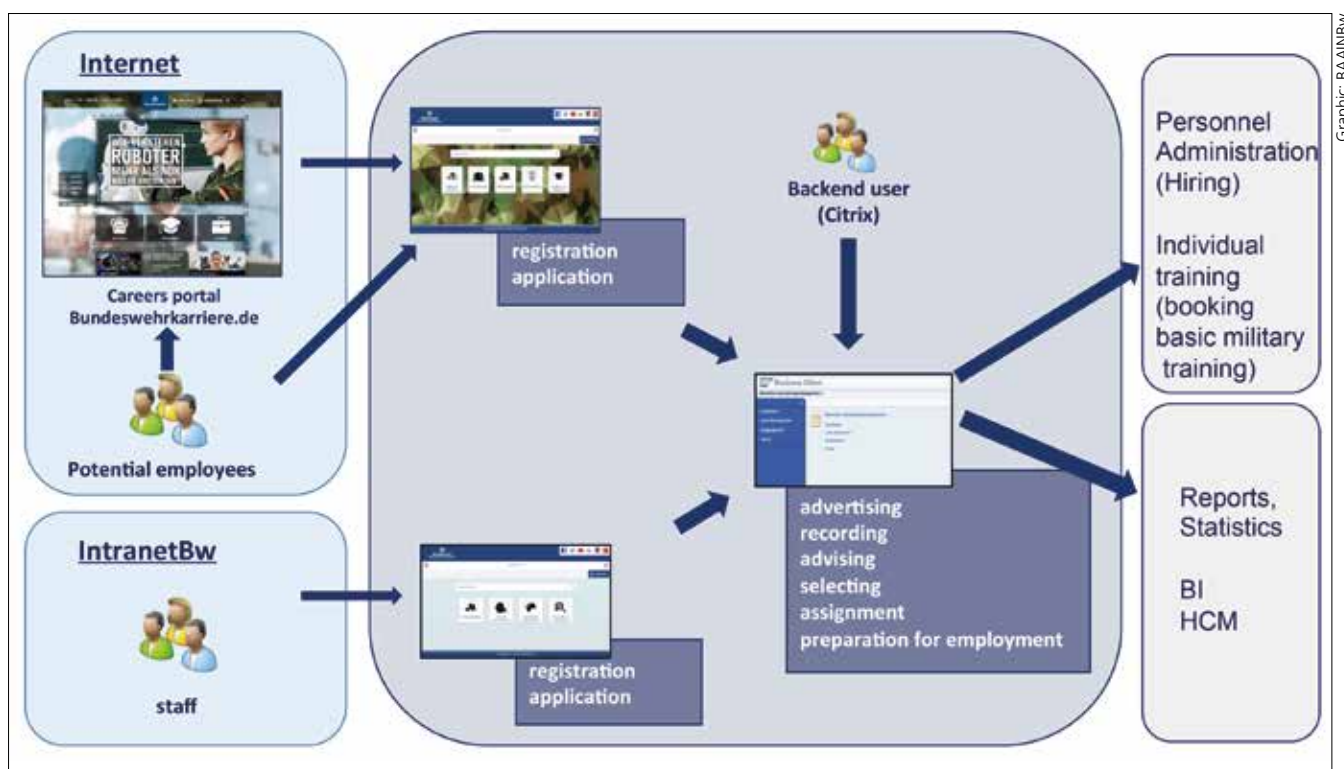
One of the highlights of the project was the SAP Innovation Award 2018 which SAP annually grants to customers who transform their business model, drive innovation and are part of the spearhead of the digital economy. The Bundeswehr and its project IT-Support for the Reporting System for the Internal and Social Situation of the Bundeswehr (ISoLaBw)

with topics such as big data, the Internet of things, augmented reality, predictive maintenance and machine learning. As a result the Bundeswehr will be able to act faster, more precisely and more reliably than in the past. The technology change therefore contributes significantly to the armed forces' ability to act at the international level. The declared aim is to replace large parts of the Bundeswehr SAP system landscape with S/4HANA before the end of 2025.

The new platform will also lead to a simultaneous and significant increase in the BMVg's control and reaction capabilities. The increasing dynamics in the fields of foreign and security policy and international Alliance commitments require an improvement of these abilities and, at the same time, a higher operational readiness of the Bundeswehr.

IT Support for the Operational Readiness Situation

For the assessment of the operational readiness situation a holistic view of all relevant situational information is essential. With regard to the supply of this situational picture and other digital situational pictures such as logistic information containing data supplied by external service providers and in order to facilitate single-medium evaluations of the operational readiness situation, the project "IT-support for the operational readiness situation (IT-U-EBL)" was initiated in 2017. The clear intention was to provide a digital application to the Bundeswehr which serves as control tool and central management cockpit (dashboard) for the user. IT-



E-recruiting is part of the project “The Bundeswehr leads the way – An active and attractive alternative.”

received an honourable mention for being a role model for digitisation in the public sector.

IT Support CPM

Real-time data processing, comprehensive simulation and analysis tools and modern intuitive applications are only some of the requirements for the digitisation of the Bundeswehr. The single-medium processing of data and the supply of an integrated, efficient and continuous IT support for the management of defence projects are other indispensable requirements that must be optimised. These requirements will be fulfilled with the project IT Support CPM, Replacement of EMIR and IVF/VOCON, in short: IT-U CPM that will be finalised in 2021 and is divided into three sub-projects. In the context of the project six legacy procedures, particularly EMIR and IVF-VOCON will be replaced with an innovative and highly integrated SASPF-based solution. Apart from the usual project management functions (work package planning, resource management, scheduling), IT-U CPM distinguishes itself by offering a complete budget integration which facilitates a detailed funding for each budget item – down to contract item level – and fund planning and management over time. The single-medium initialisation of the procurement process and the subsequent digitised awarding process will also be available. The implementation of extensive control-

ling including a digital staffing process, risk management and risk reporting is another focus of the project.

Furthermore, the integration of the planning and management of research & technology projects and the accompanying reporting system will be realised. Apart from the above-mentioned functions, solutions for Government Quality Assurance will be implemented which will provide extensive support for planning and conducting GQA inspections and supplier audits.

This also includes extensive technical reporting which at the same time underlines and exemplifies the highly integrative character of all parts of the product as it interacts with procurement data and project management data. The common parts of the solution that have been fielded since 2016 underline this aspect. The Procurement Analysis, for example, has delivered comprehensive evaluation methods and thus substantially contributed to steering decisions in Bundeswehr strategic purchasing while the Contract Lifecycle Management has made the day-to-day operations in contract management considerably easier and more efficient by using clause libraries and due to the electronic staffing of draft contracts.

In the larger context of the single-medium processing of data, the integration of electronic invoices seamlessly continues in the overall project context. The processes and the SASPF system landscape in particular must be compatible with federal and EU

legislation. Since the entry into force of EU directive 2014/55/EU on electronic invoicing in public procurement dated 26 May 2014 public customers and contracting authorities have been obliged to accept and process electronic invoices.

E-invoicing

The E-invoicing project – electronic processing of invoices – therefore ensures that the EU directive, which is to be translated into national law from 27 Nov 2018, is also applied by the Bundeswehr. Electronic invoices are invoices which are generated,



transferred and received in a structured electronic format so that they can be processed automatically and electronically. An image file, a simple PDF file without structured data or a scan of a paper invoice are therefore not electronic invoices according to the EU directive.

In order to implement the legal requirements, a federal central platform for the receipt of invoices (ZRE) will be developed

by the Federal Ministry of Finance (BMF). Subsequent to registration, suppliers and service providers will be able to submit electronic invoices to the ZRE platform via different channels of communication (DE-Mail, email, web service, ...). The reference information and invoice content additionally required for machine processing will be defined between the customer and the suppliers and service providers when awarding the contract. After successful receipt of the invoices a syntax validation and a formal check in accordance with Art. 14 of the German Turnover Tax Law takes place. Incorrect invoices will be rejected. After a successful check, the format of the invoices is transformed to a unified agency electronic invoice format and the invoices are stored in a specific agency area from which they can be retrieved.

The retrieval of invoices addressed to the Bundeswehr (invoice data record including processing log, additional documentation substantiating the invoice and/or annexes) from the ZRE platform and their subsequent distribution to the invoice processing systems is guaranteed and implemented by the E-invoicing project. In order to fulfil the requirement of revision-safe archiving, an electronic archiving system is added to the existing SASPF IT landscape.

E-Recruiting

The aim of a single-medium IT system is thus taken into account clearly and in a future-oriented manner by not only considering procedures and processes but also the people who have to act within these systems. These people have to be recruited for the armed forces with a view to future developments while the competition with other employers is increasing. The Bundeswehr as an employer increasingly relies on modern IT support for the recruiting of civilian and military personnel. The SAP component based E-recruiting application system is an effective tool with an integrated application management system; it supports personnel recruitment and is an important step towards the near-complete digitisation of the business process "personnel selection and staffing". E-recruiting is a subproject of the agenda "Bundeswehr in Führung – Aktiv.Attraktiv.Anders." ("The Bundeswehr leads the way – An active and attractive alternative") and is connected to the careers portal, which was implemented and modernised at the same time. People who are interested or potential applicants for careers and actual posts in the Bundeswehr can find detailed information about job advertisements and career in-



Photo: BAAINBW

The SAP Innovation Award 2018 was received by Captain Dr. Göbel and handed over by Rolf Schumann, Global General Manager Platform & Innovation at SAP.

formation in the online application portal and they can enter and edit all their personal data required for the application for a military career or a civilian post.

However, E-recruiting is far more than the above-described online application portal since the entire process of external and internal recruiting is supported by largely single-medium IT. This process includes determining the demand for personnel, job advertisements, the entire communication between the Bundeswehr and the applicants, aptitude testing, assignment to posts, generating the pre-employment documents up to the point where the data is transferred to the central personnel administration within SASPF. This does not just apply to military and civilian careers but to nearly all groups and posts and vacancies that need to be filled.

In order to implement the overall solution it was necessary to find new approaches in the SASPF programme and realise an SASPF-based partial solution with access from outside the existing Citrix-based access infrastructure from the Internet or the Bundeswehr Intranet. The main prereq-

uisite was the creation of an extensive IT security architecture integrating or creating components or services in the central Bundeswehr gateway and the SASPF system landscape.

The project with all its components has been in service since 2017. In the meantime additional needs for change have been recognised and a follow-on project, E-Recruiting 2nd Level, has been planned and integrated into the SASPF programme strategy in order to process the initial capability, reservists for example.

Conclusion and Outlook

The SASPF programme solution portfolio described here constitutes a fundamental pillar for the achievement of the Bundeswehr goals in the command, defence and in-service use agendas and significantly contributes to improving the Bundeswehr's steering and command capabilities. It successfully implements the requirement for a full-coverage IT support with SASPF as stipulated in the IT strategy and thus effectively contributes to digitalizing the Bundeswehr.

Complex Services/Purchasing Directorate (E)

The Purchasing Directorate is responsible for the procurement of commercial or specialised materiel for the armed forces. The Directorate buys two million different items, 500,00 of which regularly.

Complex Services (KDL) and the Bundeswehr Purchasing Process (EinkaufBw)

The Complex Services/Purchasing Directorate (E) is based in Lahnstein and Koblenz, currently being subdivided into three divisions and 13 branches as well as the Directorate Staff (EAS) and Directorate Controlling/Bundeswehr Purchasing Controlling (EAC).

The Tasks of Directorate E within BAAINBw

In fulfilling its tasks Directorate E is working on all three pillars of the procurement and in-service process:

1. Procurement of materiel solutions i.a.w. the Customer Product Management (CPM) procedure;
2. Bundeswehr Purchasing (EinkaufBw) for non-project procurement; and
3. Satisfaction of demand via Complex Services (KDL).

The procurement and in-service process is characterised by clearly assigned responsibilities, clear-cut decision-making powers and a reduced number of interfaces.

Bundeswehr Purchasing (EinkaufBw) – Divisions E1 and E2

Bundeswehr Purchasing is defined as the procurement of commercially available and/or Bundeswehr-specific material goods as well as rights and services which serve to maintain the operability of the Bundeswehr during missions, exercises and routine duty at home and abroad. Procurement by Bundeswehr Purchasing also encompasses the satisfaction of demand for follow-on spare parts for weapon systems/equipment during their in-service use phase and requirements which are met via interdepartmental procurement (e.g. "Kaufhaus des Bundes", the Federal government's virtual marketplace). A wide spectrum of different supply items is procured – the number amounts to roughly 2 million, of which 500,000 are purchased regularly. The items purchased range from small, i.e. off-the-shelf parts, such as screws, nuts and gaskets, to Bundeswehr-specific materiel for equipment

and complex weapon systems (follow-on procurement of spare parts for weapon systems).

Bundeswehr Purchasing has established an economically optimised and legally compliant process for satisfying materiel requirements using modern methods, following a comprehensive Bundeswehr-wide approach, and clearly assigning responsibilities.

The core principles of Bundeswehr Purchasing are as follows:

- a strategic method of work including a centralised and overarching command and control process;
- stringent materiel segment management oriented towards the procurement market; and
- a process-oriented organisational structure.

By implementing Bundeswehr Purchasing, a strategic tier of procurement has been added to the current, mostly operational-level tier represented by the procuring agencies. The intention is to ensure an optimised and comprehensive purchasing process. The overall responsibility for the purchasing process lies with Directorate A III at the Federal Ministry of Defence. It is at that level that the organisational framework for Bundeswehr Purchasing is set, purchasing strategies are adopted and policies are established. The responsibility for further developing the process and enforcing it at agency level lies with the Director of the Complex Services/Purchasing Directorate at BAAINBw. The Purchasing Manager ensures that all of the Bundeswehr's purchasing agencies – currently numbering well beyond 900 – put the guidelines into operation.

The Bundeswehr Purchasing system is structured according to "materiel segments", which are categorised according to the eCl@ss classification system. Based on a holistic approach, the materiel segments constitute clusters of supply items which are procured on the same or similar markets. The organisational structure mirrors these divisions.

The implementation of the strategic purchasing process was carried out systematically in three phases. The first phase saw the integration of three materiel segments, namely vehicle technology, office supplies

and medical technology, into Bundeswehr Purchasing. Some early positive results were achieved owing to optimised requirements planning which was co-ordinated with the users. For instance, instead of frequently inviting tenders in order to satisfy recurring small-scale demands, BAAINBw now concluded multiple-delivery agreements with a term of up to three years.

The second phase of the Bundeswehr Purchasing optimisation process was successfully concluded, with the exception of the materiel segment "general services". The following materiel segments were transferred into the Bundeswehr Purchasing Process: electrical engineering; automation engineering; process control engineering; housekeeping; housekeeping technology; foodstuffs; beverages; tobacco products; energy; extraction products; recycling products and residues; the partial segments grid-based energy sources (ZEE) and POL (petroleum, oil and lubricants); and the information, communication and media technologies materiel segment. After having completed the second implementation phase, the main focus was on optimising the quality and availability of data. In order to standardise Bundeswehr Purchasing, data on creditors and the framework agreements that had so far been managed in a decentralised manner was now centralised and transferred to a creditor master data management system. In addition, uniform information on the framework agreements of the entire Bundeswehr is now available to all procurement agents in a common framework agreement database. However, collecting, maintaining and displaying all data related to framework agreements down to item level with the help of the SASPF software (short for Standard Application Software Product Family) remains the short-term objective.

In the context of the 2016/2017 purchase planning process, the following materiel segments were finally merged into the strategic purchasing process at the beginning of the second quarter of 2017:

- auxiliary supplies, additives, cleaning agents;
- machine parts, fasteners, fittings;
- laboratory material, laboratory technology;
- machinery, appliances;

- operational equipment, workshop equipment (related to the major organisational element of Equipment, Information Technology and In-Service Support (AIN));
- operational equipment, workshop equipment (related to the major organisational element of Infrastructure, Environmental Protection and Services (IUD));
- packaging material;
- occupational safety, accident protection;
- piping technology;
- construction technology;
- organic chemicals; and
- semi-finished products, materials.

Preparations are currently ongoing to ensure that the complex "general services" material segment will be implemented as fast as possible in the major organisational elements AIN, IUD and Personnel.

The target of Bundeswehr Purchasing is to satisfy demand in a time, quality and performance-oriented manner while taking full advantage of cost-efficiency potentials and subscribing to a holistic

expertise gained during the AAEBw2 project will be incorporated into prospective optimisation measures. Division E1 is divided into three branches and pursues the following tasks:

- creating and providing purchasing policy documents (e.g. order catalogues) and purchasing statistics and reports for BAAINBw;
- continuously developing the Bundeswehr Purchasing Process, drawing up policy documents and planning the purchasing process;
- managing the Bundeswehr Purchasing performance process and the procurement business process;
- analyzing the purchasing process;
- ensuring sustainability in procurement;
- acting as the design office for BAAINBw; and
- acting as BAAINBw's point of contact for all bids.

Division E2 is organised into four branches, carrying out both strategic and operational tasks at material segment level. It is divided according to the different segments of the eCl@ss structure.

are subdivided into weapon system-specific and policy activities. Therefore, the strategic "tools" needed for the development of the operational procurement activities in the majority of material segments have been concentrated in one organisational unit.

In addition, Branch E2.1 is in charge of supplier management within the Bundeswehr Purchasing Process, an area that is currently being set up. To start with, reminder procedures within the Bundeswehr Purchasing Process were revised, with a pilot phase currently ongoing. The reminder procedures mostly aim at monitoring compliance of individual contractors with contractually agreed delivery dates. Also, supplier management currently lends support in cases of faulty deliveries as well as in the improvement of the process flow of incoming and outgoing goods in fixed logistics facilities, including the Bundeswehr material warehouses. In future, supplier management is intended to support the strategic and operational-level parts of the Bundeswehr Purchasing Process by monitoring the market to find, above all, reliable suppliers.

In turn, strategic activities for material segments which are not weapon system-specific and do not touch policy are pooled in Branch E2.4. This includes medicine/medical technology and closely related material segments, for instance laboratory equipment and technology. Both branches have the authority to conclude strategic contracts.

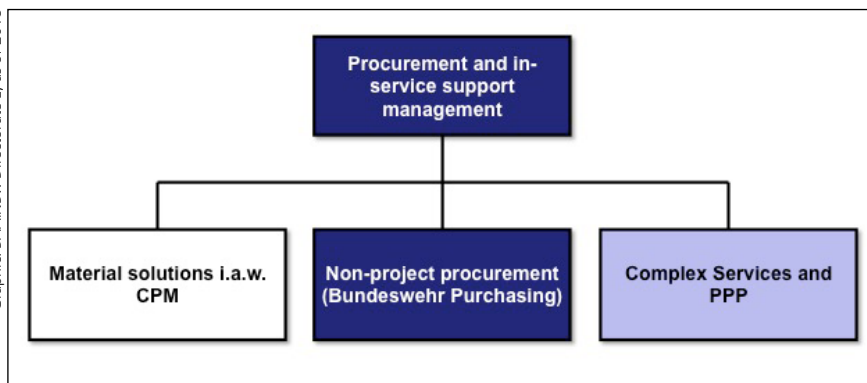
While carrying out the strategic activities mentioned above, E2.4 is also responsible for strategic contracting (standard and interdepartmental indefinite-quantity agreements) in the POL material segment, ensuring POL supply at home and abroad.

Operational tasks are concentrated within Branches E2.2 and E2.3. They deal with the actual procurement of goods. Essentially, this encompasses the following activities:

- implementing the procurement strategies and standards in case any have been set;
- carrying out the public contract award process;
- order processing;
- checking deliveries and invoices;
- carrying out monetary transactions.

These two branches are responsible for procuring almost all of the follow-on spare parts for in-service weapon systems/equipment that are required by the forces. A considerable share of the contracts is tendered competitively and with SMEs taking part in the process.

Graphic: BAAINBw Directorate E, as of 2018



Bundeswehr procurement options

understanding of service quality.

The framework conditions for Bundeswehr Purchasing have changed due to continuously increasing responsibilities placed on the Bundeswehr and overarching changes to both its IT and its personnel structure. This is why in December 2015 the order was issued to carry out an open-ended assessment and evaluation of alternative forms of organisation of Bundeswehr Purchasing, and to publish a key issue paper detailing recommendations for action on the future shape of Bundeswehr Purchasing. In February 2017, a follow-on project called "Alternative Approaches to Bundeswehr Purchasing (AAEBw), Phase 2" was tasked, based on the tabled recommendations for action. This project has been completed in the meantime. The

This enables the division to conduct targeted searches for required supplies and equipment on the procurement markets by developing and implementing specific procurement strategies for each material segment. Each material segment is controlled by a material segment manager. They have directive authority cutting across the boundaries of the major organisational elements. Support in terms of purchasing process analysis is provided for all specific material segments by BAAINBw Branch E1.1. This facilitates a common procurement process throughout the Bundeswehr for the individual segments. This, in turn, leads to pooling and synergy effects.

Strategic activities for material segments which have already been transferred are now bundled in Branch E2.1, where they

In future, operational procurement procedures are intended to be developed further by continually optimising the Bundeswehr Purchasing Process. This can be achieved, for instance, by further increasing the number of framework agreements that are initiated via material segment planning, with the purpose of using the available resources more efficiently.

Complex Services – Division E3

Public-private partnerships (PPP) – Complex Services (KDL) constitute the third pillar of the procurement and in-service process.

It is a form of satisfying requirements which can occur in all Bundeswehr task areas and processes whenever a demand cannot, or is not supposed to be, met by using Bundeswehr-owned resources alone. Unlike procurement in accordance with the amended CPM, this procedure focuses not on the product, but on the service itself.

The structure of the division is as follows: Branch E3.1 develops project strategies for complex services projects, works out the performance process, develops

it further and supports the evaluation and statistics phase of complex services projects. On top of that, Branch E3.1 supports the other branches within the remit of Division E3 in all common and policy tasks related to project management, the implementation and documentation of cost efficiency analyses, the creation of statements of work, and during expression-of-interest procedures.

Branches E3.2 through E3.4 take on project management responsibilities for complex services of which Directorate E is in charge. These include:

- Bundeswehr Vehicle Fleet Service System (System BwFPS): meeting the Bundeswehr's mobility requirements involving commercial, unprotected vehicles;
- Army Maintenance Logistics (HIL): complex maintenance services for entire Bundeswehr land systems;
- Package 1 CBRN supplies: supply management of the Bundeswehr's individual CBRN protective equipment and clothing;
- Package 2 CBRN supplies: supply management of both common and weapon system-specific material for Bundeswehr CBRN defense;

- PPP Bundeswehr air traffic control training: training of Bundeswehr air traffic controllers and aeronautical information officers (Flugberater);
 - Central Bundeswehr Spare Parts Logistics (ZEBEL): supplying civilian and selected military maintenance facilities with government-owned spare parts via a private service provider;
 - clothing management (supplying Bundeswehr soldiers and civilian employees with clothing and personal equipment).
- Branches E3.2 through E3.4 have been set up as organizational elements for the project management of complex services projects, taking both technical-logistic and overall control of the aforementioned projects. Projects for complex services are systematically developed and/or moved forward and implemented by these branches. Integrated project teams provide the framework for interdisciplinary cooperation across organizational boundaries. They contribute significantly to the success of the project work. The objective always is to develop customised capabilities for our forces in a timely manner while at the same time complying with the legal framework conditions and providing cost-effective solutions.

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Branches E3.5 and E3.6 are responsible for processing contracts, dealing with issues related to contract award law and negotiating prices for the projects. Additionally, Branch E3.6 is in charge of processing and awarding contracts related to transportation in the Bundeswehr (for transport by road, rail, air and sea). As such, Branch E3.6 is the central contracting authority ensuring that the demands for transportation in

1. Bundeswehr Vehicle Fleet Service System (System BwFPS)

The Bundeswehr Vehicle Fleet Service System serves to meet the mobility requirements of the Bundeswehr in an economically viable manner by providing commercial, unprotected vehicles. The services offered by BwFPS GmbH include the provision of commercial ve-

hicles, commercial special-duty vehicles, commercial vehicles with special military equipment as well as services. The contract on mobility and vehicle fleet management services for the Bundeswehr and measures intended to enhance the Bundeswehr Vehicle Fleet Service System entered into force on 1 July 2016. It merges the previous three framework contracts, i.e.

- the contract on the provision of commercial vehicles,
 - the contract on the provision of vehicles with special military equipment and driver training vehicles, and
 - the contract on the build-up and operation of a central vehicle management into a single framework contract.
- Another innovation of the BwFPS follow-on solution is that it is unlimited in time. This provides predictability in planning and makes it possible to implement optimization measures over an extended time period. In order to maintain a constant incentive to innovate even in the context of an open-ended contract, a new instrument named "Continuous Outcome Monitoring" (Kontinuierliche Ergebniskontrolle – KEK) was created. It serves to evaluate whether BwFPS GmbH provided services in a cost-efficient manner and in a way that is tailored to the demand, and to highlight existing potentials for optimisation.

The "Competition Survey" is intended to examine whether standard commercial mobility services that BwFPS GmbH

provides for the Bundeswehr can be procured more cost-effectively in certain places. The Bundeswehr Vehicle Fleet Service System is faced with additional challenges which transcend the economic level, for instance creating the necessary preconditions for what is called "instances of demand" (Bedarfsfall BwFPS). Such instances arise when, based on the situation in a mission country, military forces assume control, maintenance, ma-

2. Army Maintenance Logistics (HIL)

HIL GmbH was founded in February 2005 as a cooperative company intended to provide services for military land systems. In 2013, the Federal Ministry of Defence became the company's sole holder. Since then, it has been run as an in-house company of the Federal Government.

The service model has proven to work well in practice and has become indispensable in terms of ensuring materiel readiness within the Bundeswehr.

The HIL follow-on solution has been in operation since 1 January 2018.

The HIL follow-on solution contract, signed on 13 July 2017, is valid indefinitely. The aim of the follow-on solution from 2018 onwards is to keep a set portfolio of protected and unprotected military wheeled and tracked vehicles available under the economic management of a service provider which is integrated into the Bundeswehr's logistics system. The scope of services to be provided under the HIL follow-on solution encompasses, amongst other things, an expansion of the product portfolio for all protected and unprotected military wheeled and tracked vehicles managed by the Bundeswehr itself, and the provi-



Service portfolio of BwFPS GmbH

the Bundeswehr are met both during routine duty (including exercises) and during missions (e.g. EUTM Mali, ATALANTA resupply etc.).

In that context, their area of activities also extends to processing cases of impaired contract performance, for instance transport damage.

Additionally, Branch E3.6 is in charge of managing the project "PPP Bundeswehr air traffic control training in Kaufbeuren" in terms of procurement and contract law. This contract provides for the training of Bundeswehr air traffic controllers and aeronautical information managers (Flugberater), including related services such as board and lodging.

A new training campus is currently being built in Kaufbeuren, expected to be ready for occupation in August 2019.

Finally, Branch E3.6 is responsible for processing and awarding various framework agreements for a wide array of support services within the FMOD's remit. The framework agreement on support services for project management serves as an example.

As a result, both the project management and the legal and economic expertise related to complex services are concentrated in one division, thereby making it easier to tap into potentials for optimization.

The following list of outcomes drawn from current projects serves to illustrate the broad spectrum of activities:

sion of services during routine duty, exercises or deployment abroad (first use from 2019).

- Compared to the current scope of services, this will mean:
- ensuring service levels of 70% availability on workdays, and
- a significant increase in the number of products managed within the portfolio to up to 19,000 land systems, as well as
- up to 29,000 installation kits and pieces of equipment.

The services are mostly provided by subcontracted private-sector companies and by assigned non-military Bundeswehr staff in infrastructure provided for the purpose.

The provision of services by HIL GmbH, itself an in-house company owned by the Federal Government, is therefore going to continue seamlessly.

3. Central Bundeswehr Spare Parts Logistics (ZEBEL)

The project "Central Bundeswehr Spare Parts Logistics (ZEBEL) 6" ended on 31 August 2017. BAAINBw Directorate E

signed the contract for the ZEBEL 7 project on 25 August 2017. Working in a timely and needs-oriented manner, it thereby provided the conditions for continuing the project, including improved IT connectivity and an extended service portfolio for the users.

The ZEBEL 7 contract focuses on the provision of spare parts tailored to individual maintenance requests from the contractor's warehouse as well as on connectivity between contractor IT systems and the Bundeswehr IT System. The scope of services includes the following elements: the provision of spare parts from a central warehouse; transportation of the parts to the maintenance facilities; and handling of all management tasks in co-operation with the Bundeswehr Logistics Command (LogKdoBw), the Bundeswehr Logistics Center (LogZBw) and BAAINBw. Material and data management services for Bundeswehr-owned stores that are not self-sufficient will constitute additional elements of the ZEBEL 7 project. This consolidates and standardises the contractual basis of spare parts logistics. The contract will run until 2024 and have a volume of about €146M.

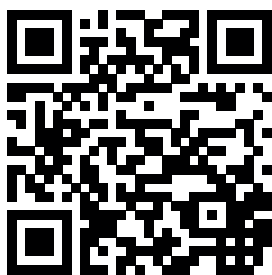
4. Bundeswehr Clothing Management (BMBw)

The Bundeswehr Clothing Management (BMBw) is tasked with meeting the Bundeswehr's demand for clothing and personal equipment, providing the Bundeswehr's soldiers and eligible civilian staff with such items.

BAAINBw Branch E3.4 assumes the duties of project management and of materiel responsibility for operational viability (MatVER) in the area of clothing and personal equipment. Thus, clothing and personal equipment are entirely developed within the CPM framework, with procurement policy documents (phase documents, statements of work and/or technical specifications) being drawn up and clothing and personal equipment being managed by the materiel manager for operational viability during the in-service phase.

Bundeswehr clothing management, a complex service, is substantially supported by BwBekleidungsmanagement GmbH (BwBM), an in-house clothing services provider of which the Bundeswehr is the only associate partner.

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Photo: HIL GmbH

A HIL maintenance facility

BwBM is tasked with:

- materiel planning (requirements planning and control);
- procuring clothing and personal equipment according to BAAINBw quality goals;
- warehousing;
- planning and carrying out distribution;
- issuing and taking back clothing of Bundeswehr members on agreed dates, during routine duty and for deployment (issuing clothing in Germany and/or providing clothing in Germany for deployments abroad);

Implementation of the KSS SK project was initiated in the second half of 2017. By the end of that year, 85,000 pairs of light combat boots (replacing the "Einsatzkampfschuh" combat mission boots) and heavy combat boots (replacing the "Kampfschuh, allgemein") had already been procured. An additional 210,000 pairs were purchased in 2018. By the end of 2018, almost all soldiers had been provided with a first pair of heavy combat boots. 2019 will see the introduction of corresponding state-of-the-art functional socks. Due to the size of the procurement project, it is not possible to issue the new combat boots to all soldiers at the same time. Accordingly, the service branches have drawn up an order of priority for their supply. Outfitting the entire Bundeswehr along the lines of the Armed Forces Combat Boots System project will be completed by the end of 2020. To this end, a total of about one million pairs of combat boots are being procured.

Armed Forces Combat Clothing (KBS SK)

The Armed Forces Combat Clothing project sees the fielding of functional clothing for soldiers which helps to enhance survivability, protection and sustainability of armed forces on deployment around the globe. The clothing is meant to support the human body in conducting operations even under extreme conditions, at day and night, under any weather conditions, and in almost all climatic regions, terrain conditions and urban environments.

- (3 or 5-colour camouflage print)
- Suspenders
- KBS SK combat suit jacket (3 or 5-colour camouflage print)
- KBS SK combat suit jacket (long, 3 or 5-colour camouflage print)
- KBS SK combat suit trousers (3 or 5-colour camouflage print)

The roll-out of Armed Forces Combat Clothing has already started. It is intended to procure 50,000 Armed Forces Combat Clothing kits by 2021 and to ensure that by 2027 90,000 soldiers will be outfitted with them.

Modular Ballistic Protection and Load-Carrying Equipment (MOBAST)

The Modular Ballistic Protection and Load-Carrying Equipment for soldiers (MOBAST) consists of a modular body armour system and the corresponding basic load-carrying equipment (multi-purpose magazine pouches, fast rope bag, multi-purpose bags etc.) as well as underwear with integrated protection against micro fragments. The aim of this project, which falls within the wider framework of what is called "task-oriented equipment", is to replace all previous common versions of body armour and to considerably increase the total quantity of available body armour in the medium and long term. To this end, the procurement of around 46,000 systems by 2025 will be tasked. In the long term, a further considerable increase is planned to be completed by 2031.

HIL GmbH's scope of services



70% availability of military wheeled and tracked vehicles each working day.

Source: BAAINBw Directorate E

HIL GmbH's scope of services

- exchange, refitting, laundry, dry cleaning, modification and maintenance of clothing and personal equipment.
- The following clothing projects currently stand out from a vast array of individual projects:

New Armed Forces Combat Boots System (KSS SK)

Within this project, each soldier is issued two pairs of heavy, and one pair of light, newly fielded combat boots. The new aspect in Bundeswehr terms is that each soldier can choose between models from two different manufacturers in each case.

To that end, the following components will be introduced:

- Cold-weather liner jacket
- Cold-weather liner trousers
- Waterproof liner jacket
- Waterproof liner trousers
- Multi-layered undershirt/underpants
- SOFCOM undersocks
- Insulation suit (insulation layer II)
- Underwear (hydrophilic, short)
- Gloves
- Dust protection cloth
- Combat shirt (3 or 5-colour camouflage print)
- Hardsided knee protector
- Mobile waterproof protection hood

Official Provision of Service, Dress and Sports Clothing ("Fiscal Supply")

An efficiency analysis is being carried out in order to assess whether service, dress and sports clothing can be provided officially for all soldiers. This includes furnishing all-season jackets and soft-shell jackets, both of which have been given priority and will be provided officially from the next fiscal year onwards.

New Combat Helmet

The Bundeswehr Office for Defence Planning is currently drawing up the Capability Gap and Functional Requirement document in respect of a new combat helmet. This project aims at replacing the common combat helmet introduced in the 1990s and its variant for airborne infantry with a more modern model, including capability upgrades (e.g. integrated mounts for night-vision devices and other additional equipment). ■

Directorate T – Common Technical, Logistic and Economic Activities

At Directorate T, the essential common technical, logistic and economic activities of the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) are pooled and managed centrally.

Directorate T has a wide range of responsibilities:

- Controlling (e.g. research and technology projects, enhancing and enabling projects),
- Coordination (e.g. operations analysis, fast-track initiatives for operations),
- Support (e.g. BAAINBw executive groups, projects, other directorates, all logistic processes),
- external representation (e.g. other major organisational elements, agencies, departments and international organisations),
- licensing authority (e.g. transportation licenses), surveyor activities (e.g. accident investigations, price audits).

By combining the common specialist tasks within Directorate T, an essential element was established in the sequence of BAAINBw activities. In addition, Directorate T is deeply involved in the strategic topics of the Armaments Agenda, the strategic control of research and technology matters, and the In-Service Support Agenda. Consequently, it also plays an important role for efficient armaments management.

Division T1

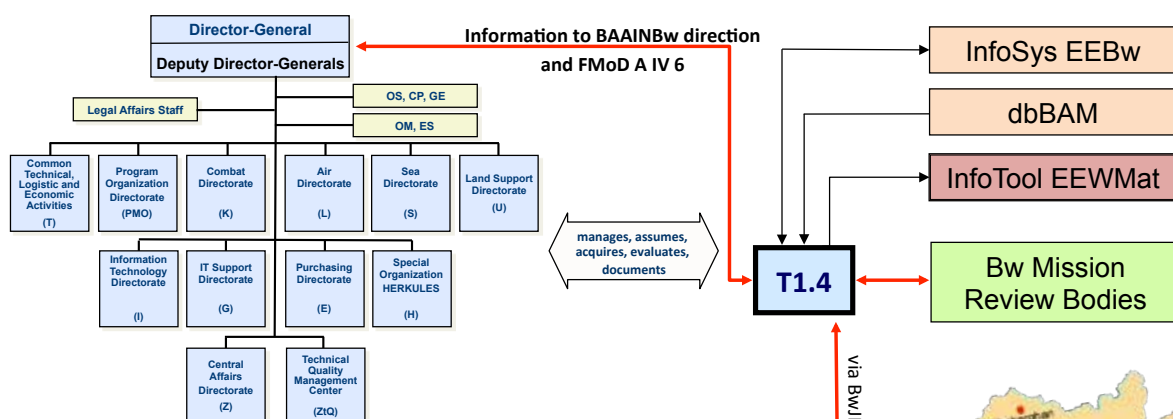
At Division T1 the following tasks have been combined: mission-related matters, overall coordination of research and technology (R&T) matters, international cooperation and project-related international departmental agreements, administrative as well as enabling and enhancing assistance. The spectrum of Division T1 is complemented by tasks relating to policy and technology for Modelling and Simulation (M&S) and for Concept Development and Experimentation (CD&E) as well as tasks relating to foreign defence material, national and international standardisation, and technical specifications.

Branch T1.1 is responsible for administrative and materiel assistance and concludes recycling and/or disposal contracts for selected directorates required for the further handling of materiel to be disposed of. This Branch is also in charge of coordinating the task of “enhancing and enabling programmes” within BAAINBw. The objective of enhancing and enabling assistance is to strengthen partner nations and allies

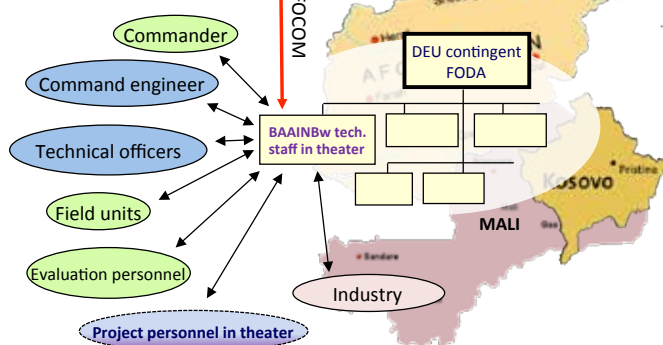
in order to enable them to perform peace-building tasks and post-crisis rehabilitation as well as crisis prevention and management in their own responsibility and in a sustainable fashion.

Branch T1.2 is in charge of the negotiations and the finalisation of project-related international armaments cooperation with other nations, including the cooperation with different international organisations and agencies (NATO, EDA and OCCAR). Moreover, the Branch supervises the German side of the Foreign Military Sales programme of the US Department of Defence. Agreements have to be prepared and negotiated as part of the armaments cooperation, for example Memorandums of Understanding (MoU), Project Arrangements (PA) and Data Exchange Arrangements (DEA). FMS is in charge of procurement contracts for weapon systems (currently C-130J, PEGASUS) and associated spare parts via the US military procurement authorities. Branch T1.3 coordinates and manages international cooperation in the field of common defence technological cooperation not linked to specific projects. This Branch is

Management of Mission Reviews by Branch T1.4



- Central evaluation by T1.4 and integration into the procurement and in-service process
→ Inclusion of the findings of the Bw Mission Review bodies by the responsible person
- Bi-weekly briefing on mission-relevant topics to the BAAINBw executive management



BAAINBw's central point of contact in general matters of OCCAR and EDA as well as Bundeswehr-wide liaison activities. In addition, it is responsible for preparing technical specifications (TL) and for managing and coordinating Bundeswehr standardisation activities.

Branch T1.4 assumes coordinating and controlling responsibilities in different mission-related subject areas. On the one hand, this Branch coordinates the procurement of mission-essential and urgent demand; on the other hand, it manages mission review tasks. Thus, lessons learned can directly be used for further development of

tion of Bundeswehr in-service systems in line with prevailing threats.

Branch T1.6 is responsible for Modelling and Simulation (M&S) as well as Concept Development and Experimentation (CD&E) at BAAINBw. The M&S controlling authority coordinates existing and newly established Bundeswehr M&S standards both nationally and internationally (NATO, EDA). This authority also manages several R&T projects with regard to the application and in-service use of M&S to further develop the simulations infrastructure and the cross-linking of simulation systems and real systems

ards concerning occupational safety and health, environmental protection, ergonomic design of workstations and weapon system and ammunition safety. Project managers are supported and advised by Branches T2.1 to T2.4 "Product-related protection activities".

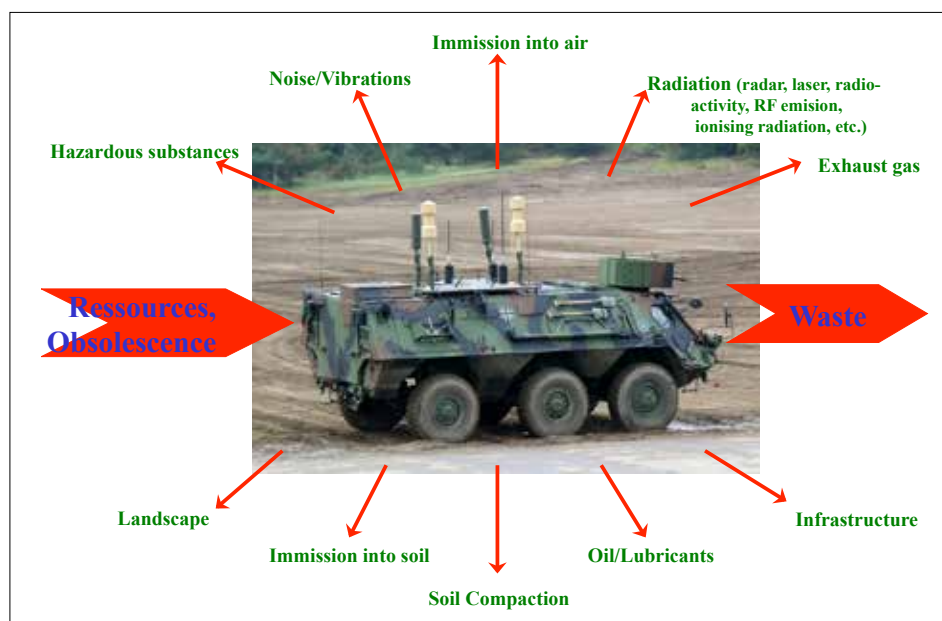
Apart from these traditional responsibilities in the field of occupational safety and health, the focus is also increasingly on functional safety and/or software security when assessing system safety due to progress and dominance of smart system components in weapon systems.

In addition, Division T2 deals with the investigation of accidents during handling weapons and ammunition and the Officer for Design Safety of Ammunition and Firing Safety at BAAINBw is part of the team.

At present, the coordinator for 3D printing, who supports the Bundeswehr in all matters relating to this new technology in cooperation with the 3D printing centre located at the Bundeswehr Research Institute for Materials, Fuels and Lubricants in Erding, is part of Branch T2.4.

Branch T2.5 manages and monitors the recycling and disposal of Bundeswehr materiel. Special attention is paid to observing the provisions of the War Weapons Control Act, weapons laws and environmental laws. This Branch also is the link to the federal-owned VEBEG GmbH.

With its functional demonstrators, WTS as Branch T2.6 and as the archive of the office and defence documentation library contributes to preserving know-how in the armaments sector and, thus, supports the career training of civil servants as well as pre-deployment training of forces by lending out foreign weapons. When visiting the public exhibition in Koblenz, citizens who are interested in defence engineering can delve into military technology and its fundamental lines of development from the late 19th century to today by means of 2,500 exhibits.



Impression of the environmental impact by an armoured transport vehicle

the materiel or for the provision of services. Moreover, this Branch coordinates decrees and orders relating to missions and exercises and within the civil-military cooperation framework to ensure that BAAINBw is adequately considered in these documents. Branch T1.5 coordinates all BAAINBw activities in the area of defence research and technology (R&T). Common objectives of all R&T activities are:

- to ensure that the MoD has its own analysis and evaluation capability to identify new technologies and their effect regarding threats to and capabilities of the Bundeswehr; and
- to provide scientific and technological insights into all relevant fields of technology to permit practical, intelligent and cost-effective decisions about equipment.

In addition, Branch T1.5 is responsible for the evaluation of foreign defence material. The evaluation of foreign defence materiel provides a valuable basis for the analysis of capability gaps and the technical adapta-

tion for experimental and training purposes. Current topics are, for example, the use of non-lethal weapons, 3D printing within the Bundeswehr, artificial intelligence and human enhancement (improving the performance capability of soldiers with the help of exoskeletons or "smart" clothing).

Division T2

When designing and using defence materiel, the system-related legal and Bundeswehr regulations with respect to occupational safety and health and environmental regulations are to be observed. Bundeswehr civilian and military staff are entitled to health protection in the workplace and humane working conditions in the same way as employees working in trade and industry. Furthermore, Bundeswehr activities must have no inadmissible impacts on the environment.

The project managers are responsible for the observance of regulations and stand-

Division T3

Within Directorate T, Division T3 is currently concerned with the harmonisation of European pricing regulations. The aim is to pursue further harmonisation of pricing regulations within Europe in order to guarantee comparable contract auditing conditions on EU level, beyond national borders. In the EUROMALE project, for example, it is the objective of Division T3 in cooperation with the PMO and OCCAR to prepare pricing provisions in cooperation agreements in such a way that international auditing teams can be employed in a transparent pricing process.

Division T3 is divided into the following branches:

- Cost Competence Centre (T3.1),
- Price Auditing Policy/Common Price Auditing (T3.2),
- Price Auditing Airframe/Engine (T3.3),
- Price Auditing Materiel Maintenance of Armed Services, Missiles, Other Aeronautical Equipment (T3.4),
- Price Auditing Electronics, Sensor Systems (T3.5) and
- Price Auditing Weapons and Ammunitions, Wheeled and Tracked Vehicles, Ships and Vessels, Other Equipment (T3.6).

The task of the cost competence centre is to provide support for the economic execution and implementation of projects and organisational measures in all CPM phases by means of

- parametric and calculated cost estimates,
 - efficiency analyses,
 - assessment of alternative forms of satisfaction of demand and
 - review and staffing of phase documents.
- In particular cases, additional cost-effectiveness evaluations are conducted outside of CPM. Furthermore, T3.1 is BAAINBw's central point of contact for matters regarding life cycle cost management.

The tasks of Branch T3.2 range from

- central contract control of price audits
- dealing with requests regarding fundamental 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 multinational organizations and NATO program offices and
- official assistance for foreign governments.

The operative price audit branches T3.3 to T3.6 evaluate, in terms of technical and economical aspects and in accordance with price law, whether cost prices are appropriate. For this evaluation, they use detailed cost data and documents and assess the quantities and valuations.

Division T4

In Division T4 "Common Activities Relating to Expenditures for Equipment, In-Service Use and Logistics" responsibilities of a primarily common technical, economical and logistic nature have been combined.

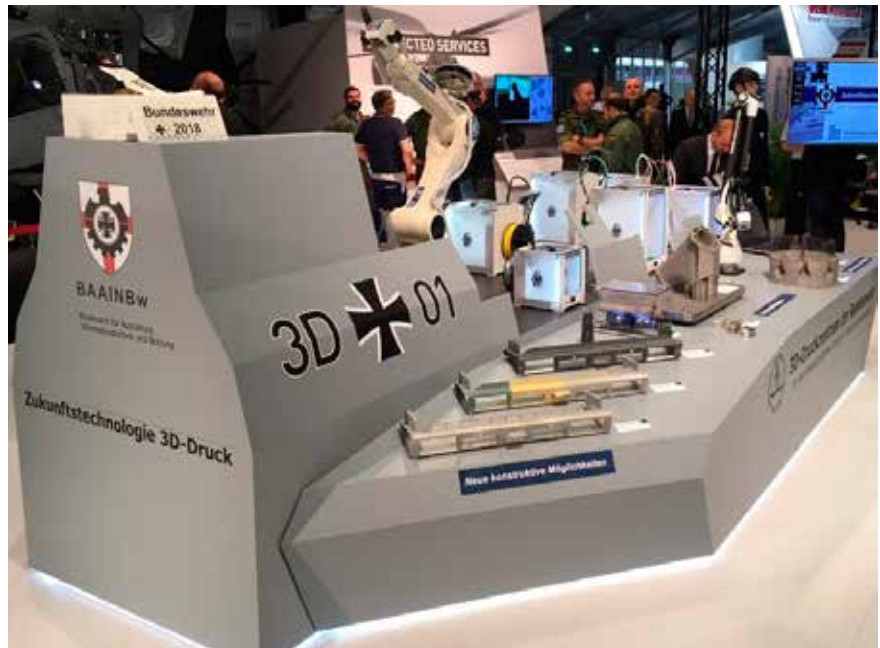
The tasks of Division T4 focus on project support in managing the logistics project element in all life-cycle phases of defence ma-

teriel. It serves as the link to the Bundeswehr Logistics Command and is, as such, essential service provider in the implementation of product-related logistic processes. Furthermore, in cooperation with the Logistics Command BAAINBw strongly contributes to the tailoring and further development of the Bundeswehr Logistics System.

Branch T4.1 assumes basic Equipment, In-Service Use and Logistics tasks and, within the framework of technical support tasks, advises the projects with regard to the lo-

(Bundeswehr technical centres and research institutes) and assumes technical supervision of these agencies with regard to their logistic tasks in the execution of orders, materiel management, maintenance and equipment planning.

Branch T4.5 is responsible for the management of imports based on procurement contracts of BAAINBw and its subordinate units, the Federal Office of Bundeswehr Infrastructure, Environmental Protection and Services, the Bundeswehr universities



Presentation of products manufactured using a 3D printer

gistics project element. Distinct from Branch T4.1 are the Branches T4.2 to T4.5, which provide operational support to project directorates and agencies.

The Branch T4.2 provides the project divisions with technical advice in all issues regarding materiel management (for example, management and prediction of inventory additions) as well as condemnation of defence materiel. In addition, the appointed materiel condemnation officer makes conclusive decisions about all condemnations. Branch T4.3 maintains the catalogue of materiel planning objects for the Bundeswehr across organisations, thus providing the basis for materiel target planning in all agencies. Furthermore, the Branch advises and supports the project directorates of BAAINBw with regard to codification of materiel (on individual request), is responsible for user administration in the "Complete Equipment Schedule Annex Sheet" data processing procedure, assigns project identifiers and defines technical responsibilities for supply items.

Branch T4.4 provides operational support to agencies subordinate to BAAINBw

and the Bundeswehr Geoinformation Office. It is also responsible for exports/shipments for disposal and Bundeswehr materiel transfers to other countries including requests to the Federal Office for Economic Affairs and Export Control, customs clearance and export control at BAAINBw. In addition, the Branch is responsible for and manages transport activities, fundamental transport issues as well as Bundeswehr materiel loans, free-of-charge transfers and the end use of defence materiel as well as maintenance activities for equipment loaned by HIL GmbH.

In addition to these primary tasks, Division T4 is involved in several special organisations and task forces, for example, the subproject for the optimisation of the spare part and exchange part management and the development of principles for the preparation/management of the project-related logistic concept as part of the In-Service Use Agenda, the re-structuring of the fixed logistics facilities (oIE 2019+), the preparation and continuous updating of the General Publication for the Performance of Tasks in the In-Service phase. ■

Photo: BAAINBw

Technical Quality Management Center (Directorate ZtQ)

The quality assurance activities of the Technical Quality Management Center (Zentrum für technisches Qualitätsmanagement - ZtQ) reflect the interests of economical administrative practice as well as the special responsibility of the Bundeswehr as an employer vis-à-vis its servicemen and women to ensure the functional reliability and operational safety of their equipment. Directorate ZtQ is independent of project directorates and contracting branches, and its work is mainly directed at bidders and contractors, meaning external partners as viewed from within the Federal Defence Administration.

The Directorate primarily takes action in those cases in which the contracting authority cannot establish beyond doubt, on the basis of the contractor's quality management activities, that the contractor's supplies

carried out by the public authorities. Notwithstanding the above, a contractor ensuring the contractually agreed properties of a product or a service is always responsible in such cases.

fication, weapon overload firing tests and inspections of hazardous goods packaging,

- operational tasking and performance monitoring of "open-end contracts for

Photos/Graphic: BAANBW



One of the many highly specialised inspection teams, shown here after a joint advanced training; the Directorate employs a staff of about 500 inspection specialists.

and services are rendered in conformity with the contract and in a cost-effective way, always considering the relevant context. This includes the quality assurance activities for which the contractors are responsible vis-à-vis subcontractors or suppliers.

This especially applies in the case of risky projects - such as complex, time-critical, expensive, potentially harmful or ground-breaking technological developments, procurements and maintenance.

Activities prior to and after Contract Conclusion

Directorate ZtQ's work is meant to support, through a risk-based approach, the contractor in rendering the contractually agreed supplies and services, and document this in a manner that is appropriate for revision. It is mandatory to follow a tiered sequence of tests, ranging from audits at irregular intervals to hundred-percent inspections of parts

Thus, technical quality assurance touches both on what is called (pre)contractual quality assurance and on quality assurance within individual projects. By the time a contract is concluded, project-internal quality assurance has to ensure that

- within the context of requirements management, unambiguous, weighted, realistic and measurable requirements are determined in a clearer way for both the product and the contractor (cf. pre-qualification); and that
- possible insufficient performance may be sanctioned more systematically.

Directorate ZtQ's major tasks after contract conclusion are:

- monitoring the contractor's quality management systems in terms of their effectiveness and, if appropriate and required (risk-based), performing supplementary official inspections,
- legal tasks, such as airworthiness product conformity inspections and reveri-

maintenance at the contractor's works", as well as

- within Germany, handling requests for Government Quality Assurance made by NATO partners and friendly third countries in accordance with STANAG 4107, which regulates the mutual recognition of Government Quality Assurance measures performed in application of the NATO Allied Quality Assurance Publications (AQAP).

Attested Quality Management System

Directorate ZtQ is the only directorate of a higher authority within the area of responsibility of FMoD that employs an attested quality management system, in accordance with ISO 9001:2015 that has been approved and certified by an independent third party. By means of this system, Directorate ZtQ increasingly committed itself to being a "ser-

vice provider" for the relevant interested parties. These especially include project managers and contract branches of BAA-INBw, FMoD and the parliamentary level, employees of Directorate ZtQ and personnel representation bodies.

E-Leadership and E-Administration

The Technical Quality Management Center consists of four divisions. In matters related to technical quality management, especially the operational conduct of Government Quality Assurance measures, Division ZtQ1 has power of direction within the remit of the Federal Ministry of Defence. Through the competent specialist branches, it is particularly involved in the pre-contract phase vis-à-vis the project directorates. The quality assurance teams (QA teams) of the ZtQ2 to ZtQ4 regional divisions, based in Hamburg, Kassel and Manching, perform their work right at the contractors' sites. They have about 80 field offices that support the project managers in an indirect and decentralised manner in gradually implementing and enforcing contract requirements, also during production. In addition, they independently handle individual maintenance contracts concluded with trade and industry.

Its QA teams are quite far apart from each other, which is why Directorate ZtQ started using assets like electronic information and communications technology, centralised file servers, integrated intelligent database systems (such as in SASPF), webinars and wikis quite early on. One of the current challenges is to reduce the varied quantitative data collections to a degree that is easier to work with. In doing so, it is important to not let this secondary task of the official inspection organisation ("acquisition, plausibility check and documentation of data") gradually become the dominating core task. This would, on the one hand, allow for an increasingly more detailed (although quasi static) overview of the Bundeswehr's material status; on the other hand, risks that are not yet fully under control even now would increase to form an even greater obstacle to the performance of original core tasks if the resources were to remain the same, especially in light of the effects of demographic change. Similar considerations and limits apply to e-leadership.

The fact that Directorate ZtQ's regional offices are spread out all over Germany required the Directorate from early on to develop progressive ideas as to what good leadership means. One thing is clear: E-leadership calls for different leader-

ship skills and methods than its "face-to-face" counterpart. Thus, an ever-present challenge remains for modern leadership within dynamic working environments. At the same time, all people involved should be aware that "remotely supervising" the employees working from home or in field offices might become a time-consuming activity when a common code of values is to be ensured. In addition, it is recognized that reorganisations designed to make individual jobs more attractive and potentially change the jobs' range of activities do not necessarily result in the overall success of a company; however, they could have such an effect if they are well-conceived and different perspectives are considered right from the beginning.

International Context

The NATO AQAPs are the main basis for Directorate ZtQ to perform Government Quality Assurance during the development, procurement or maintenance of de-

ment system or on the right to perform Government Quality Assurance at the contractors' or respective subcontractors' sites, all depending on the individual risks identified in the contract.

The latest amendments of ISO 9001 and EN 9100 more rigorously emphasise the contractor's responsibility for the entire production cycle. Some other major points are risk management, quality management planning, material and supply chain traceability (including subcontractors and suppliers), processing of and procedures for counterfeit parts, handling of nonconformities and corrective actions.

The above-mentioned amendments of international standards resulted in the updating of AQAP. The current status is as follows:

The NATO nations have agreed to perform Government Quality Assurance activities for other partner nations free of charge (as a rule) if a contract on military equipment or services has been concluded with

Agreement	STANAG 4107 AQAP 4107
Procedure	AQAP 2070
Contractual	Prime QA Conditions AQAP 2012 (auf Basis ISO 9001:2015) AQAP 2131 AQAP 2310 (auf Basis AS/EN 9100:2016) Supplementary QA Conditions AQAP 2105 AQAP2210
Policy Guidance	AQAP 200 AQAP2009
Supporting Information issued as Standard Related Documents	List of National QA Authorities Points of Contact for GQA AQAP 2110 Implementation Guidance AQAPGuidance

AQAP 2120 and AQAP 2130 have been incorporated in AQAP 2110:2016. This master regulation can now be tailored to all individual cases.

fence material for the Bundeswehr or its partners.

They have the status of standards and are part of the Standardization Agreement (STANAG) 4107:2016 "Mutual Acceptance of Government Quality Assurance and Usage of Allied Quality Assurance Publications", which has been ratified within NATO.

This is why BAAINBw contracts often contain agreements, in the form of an applicable AQAP regulation, on requirements regarding the contractor's quality manage-

a domestic company and the resource of the domestic GQA service allows for such action. Non-NATO nations are increasingly employing the standardised and internationally harmonised AQAPs and also include them in their contracts. However, as a rule, they cannot make use of supporting activities performed by other Government Quality Assurance Authorities (GQAA) without compensating such authorities for their efforts. In addition, the FMoD's approval as well as a Memorandum of Understanding (MoU) are required.

Changing Government Quality Assurance Procedures for Aeronautical Equipment and Systems

Government Quality Assurance is performed on all aeronautical equipment and systems, as is the case with all other contractually agreed supplies and services for the public purchaser. This is done in order to check their conformity with contract requirements. In order to do so, the Government Quality Assurance measures are supplemented with additional elements derived from statutory requirements. The required military peculiarities pertaining to the Bundeswehr were regulated and promulgated within a Type A1 General Publication, in keeping with the Federal Aviation Act. This General Publication includes legally substantiated additional steps of inspection that go beyond the activities performed within the framework of Government Quality Assurance; it also defines the required level of experience and competences of the official inspection personnel responsible.

The airworthiness inspection process performed by this official personnel mainly consists of product-specific inspections that are conducted independently, recurrent support for industrial inspections and inspections regarding the contractor's documentation and demonstrations. This sequence of measures must be performed and demonstrated for each aircraft or aeronautical equipment.

Within the national military set of regulations, as defined in Type A1 General Publication A1-1525, it is permitted under specified conditions to have inspections performed by qualified inspection personnel other than the official licensed inspectors, and these can be accepted as airworthiness inspections (by delegation). This inspection by others must be contractually agreed; its implementation will then be monitored by the competent ZtQ regional office as part of Government Quality Assurance.

In recent years, the Bundeswehr has built a foundation that can serve as a unified common basis for Europe-wide defence projects, similar to the civilian EASA (European Aviation Safety Agency) standards. An important step in this context is the introduction of an internationalised military set of regulations, called EMAR (European Military Airworthiness Requirements).

In general, further conditions will have to be fulfilled for their implementation, both by official agencies and industry. Airworthiness inspections of aircraft types that are entirely delegated to third parties in accordance with EMAR will be conducted by the relevant aeronautical company, which

is fully responsible in this matter. These inspection services are procured (from a commercial contractor, based on a contract) with public funds. For this reason, it is necessary to have ZtQ regional offices check, in relation to each contract, whether the contractor applies the pertinent operating manuals and the QM documentation. However, the focus of official inspections is shifting within the EMAR set of regulations; it is moving away from checks aimed at



Government Quality Assurance concerns all technology sectors. The image shows a functional firing test using MG5 as part of the performance demonstration.

technical aspects regarding airworthiness towards inspections that build trust in how the contractor fulfils all of his contractual obligations.

Change of Competences

The assets used for the transmission and processing of information are continuously being modernised within the Bundeswehr. This becomes apparent, for example, in the programmes for the digitalisation of land-based operations (D-LBO), the harmonisation of command and control information systems (HaFIS) or, in the future, the German Mission Network (GMN) together with its pertaining subprojects. These modernisation efforts are becoming even more important in the context of the German contribution to the NATO Very High Readiness Joint Task Force (VJTF).

Generally speaking, it is true that information technology is increasingly becoming an integral part of military systems. Operational safety as well as IT security must be ensured, which is an example of the demands placed on quality assurance in this regard. In the area of information technology, Government Quality Assurance is faced with:

- an increasing complexity of the overall systems that are meant to be implemented, consisting of older, already fielded parts and modern new ones, a pertaining large number of interfaces between individual subsystems,

- the need for coordination of Government Quality Assurance between different sites and system components,
- tight time frames and
- the expected fast-paced regeneration of hardware and software.

Apart from supporting development and procurement projects, Government Quality Assurance will increasingly be involved in the maintenance and modification of software. This applies to the different large weapon

systems that have been fielded in the Bundeswehr as well as to the multitude of medium-sized or smaller ones, both internally (at the Bundeswehr systems support centers, for example) and externally with regard to the contractors.

Directorate ZtQ answers this trend by expanding its know-how regarding IT inspections.

Improving the Dialogue

The dialogue with (future) contractual partners will focus on the consistent use of harmonised QA standards and their demonstrated application within the entire supply chain. In addition, another goal must be to specifically improve the collection and evaluation of operating and usage data of costly weapon systems and military equipment, as is already common, for the most part, in the field of aviation. This must be achieved in order to be able to incorporate the findings in the in-service process through improvements of parts or assemblies. On-demand repairs may indeed represent a disruptive business model; however, in the context of military operations, they can only serve to supplement reliable, fact-based lifetime predictions for parts and resilient maintenance strategies. This is Directorate ZtQ's invitation to face the common challenges hand in hand and on the basis of an established dialogue. ■

Central Affairs Directorate (ZA)

The Central Affairs Directorate (ZA) of the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) is in charge of central management affairs. Four divisions with 18 branches and one directorate office deal with interdisciplinary and general administrative matters.

Division ZA1

Division ZA1 consists of the branches ZA1.1, ZA1.2, ZA1.3 and ZA1.4.

Branch ZA1.1 is responsible for organisational structures and procedures of BAAINBw and its subordinate agencies. In addition, this branch handles tasks relating to administrative control, military complaints and requests according to the Freedom of Information Act. Branch ZA1.2 deals with organisational consulting (organisational studies and manpower requirement calculation), cost and performance accounting (CPA), process orientation, and the BAAINBw continuous improvement process (CIP). Organisational studies are systematic investigations of organisations or organisational elements with the aim of developing, after analysis, an optimisation concept for the respective task. Not only do process orientation and its performance processes provide valuable input; they also continue to build on the optimised processes. Manpower requirement calculation/assessment is performed to determine which resources are required to fulfil the specified tasks in a given period of time. Cost and performance ac-

counting acts in support of efficiency-driven control by providing assessments and information, thus offering a major contribution to ensuring transparency throughout cost and performance flows.

The continuous improvement programme (CIP) provides an opportunity for contributing ideas for improvement across the board. The ZA1.2 CIP officer coordinates all activities to implement and promote CIP within BAAINBw, on behalf of the executive group.

Branch ZA1.3 is responsible for any issues relating to military security and secrecy at BAAINBw, the request for visit process as well as functional supervision of the subordinate sphere with regard to such issues.

The BAAINBw technical information centre ZA1.4 researches, acquires and archives necessary technical information, and makes it centrally available to BAAINBw and agencies staff. Bundeswehr contractors receive technical information and regulations as part of contractually agreed government-furnished items. Bundeswehr units on deployment abroad are supplied with regulations using the DvWeb internet portal, similar to the information supply to contractors. Further-

more, this branch is responsible for administrative tasks in the area of technical regulations for the entire Bundeswehr. The Active Regulation Management functional area offers assistance to the bureaucracy reduction centre at the Federal Ministry of Defence and to the Regulation Management Branch at the Armed Forces Office, providing support in implementing regulation management at BAAINBw and its remit.

Division ZA2

Structure and tasks of Division ZA2 - Finance - are marked by the particular responsibilities of BAAINBw which is not only a major procurement agency of the Federal Republic of Germany and thus an important public customer, but has also had materiel responsibility for the operational viability of defence materiel since its founding. The division also administers the budgetary funds required for BAAINBw administration. The tasks of financial planning and implementation of the budget are pooled in Division ZA2.

Division ZA2 is subdivided into the branches ZA2.1 "Budget Policy and Tax Affairs", ZA2.2

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"Financial Requirements Analysis/Financial Planning and Funds Management for Investments", ZA2.3 "Financial Requirements Analysis/Financial Planning and Funds Management for Materiel Maintenance", ZA2.4 "Financial Requirements Analysis/Financial Planning and Funds Management for Other Operations, Information Technology and Administrative Expenditures" and ZA2.5 "Contract Accounting". Branch ZA2.1, besides processing general questions on tax and budgetary law, is involved in contract review and contract consulting in accordance with §§ 58, 59 and 63 of the Federal Budget Code. Beyond that, this branch supervises all outstanding government claims (e.g. recoveries, contract penalties, interest etc.), does the relevant accounting and performs the payment of taxes for BAAINBw and its agencies. Besides the budgetary involvement in all procedures and measures in accordance with §§ 23, 26 and 44 of the Federal Budget Code (Contributions), the branch is tasked with ordering all payments of BAAINBw.

The main task of ZA2.2 is funds management for R&D, and for development and procurement of defence materiel. Since 1 July 2017, central tasks of financial requirements analysis have also been part of its responsibility. Besides funds management for development and procurement, ZA2.2 handles budget item management for non-specific investment-related budget chapters/items. Furthermore, this branch is home to the SASPF accounting process manager. He is in charge of developing the conceptual basis for accounting under SASPF for the major organisational element for Equipment, Information Technology and In-Service Support (AIN).

Branch ZA2.3's tasks include financial planning and funds management for materiel maintenance in the framework of materiel responsibility for operational viability.

Branch ZA2.4 is responsible for financial planning and funds management of the funds required for maintaining the operability of BAAINBw and its subordinate agencies. Furthermore, the funds for information technology and the Bundeswehr information and communication system, as well as operator solutions are planned and managed in this branch.

The tasks of Branch ZA2.5 include, besides contract accounting for BAAINBw contracts, the supervision of delivery dates, final pricing agreements, and recovery of and interest on overpaid amounts after price review.

Division ZA3

Division ZA3, "Requesting Agency-related Personnel Activities, Functional Supervision of the BAAINBw Agencies, Common Legal Affairs" consists of five branches and handles, among other responsibilities, the tasks assigned to BAAINBw for civilian and military personnel.

Branch ZA3.1 coordinates matters concerning civilian BAAINBw staff and is, as such, the main point of contact for all Bundeswehr personnel management offices.

In particular, its responsibilities include personnel management for BAAINBw as employing agency.

The branch's responsibilities also include support for the Federal Ministry of Defence, the Federal Office of Bundeswehr Personnel Management and the Bundeswehr Service Centres in matters of personnel.

Branch ZA3.2 is responsible for decentralised personnel management as well as any personnel affairs relating to military personnel. The chief of Branch ZA3.2 also is the officer in charge of matters concerning military personnel and the disciplinary superior – in accordance with the Ministerial Directive Governing Superior-Subordinate Relations Art. 3 – of all officers up to level A15 in BAAINBw, and deputy officer in charge of reservist matters within the major organisational element of Equipment, Information Technology and In-Service Support (AIN). The chief of the section "Leadership Development and Civic Education" doubles as disciplinary superior in accordance with the Ministerial Directive Governing Superior-Subordinate Relations, Art. 3 of all noncommissioned officers at BAAINBw. Therefore, ZA3.2 is the central link for military BAAINBw staff to all personnel management offices.

Branch ZA3.3's tasks encompass general and common personnel affairs (civilian and military). Aside from support to an employing agency's staff-related policy work, this includes, in particular, user administration and management for SASPF, time and attendance recording, absence time management, maintaining local personnel files and preventive occupational medical care for all employees of the agency. Branch ZA3.4 – "Strategic Planning of Training and Continuous Professional Development for AIN Personnel, Attractiveness Agenda" – is responsible for the coordination of matters pertaining to basic and advanced training of civilian and military staff of BAAINBw and its subordinate agencies. The branch's responsibilities also include support for the Federal Office of Bundeswehr Personnel Management and the Bundeswehr Service Centres in matters of personnel recruitment measures.

The tasks of Branch ZA3.5 include, beside disciplinary matters, general administration and consulting in matters of the equal opportunities, staff representation and persons with disabilities law. The branch also deals with matters concerning the compatibility of family life and work/duty, in particular the establishment and overseeing of BAAINBw childcare facilities in Koblenz and Lahnstein.

Beyond this, ZA3.5 is charged with liability and damage investigation, benefits policy, and the

functional supervision of procurement at BAAINBw agencies.

The administrative data protection officer for BAAINBw is also part of the ZA3.5 staff.

Division ZA4

Division ZA4 includes the branches ZA4.1 "IT Service BAAINBw, IT Security Officer for the AIN Organisation, IT Security Officer for BAAINBw", ZA4.2 "Infrastructure Affairs of the AIN Organisation", ZA4.3 "Internal Services, BAAINBw Activities in Representation of the User" and ZA4.4 "Postal and Messenger Services, Print Shop, Classified Material Registry". Branch ZA4.1 is responsible for the IT service and for information security within BAAINBw and the AIN organisation. The term "IT service" encompasses all typical activities relating to the provision of services in IT. For instance, the personal IT requirements (hardware and software) of all personnel is managed in this branch and made available, either as the standard, via the Bundeswehr-owned IT-company BWI, or as a special application via ZA4.1 itself. Individual areas of activity are, among others, the provision of mobile IT and dedicated servers for special applications, teleworking places, programming of data bases and the introduction of a modern document management and groupware system into BAAINBw.

The Equipment, Information Technology and In-Service Support (AIN) organisation is responsible for the determination and specification of its own infrastructural requirements, similar to the rules applicable to the services. This task has been given by the Federal Ministry of Defence Branch A I 4 to BAAINBw Branch ZA4.2. It includes all agencies and institutions dealing with defence technology, i.e. BAAINBw and all its technical centres, defence research institutes and the naval arsenal, as well as the Fraunhofer Institutes partly funded by the Federal Ministry of Defence. The, mainly atypical, infrastructural requirements of the AIN organisation are primarily aimed at satisfying requirements for trials, investigations and R&T. In addition, Branch ZA4.2 handles infrastructure tasks for the Federal Government's in house companies overseen at BAAINBw (HIL GmbH, BwBM GmbH, BwFPS GmbH, BWI GmbH).

The scope of responsibility of Branch ZA4.3 includes internal services for BAAINBw with the areas "Procurement of own requirements" / "Budget" / "Logistics and material provision" / "Motor pool". The area "Activities in Representation of the User" coordinates all matters concerning the sites, facilities and accommodation of the user BAAINBw in Koblenz, Lahnstein and Bonn.

Branch ZA4.4 ensures internal operations by running postal and messenger services, a print shop and a classified material registry. ■

The BAAINBw Agencies

A total of six defence technology departments, two military science departments and the Naval Arsenal are subordinated to the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw).

In addition, the German Liaison Office for Defense Materiel, USA/Canada, is also part of the BAAINBw.

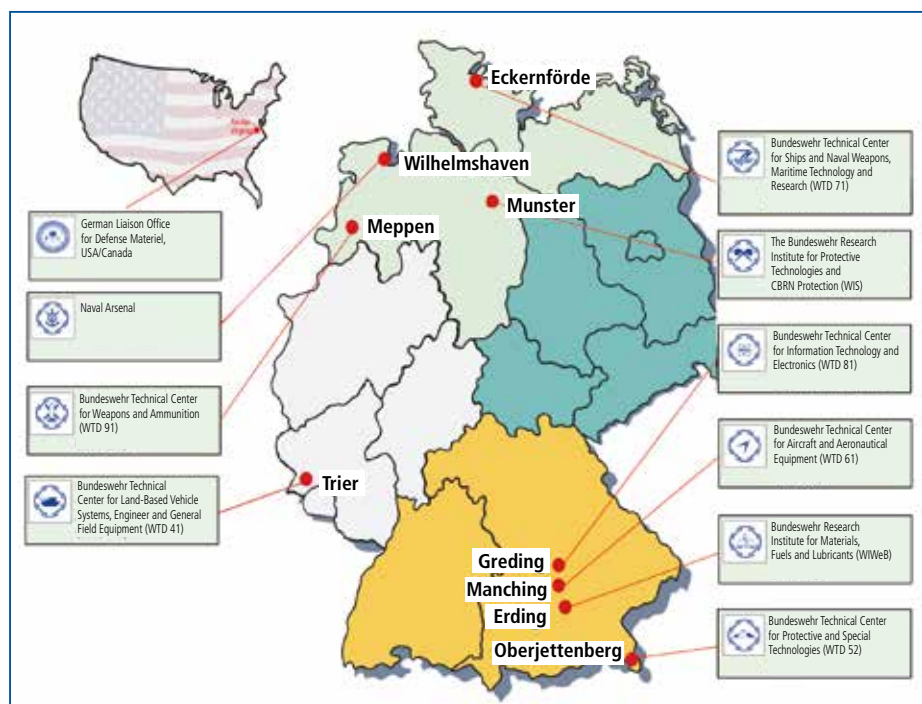
Bundeswehr Technical Center for Land-Based Vehicle Systems, Engineer and General Field Equipment (WTD 41)

WTD 41 in Trier and its branch offices have broad competences as regards wheeled and tracked vehicles, propulsion systems and chassis components, electric-chemical energy sources and stores, vehicle electrics, engineer vehicles, POL and field camp technology, soil mechanics, hydraulics, air-conditioning engineering and compressed gas technology. Thanks to its technically highly qualified personnel and its unique infrastructure WTD 41 has what it takes to execute and evaluate trials and examinations of ground vehicles and their components. Tasks are mainly assigned by the BAAINBw as well as by further customers from Germany and abroad.

At the moment WTD 41 has 463 employees. Moreover, WTD 41 offers vocational training in the occupations "Kfz-Mechatronikerin/Mechatroniker" (automotive mechatronics engineer) and "Elektronikerin/Elektroniker für Geräte und Systeme" (electrician for equipment and systems).

Current Studies

1. Operation of Vehicles with Modern Exhaust Emission Control Systems (Euro V/ Euro VI) with Highly Sulfurous Fuels
Modern commercial vehicles that comply with the Euro V and Euro VI emission standards require diesel fuel which corresponds to the European standard DIN EN 590 for the proper functioning of their engines and the exhaust technology. As regards the procurement of new vehicles the Bundeswehr, too, resorts to commercially available modern vehicles. The use of modern vehicles becomes problematic, however, within the scope of NATO's Single Fuel Concept (SFC) and Single Fuel Policy (SFP). The SFC stipulates that diesel engines of military equipment must generally be suitable for operation with kerosene (F-34). Modern fuel-lubri-



Graphic: mawibo-media

cated diesel injection systems are subject to enormous wear and tear in this process since kerosene has a low lubricity in comparison to diesel fuel. Against this backdrop, NATO grants its members the permission to upgrade F-34 by means of the lubricity improver S-1750 to become F-63. Furthermore, the sulfur content of kerosene, and thus F-63 as well, might be considerably higher in comparison to commercial diesel fuel in accordance with

DIN EN 590 (desired value in accordance with DIN EN 590: ≤ 10 mg/kg). The high sulfur content results in noncompliance with the legal exhaust fume values and in damage to components within the engine that are subjected to exhaust fumes as well as to exhaust emission control systems. If, for logistic reasons, it is required to resort to locally available diesel fuel with increased sulfur content, these framework conditions will have a par-

Photo: WTD 41



The LEGUAN assault bridge

ticular impact. In order to examine the effects of highly sulfurous fuels on the compatibility of engines with state-of-the-art exhaust technology WTD 41 was tasked by BAAINBw with performing a test series comprising driving tests as well as tests on the agency's engine test beds.

The MELLs Weapon System

The MELLs Weapon System Has Been Successfully Tested by the Bundeswehr for Use with the Infantry Combat Vehicle (ICV). The infantry combat vehicles of the Bundeswehr (PUMA and MARDER) shall in the future be equipped with an efficient anti-armour capability. To this end, tests with the MELLs weapon system (multirole light guided-missile system) were conducted with both vehicle systems.

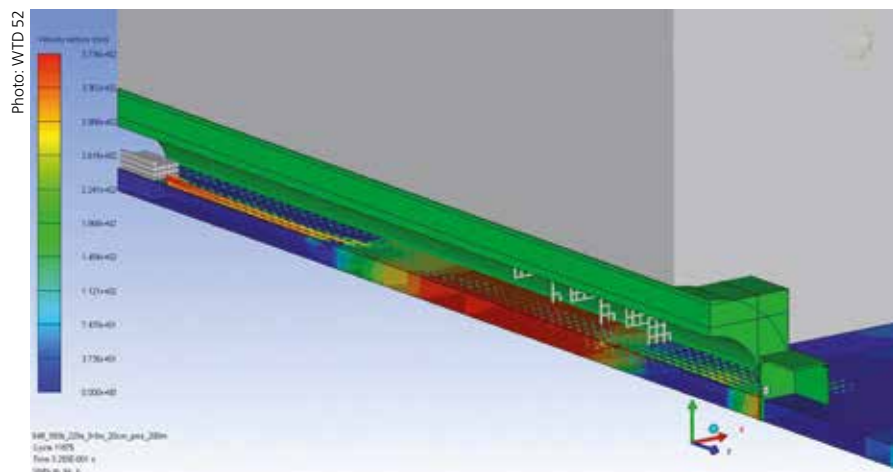
up to a load class of MLC 80 to cross water or terrain gaps. The system also encompasses a protected tractor trailer for transporting the bridge elements and a computer-based training facility. Before the system can be delivered to the armed forces, however, extensive examinations have to be conducted. At the facilities of WTD 41 in Koblenz, Trier and Föhren the system's performance data will be checked. To this end, several bridge pits are available on the extensive test area. This way it is possible to test all operational scenarios that may occur later on under various terrain conditions. Apart from conducting field engineering trials of the bridges and their launching equipment WTD 41 specialist personnel examines other components as well; this includes determining vehicle-specific

defense measures against asymmetric threats. This includes protection of infrastructure against asymmetric threats and ammunition storage safety, numeric simulation, indirect protection (camouflage, concealment and deception), non-lethal weapons (NLW) and physical detection of improvised explosive devices (IED).

Special technologies include a variety of different topics that can be dealt with in an ideal manner due to a year-long build-up of competences and specific conditions of infrastructure prevailing at WTD 52. This includes simulation of nuclear blast waves, aerodynamic load tests, mobile antenna supporting structures, primary batteries with a high risk potential, detection of landmines and underwater testing. WTD 52 benefits from particular geographic and geological conditions which are unequalled in this combination. The underground facility in the "Reiteralpe" massif, the Bundeswehr cableway and the alpine test sites and demolition ranges at an altitude of approximately 1,700 m all represent manifold opportunities for research and compliance demonstration. Urban areas increasingly turn into a theatre of armed conflicts. This has far-reaching consequences for the local civilian population and a considerable impact on Bundeswehr operations as well. WTD 52 contributes in multiple ways so as to provide the best possible protection for our soldiers operating in urban scenarios. The risk potential of air blasts following a massive detonation in an urban area is of special interest in this regard. In this context, WTD 52 operates Europe's largest air blast simulator, called Large Blast Simulator (LBS), which can accommodate objects up to the size of a small building. The air blasts are generated by abruptly opening compressed air bottles. The resulting effect is enhanced by the tunnel-like shape of the test stand area and, thus, blasts can be created that equal those of nuclear weapons or detonations with several tons of explosives.

In the framework of an international cooperation with the French Centre D'Etudes de Gramat (CEG), it was possible, for the first time, to use the "retroreflective shadowscopy" method for making shock fronts visible on a large scale. In order to do so, images were recorded at a frequency of 31,000 images per second with an exposure time of 10 µs. This made it possible to detect in detail the shock front, which was moving at a propagation velocity of 350 m/s.

The two partner nations both benefit from this cooperation: CEG intends to use the obtained results to validate numerical simu-



Semi-symmetric numerical model of pressure expansion inside the LBS

Vibrations of tracked vehicles pose a particular challenge to MELLs. Therefore, both ICV equipped with the MELLs weapon system were subjected to vehicle dynamics testing under near operational conditions. The infrastructure of WTD 41 provided ideal conditions for this purpose. Periodic functional and reliability tests confirmed the suitability of MELLs for use with the infantry combat vehicles. The successful tests form the basis for providing the mechanised infantry forces with the required capabilities.

The LEGUAN Armoured Assault Bridge

WTD 41 has been testing the new armoured system LEGUAN assault bridge. The assault bridge is an armoured bridging system on the running gear of the LEOPARD 2 main battle tank that comprises two movable bridges of 14 metres each and a bridge with a length of 26 metres. The bridges are made of high-strength aluminium and enable vehicles

characteristic data, trailer tests for road and rail transport, automotive electrics, the hydraulic system as well as ergonomic aspects.

Permanent tasks with operational relevance include the testing of POL supply and engineer equipment prior to delivery to the theatres of operations and the weighing of air transport containers (with contents). Furthermore, WTD 41 has been actively involved in the presentation of the Bundeswehr at fairs and exhibitions within the framework of recruiting campaigns as well as in supporting the technical service career training and supervising student interns.

Bundeswehr Technical Center for Protective and Special Technologies (WTD 52)

The core competence areas of WTD 52 are the fields of both direct and indirect protection. Their focus is on ensuring survivability on the battlefield and preventive



Trial setup within the LBS

lation codes; WTD 52, on the other hand, gains additional insights into pressure expansion in the context of military operations in urban terrain (MOUT) scenarios. From a strategic point of view, the 2016 White Paper on German Security Policy and the Future of the Bundeswehr focuses on taking an increasingly interconnected approach and assuming responsibility in

key areas of security policy through international partnerships and cooperation. An increasingly interconnected approach can help in building trust at a political and operational level, especially in the areas of multinational test and evaluation projects as well as procurement projects. This is the required foundation on which national capabilities can be developed in a harmo-



LBS with compressed air bottles serving as the driving force

nised way. In addition, it can serve as the basis for improvement in the area of interoperability of organisations, technology and systems within the armaments sector. WTD 52 used these strategic requirements as a reference point to create a pilot project on the strengthening of the agency's international and interagency profile (STEC - Strengthening of Test and Evalua-

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Photo: WTD 61



In order to simulate absolute darkness, a specifically designed mobile darkroom at WTD 61 is used in the current testing of night vision goggles in the A400M aircraft.

tion Centers) intended to last three years. A new element for management and marketing (M&M) was established in order to implement projects. It helps incorporate the agency's strategic goals into operational planning and implementation activities by using recognised management

methods. In addition, the M&M element represents the main point of contact for external customers and partners and, thus, provides them with information from a single source. This concept of one face to the customer is an example of active customer orientation and serves as the basis

of a consistent flow of information. When the project comes to an end (in late 2019) the obtained results will be assessed and conclusions will be drawn concerning the direction in which the Bundeswehr Technical Center for Protective and Special Technologies is headed in the future.

Bundeswehr Technical Center for Aircraft and Aeronautical Equipment (WTD 61)

Being the Bundeswehr's technical center of excellence for military aviation, WTD 61 in Manching conducts in-flight substantiation and technical compliance demonstrations in national and international flight test projects. It is responsible for the qualification and technical evaluation of developments as well as for the assessment and testing of airborne weapon systems and their subsystems. For these tasks, it relies on the performance of flight tests and ground tests in accordance with internationally recognised standards using own test aircraft, specially trained personnel as well as test facilities, a reserved airspace for testing and measurement procedures. Its core tasks specifically include military and mission-relevant issues like

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- laser protection,
- testing of new sensor and communications technology,
- UAV tests,
- and compliance demonstration activities during the adaptation of state-of-the-art medical equipment for all relevant Bundeswehr aircraft types.

As an example, the first laser- and GPS-guided "GBU-48" bombs constitute another step towards the EUROFIGHTER's air-to-ground capability. In order to verify weapon integration, a major flight campaign was conducted in Sweden under the direction of WTD 61. This was followed by a functionality verification of a new radar software including firings of AMRAAM air-to-air guided missiles on the Hebrides using a WTD 61 EUROFIGHTER aircraft that was specifically instrumented for these tests.

Qualification flights conducted by WTD 61 with the TIGER attack helicopter were performed with unguided rockets after installation of a modified engine assembly and with the STINGER guided missile for missile qualification. In addition, flights were conducted in support of the user to verify failures that occurred, for example, during the jettison of the "HOT" guidance wire. Moreover, WTD 61 was actively involved in the weapon integration by industry of M134D Gatling and MG6 into the H145M Light Utility Helicopter - Special Operation Forces (LUH SOF). As part of a hazard analysis of these weapons under operational conditions, ground and flight tests were conducted at day and night, including tests of flare ejection and night vision goggles. In addition, noise measurements were conducted to protect the crews against potential hearing impairments, and evidence was provided for the approval of fast roping and repelling procedures of Special Forces for this helicopter. As a potential successor model to the SMOKEY 5000 litre fire-fighting equipment currently used in the Bundeswehr, the BAMBI BUCKET BBTHL7600 was successfully tested and evaluated in a flight test with regard to its suitability for employment in the CH-53 medium transport helicopter. More tests are envisaged in the course of the upcoming procurement procedure.

Gradually, all aircraft of the FMOD Special Air Mission Wing which are mostly used by the Federal President and by members of the German government (the so-called

"White Fleet") will be protected against surface-to-air guided missiles by a LAIRCM (Large Aircraft Infrared Counter Measures) system. The required test missions that have already been conducted for the A319 and A340 aircraft have now also been successfully conducted for the Global 5000 aircraft. At present, preparations are being made for the expansion of the fleet by the A321 aircraft. The installation of a similar system into the A400M weapon system is currently being prepared.

One part of the operational test for the follow-on capability of the A400M transport aircraft is the evaluation of its air refueling capability. Following a ground test with a TORNADO receiver aircraft to test the refueling compatibility with a A400M tanker, air-to-air refueling flights were conducted. At present, air-to-air refueling

flights are being conducted for a pairing clearance with the EUROFIGHTER weapon system.

An urgent operational requirement existed to provide the TORNADO aircraft with a night viewing capability. The series of tests required for issuing the Authorisation for Military Flight Operations was successfully conducted. The compliance demonstration for integrating a low-level light intensifier into the A400M was performed at the planned "Night Vision Competence Center" of the Bundeswehr, WTD 61. WTD 61 is currently also evolving into a competence centre for unmanned aircraft systems. In cooperation with industry as the developer, reconnaissance and scouting drones for accompanying military missions (e.g. MIDEA) are tested

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and evidence for the approval of new or further developments of unmanned systems of all sizes are provided. The upcoming introduction of various new airborne weapon systems like the heavy transport helicopter, the SAR successor helicopter to Bell UH-1D as well as unmanned systems like RPAS, the maintenance of the strategic air transport capability or the development of new aircraft and aeronautical equipment (e.g. engines) will increasingly require the know-how and flying proficiency of WTD 61 also in the future.

The Bundeswehr Technical Center for Ships and Naval Weapons, Maritime Technology and Research (WTD 71)

The Bundeswehr Technical Center for Ships and Naval Weapons, Maritime Technology and Research (WTD 71) is responsible for tasks in all areas of maritime defense technology and defense research. Thus, it provides the technical expertise in maritime research and development required to pro-

vide suitable and safe maritime equipment to the Bundeswehr. At the same time, WTD 71 is the central technical-scientific authority of the Federal Government tasked with departmental research within the naval armaments sector. The objective of all WTD 71 activities is to provide reliable and operational systems and equipment to the German Navy. With its integrated capability network of technical expertise, maritime scientific competence, knowledge of methods as well as technical and scientific trial/measurement infrastructure, WTD 71 forms the link between the products

(“ship” as an overall system, the platform and deployment system portions, systems, individual appliances, equipment), the military capability requirements of the German Navy, the project management of the German Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) as well as defence industry and external academic facilities (institutes, universities). A particular strength of WTD 71 is its very international and interdepartmental profile, which leads to a variety of international cooperative projects. The location of WTD 71 has a long tradition. The Imperial German Navy already tested its torpedoes in the Eckernförde Bay and built a torpedo experimental station in 1912. Today, 660 staff members at WTD use their know-how to develop, test and procure naval weapon systems. Scientists and engineers, qualified and experienced technicians, tradesmen and mariners have made WTD 71 the centre of professional expertise in the field

Maritime Research

Establishing, extending and maintaining the required assessment and advice capability by conducting research projects under its own responsibility as well as awarding, supporting and evaluating research and technology studies in all fields of naval armament.

Technological Investigations

Experimental and analytical investigations (experiments, demonstrators, studies, market analyses, evaluations, simulations) of maritime defence materiel in all phases of the development process of defence materiel, also under maritime environmental conditions, in particular, to determine the productibility, suitability and performance capability of appliances and systems.

In-Service Support

Expert support of in-service naval weapon systems (such as magnetic or acoustic ranging).

An additional task is the active cooperation in bilateral or multilateral organisations such as the German-Dutch Centre for Ship Signature Management (CSSM) as well as cooperation or representation of Germany at international organisations such as UN, NATO, EDA etc.

The tasks of the agency are distributed across five divisions.

The “Ship as a Weapon System” division focuses on the integration of individual components and subsystems into a functional and operationally safe maritime weapon system. This includes primarily test and compliance demonstration activities and the determination of additional operational parameters and functional limits. At present, the frigates of the new F125 generation are undergoing trials.

The “Ship Technology, Combat Survivability” division is in charge of naval engineering tasks related to the development, procurement and use of ships and boats of the German Navy. This includes the traditional shipbuilding disciplines, main propulsion engineering, auxiliary systems engineering and marine electrical engineering as well as a special field of activity dealing with shock and vibration resistance.

The main tasks of the “Reconnaissance, Effects, Force Protection” division include the investigation and provision of technologies for further development of and defence against maritime weapons. Employees working in the field of underwater weapons have to deal with vessel technology, with a particular focus on hydrodynamics, propulsion technologies, energy accumulators, metrology and control engineering. In addition, they work on underwater sensors, includ-

Photo: WTD 71



The premises of WTD 71 in Surendorf

vide suitable and safe maritime equipment to the Bundeswehr. At the same time, WTD 71 is the central technical-scientific authority of the Federal Government tasked with departmental research within the naval armaments sector.

The objective of all WTD 71 activities is to provide reliable and operational systems and equipment to the German Navy.

With its integrated capability network of technical expertise, maritime scientific competence, knowledge of methods as well as technical and scientific trial/measurement infrastructure, WTD 71 forms the link between the products

of maritime defence technology. WTD 71 comprises a total of nine facilities located all over the state of Schleswig-Holstein.

The agency's core tasks include: Project Support

The core task of WTD 71 is to support projects and conduct compliance demonstrations for naval armament systems and equipment in all CPM phases (performance demonstrations, integrated compliance demonstrations) as well as operational suitability tests under maritime service conditions.

ing the associated signal processing for minehunting.

The "Sensor Technology, Signatures, German CSSM Representative" division is in charge of military maritime sensors and ship signatures, which are of particular importance with respect to passive ship protection and sensor development throughout Europe. It also contributes German staff to the international "Center for Ship Signature Management (DEU-NLD)".

The "Underwater Detection and Communication" division performs tasks related to SONAR, waterborne, structureborne and airborne noise and underwater communication. Acoustic propagation and backscatter modelling methods are used to make predictions of the performance of sonar and underwater communication systems and to assess alternatives. Studying the oceanographic, meteorological and geological influence of the maritime environment completes the division's range of activities.

In addition, WTD 71 operates a number of noteworthy measurement and test facilities, some of which are unique in Europe:

- Measuring points for magnetic measurement and treatment of ships and components, including a large field simulator for ships of up to 1,000 tonnes displacement
- Earth's magnetic field simulator
- Acoustic measurement points in shallow and deep waters
- Underwater and above-water tracking ranges
- Test area for underwater demolitions
- Torpedo firing range and firing lane
- Test facilities for environmental simulation
- Engineering test stands
- Measuring site for antenna models
- EMC measuring chamber (EMC = electromagnetic compatibility)
- Test sites for air and surface targets and projectiles
- Fleet of five research and trial ships
- Horizontal and vertical shock test facilities (with a nominal load of up to 3 tonnes)

The main focus of the current work is on the projects Class 180 Multi-Role Combat Ship (MKS 180), Class 125 Frigate (F 125), Class 130 corvettes (K 130 first and second lot), operational training centre (frigate/combat support ship) and Navy procedural training, new generation Class 212 submarines (U212 CD - Norway/Germany), Class 332 minehunter with drone control capability (MJ 332 CL), and WTD 71 defence fleet (STS and SVK projects).

In the near future, more new naval projects will be added: Training ships for the

Photos/Graphic: BAAINBw



Aerial picture of WTD 81 in Greiding

Navy, WTD 71 defence fleet (SVS project), tankers, Modification of tug boats, and the midlife conversion U212 (first lot).

Bundeswehr Technical Center for Information Technology and Electronics (WTD 81)

Based in the Bavarian town of Greiding, WTD 81 is the center of expertise for weapon system-related information technology (IT) and electronics of the German Armed Forces (Bundeswehr). As an agency under the remit of the BAAINBw, WTD 81 is providing support in all phases of the (amended) CPM.

Its core tasks include project monitoring and support, the performance of specialised technical tasks, the control of research and technology projects and the management of projects in the fields of navigation systems and commercial off-the-shelf measuring and test equipment. WTD 81 can rely on vast technical know-how in the following areas:

- Standards, protocols, procedures and technologies for information process-

ing, information transfer and IT security in weapon systems, command and control systems and support systems

- Information collection, reconnaissance components and technologies (radar, optronics including the associated signal processing)
- Electromagnetic compatibility (EMC), lightning protection and electrical safety
- Electronic warfare (EW)
- Interoperability of command and control information (C2I) systems and command, control, information and weapons control systems
- Integration of IT into platforms
- Technical examination of overall systems as well as examination of systems of systems, i.e. individual systems interacting in a network under near-operational scenarios
- Radar and identification technology
- Intelligent weapon systems, homing technology, fire control technology
- Electromagnetic compatibility (EMC)
- Navigation
- Materials and technologies for semiconductors



EMC assessment in the large test facility of WTD 81



EMC test facility and target simulation dome

In order to accomplish its tasks, the Bundeswehr Technical Center for Information Technology and Electronics is operating laboratories equipped with highly qualified staff as well as state-of-the-art infrastructure and technology.

These facilities include one of Europe's largest fully shielded test facilities for the study of electromagnetic compatibility and electromagnetic effects.

This is where military systems and electronic components are tested for compliance with the limit values laid down in standards. The tested weapon systems must neither be vulnerable to interference from external electromagnetic sources nor must they inadmissibly influence internal systems.

In its capacity as EMC test center, WTD 81 is the central point of contact for all

matters of electromagnetic compatibility and electromagnetic effects in the Bundeswehr.

One of the world's largest domed buildings, measuring 45 meters in diameter, is located in the immediate vicinity of the EMC test facility and houses a unique target simulation system. This "target simulation dome" provides an environment for hardware-in-the-loop simulations of optical and optronic components and systems. The test objects are exposed to scenarios and targets covering different spectral ranges from UVB to long-wave IR. Two powerful motion simulators are available to simulate the motions of test objects.

The modern Center for Interoperability, Network Centric Warfare and Simulation (Zentrum für Interoperabilität, NetOpFü

und Simulation, ZINS) offers the possibility to carry out multi-project networking experiments in all stages of the amended CPM to study interoperability and performance in a system network. To that end, ZINS is equipped with a large media wall, an audio system, laboratories, multi-purpose rooms and a powerful network with numerous connection options. It offers very flexible possibilities for test setups, parallel analysis activities, meetings, documentation of results and reviews.

Being competent, innovative and efficient, WTD 81 is an important economic factor in the Bavarian region of Middle Franconia. The potential of its personnel and its well-established areas of activity qualify for making it a future-oriented high-tech center with high-quality workplaces.

From the wide range of activities currently being conducted, two projects are presented below:

The New FLYCATCHER MK2 Flight Calibration Radar

In order to test airborne weapon systems, WTD 81 has a high-precision radar at its disposal to measure technical parameters. Since the 1990s, the radar system has been used to support other measuring systems with the various tasks to be performed in connection with electronic warfare (EW). The resulting intensive use of this radar over many years made it necessary to procure a replacement and thus a new, modern radar system for future measuring tasks. The FLYCATCHER MK2 technical solution produced by Thales won the European call for bids in 2014. The contract which was concluded was to include important functionalities for detecting and tracking aerial targets as well as interfaces for the evaluation of measuring results.

Originally, FLYCATCHER was developed as a weapon system to engage air targets at close range. As a highly mobile system it was intended for rapid deployment on two trucks and therefore consists of two containers: a sensor container, which houses an air surveillance radar, a tracking radar and several optical sensors, and an operator container accommodating two workstations for the operators. Thanks to the air-conditioning systems and the auxiliary power units available in the containers, the system may be operated independently from any infrastructure.

The most important technical parameters include an air surveillance radar in the I frequency band with the capability to detect aerial targets at a distance of up to 50 km, a tracking radar in the Ka frequency band



FLYCATCHER MK 2

with a range of up to 25 km, optical sensors and lasers for automatic tracking, and a fire control system for the use of air defence guns and surface-to-air missiles.

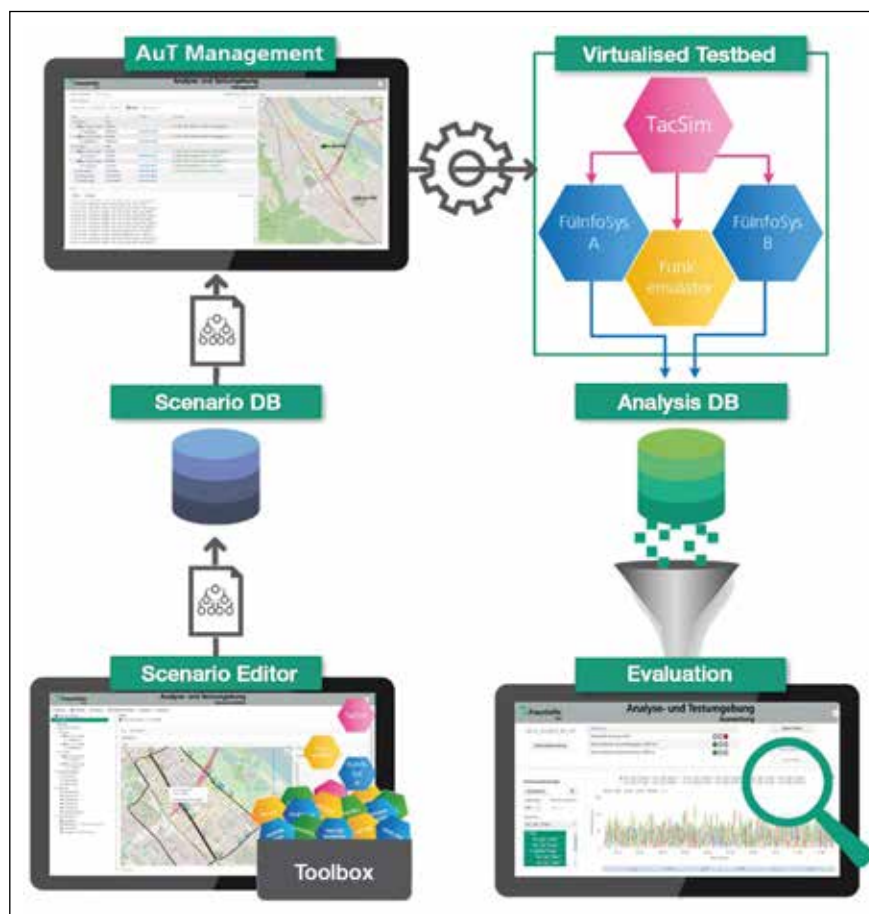
Due to the planned future use of the FLY-CATCHER at WTD 81, it was necessary to define the retrofit of additional video and data interfaces, to adapt the communication infrastructure and to implement an IFF system for mode S (civilian use) and mode 5 (military use) target identification. With its new functionalities and capabilities, the FLYCATCHER represents a powerful measurement platform for conducting investigations in cooperation with other military organisational units and Bundeswehr technical centers.

The Analysis of Large Heterogeneous Information and Communication Networks

The flexibility in information supply which is increasingly required for Bundeswehr operations must already be considered in the development phase (concept development, synthesis and analysis) of information and communication technology (ICT) systems. Equipment tests performed to date which involved a small number of participants (nodes) no longer meet the demands of the digitalisation of land-based operations (D-LBO), as the interdependence and interaction between the different systems under analysis can only be analysed to a limited extent. All nodes existing in the system need to be examined in the context of the overall system, because the overall system is more than the “sum” of its individual systems and also includes their relationships among each other. Operability may be validated in operational tests with real platforms and equipment in the field, but the observation of all relevant effects (verification) under field conditions necessitates a significant logistical effort both for man and material. Moreover, reproducibility in mobile scenarios is being stymied by at least one space-time correlation, unless the system network is limited to dimensions which can also be assembled in a lab under realistic conditions.

With its analysis and test environment (Analyse- und Testumgebung, AuT), WTD 81 is able to offer a solution which meets the following key test requirements:

- reproducibility,
- centralised management, stimulation and control of all system components,
- observability of all statuses of the individual systems in the system network with co-active effect chains,
- centralised structured management of data on the configurations and parameters of all systems with their



Analysis and test environment (AuT)

respective context as well as on test procedures and test results,

- high degree of scalability (up to the equivalent of a brigade),
- highly realistic conditions,
- real-time capability,
- applicability to all questions/suggested solutions in the entire life cycle of IT services,
- intuitive user guidance and presentation of results according to specific applications.

The completely virtualised test bed of the AuT analysis and test environment, which is complemented by simulated correlations, may be used if all relevant aspects of actual system behaviour are fully reproduced in context. The verification of this assumption and use of radio networked components, in particular, require a test and analysis framework which allows for the integration of real communication components and provides technically sophisticated channel emulators for connecting these components in various frequency bands.

This is the purpose of the Simulation, Test and Reference Environment for Mobile Operations (SumO) which is currently being set up at WTD 81 to serve as a demonstrator for a system context completely

controllable by technical means. SumO offers dedicated labs for every communication technology in which real devices under test (DUT) can be “clamped into” a suitable test frame. This procedure allows real communication systems to network together in realistically large scenarios and to reveal all real irregularities (for example in the event of channel access, interference, multipath propagation, fading). All stimulations and emulations from the field of transmission and motion physics are performed in a synchronised manner. The test frames allow for the centralised configuration and control of all DUTs and link up the different types of ICTs to form a technical effect chain. In addition, the AuT embedded in SumO serves the purpose of extending the test scope by virtualised components if real DUTs are available in insufficient quantity. With its AuT, SumO is supporting IT projects in all stages of the (amended) CPM procedure. To that end, a structured process is established with the objectives of conducting proof of concept of new technologies at an early stage, validating suggested solutions and performing integrated compliance demonstrations. Should irregularities occur in systems in use, the flexibility offered by SumO also

allows reproducing the prevailing conditions in the best possible, controlled way to assist in the efficient identification and resolution of problems. By integrating components of the fielded systems which are part of the Bundeswehr IT system into the SumO test environment, SumO becomes the technical reference for this system of systems, which can provide valuable input for the targeted further development and harmonisation of the Bundeswehr IT system.

The Bundeswehr Technical Center for Weapons and Ammunition (WTD 91)

Tasks and Facilities

WTD 91 is the main Bundeswehr proving facility for weapons and ammunition and has the sole specialist competence in this field within the entire armaments organization. Apart from all weapon and ammunition inspections, the specific requirements of the individual weapons carrier regarding weapons and fire control, protection and effects, reconnaissance, and target recognition also form part of the agency's research. Moreover, the technical center holds significant competences in the fields of acoustics,

cility for weapons and ammunition and has the sole specialist competence in this field within the entire armaments organization. Apart from all weapon and ammunition inspections, the specific requirements of the individual weapons carrier regarding weapons and fire control, protection and effects, reconnaissance, and target recognition also form part of the agency's research. Moreover, the technical center holds significant competences in the fields of acoustics, optics, optronics, laser technology, battlefield reconnaissance, simulation engineering, geoinformation, special engineer infrastructure, and measurement engineering. The agency's excellence center for explosives is the only authority in the armaments organization that is responsible for the qualification and safety evaluation of military explosives as well as for the central ammunition surveillance in the Bundeswehr.

Gun Trials

In 2018, the qualification of 9 x 19mm ball ammunition cartridges and ball tracer ammunition cartridges, both conforming to REACH (Regulation EC No 1907/2006 - Registration, Evaluation, Authorisation and Restriction of Chemicals), was successfully conducted within the area of activity of the

idents, work in the framework of ammunition surveillance and support of the responsible specialist department at the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support in terms of technical matters.

The Bundeswehr Research Institute for Protective Technologies and CBRN Protection (WIS)

WIS is a departmental research facility concerned with the protection of Bundeswehr service members against the effects of nuclear, biological and chemical weapons of mass destruction. Within the framework of its research activities, WIS develops the technical-scientific fundamentals required for this purpose and contributes to covering the demand for CBRN and fire protection equipment. As a service provider for policy-makers and the general public, WIS ensures the capability of assessing CBRN weapons.

Considering the fact that Bundeswehr personnel are more and more assigned to deployments outside Germany and experts are sent to crisis countries for advising and training purposes, the aspect of protecting the soldiers against such threats has become more and more pressing.

Research and development with regard to subjects such as the quick and safe identification of active ingredients within explosive ordnance disposal activities, checking and evaluation of unknown substances by means of chemical-analytical methods, decontamination, cleaning of potable water and handling of contaminated wastewater are essential for ensuring health and the defence capabilities of field units that are deployed to war zones and need to be prepared for the use of unconventional weapons. Detecting High-Power Electromagnetics (HPEM), which might impair the functional capability of Bundeswehr electronic systems or even damage these systems, and developing adequate safeguards are other important research tasks to be performed by WIS.

The approximately 200 WIS employees who mainly have a qualification in natural sciences are working in laboratories, pilot plants and facilities for full-scale testing on all subject-specific issues.

Latest Examples for the Work of WIS

Verification of the ban on chemical weapons: WIS is contributing to the investigation of the incidents in Iraq and Syria and – by means of its highly specialized laboratory – provides essential findings that serve as a basis for political decisions.

Photo: Bundeswehr



MELLS trial with PUMA IFV

optics, optronics, laser technology, battlefield reconnaissance, simulation engineering, geoinformation, special engineer infrastructure, and measurement engineering. The agency's excellence center for explosives is the only authority in the armaments organization that is responsible for the qualification and safety evaluation of military explosives as well as for the central ammunition surveillance in the Bundeswehr.

Current Projects

PUMA Project Support

WTD 91 is the main Bundeswehr proving fa-

national inspection authority for infantry weapon ammunition, a part of Branch 420 at WTD 91. The qualification of the new 5.56 x 45mm ball ammunition and ball tracer ammunition, also both conforming to REACH, is currently under way. This comprehensive task, which was begun only recently, will keep the national inspection authority busy for quite some time to come. The long-term goal is to keep the different types of infantry ammunition free of substances prohibited by the REACH regulation. Further tasks of the national inspection authority included assistance in the inspections after special in-

Detection of biohazards: Besides taking samples (also for forensic purposes), the range of tasks includes all aspects with regard to equipment from measuring instruments to protected and deployable high-security infrastructure.

Non-contact detection of warfare agents and chemicals: From remote detection to camp protection and to surface measurements by means of spectroscopic methods, WIS develops and tests future technology. In the process, it examines both autonomous detection systems and sensor networks on various platforms.

Protective equipment: Missions in hot climatic zones and new threat scenarios require, as far as clothing is concerned, physiologically improved protective equipment offering a higher level of protection. The fundamental studies necessary for this purpose are being conducted at WIS and laboratory prototypes are being optimised in close cooperation with industry. Following the introduction into service, accompanying Government Quality Assurance is conducted to ensure the high performance potential of the equipment.

Ecofriendly decontamination: For the decontamination of biological or chemical warfare agents, radioactive fallout and toxic industry chemicals, WIS is testing procedures and equipment, some of which require few

chemicals or none at all. In doing so, special emphasis is put on safe detoxification as well as preservation of functions of devices, such as electronic devices.

Water treatment: Mobile procedures for the production of service and potable water from various types of raw water are

tested for retaining contaminants as well as operational safety.

Electromagnetic effects: Electromagnetic pulses (EMP) generated in nuclear weapon detonations or other high-power electromagnetic (HPEM) fields are capable of jamming and/or destroying all types of un-



Graphic: WIS

NSPA Industry Day 12 September 2019



On **12 September 2019**, the NATO Support and Procurement Agency (**NSPA** www.nspa.nato.int) will hold an Industry Day on Support to Operations in Luxembourg dedicated to:

- Airfield services (e.g. air traffic management, fire and rescue services, CATO, etc.)
- Real life support (e.g. catering, laundry, ablutions, etc.)
- Engineering services (e.g. facility maintenance, utilities, power supply, etc.)

This event allows companies a unique opportunity to understand what actual and potential business opportunities are available via NSPA contracts and share their capabilities with potential industrial partners.

A key objective of this event is to identify existing or potential barriers hindering industry's participation in NSPA activities in support to operations. Companies interested in attending are asked to indicate topics of value to them.

Please indicate interest and/or suggestions by email to pp@nspa.nato.int preferably by **2 August 2019**. The agenda and administrative details will be released shortly thereafter to the interested parties.

protected electronic components within a large radius. WIS examines the protection level of military equipment, systems and infrastructure on the basis of measurements and conducts research into improved protection measures.

Fire protection: WIS activities focus on fire detection and fire suppression by means of automatic fire extinguishing systems incorporated in weapon systems. Besides, eco-friendly fire extinguishing agents are developed for Bundeswehr-specific applications. Northern Hazardous Substance Measurement Office: WIS supports safe Bundeswehr activities by investigating and evaluating hazardous substances in work areas or the environment.

Central collection point: At WIS, Bundeswehr radioactive waste is conditioned for later final disposal and put into interim storage.

"Researching – Testing – Advising – For the safety of our soldiers" – according to this slogan WIS, with its versatile spectrum of tasks, makes a contribution to future-oriented, functional equipment of the Bundeswehr. With its scientific findings, WIS makes an important contribution to CBRN protection.

Bundeswehr Research Institute for Materials, Fuels and Lubricants (WIWeB)

As a Bundeswehr research facility, the Bundeswehr Research Institute for Materials, Fuels and Lubricants (WIWeB) develops the necessary technological and scientific foundations with regard to the safety and reliability as well as the evaluation of materials, fuels and lubricants, chemicals and the clothing and personal equipment of soldiers. Besides its focus on these main issues, the institute is also responsible for matters related to the safety of chemicals, occupational safety and health, as well as environmental protection. WIWeB is part of the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) and employs a total of about 230 people at its locations in Erding (headquarters) and Wilhelmshaven.

News

In 2018, WIWeB as a research facility received a positive evaluation from the Federal Government's Science Council and was credited with mostly very good and even outstanding accomplishments in research as well as excellent testing and consulting services. The Science Council also stressed WIWeB's important role in maintaining the operational readiness of the Bundeswehr and ensuring the pro-



Photo: Bundeswehr/PAO Resolute Support

3D printing container at Camp Marmal in Mazar-e Sharif (Afghanistan), used to manufacture spare parts in the country of deployment: A soldier on deployment and a WIWeB employee check a newly printed plastic cover of a warm air space heater.

tection of soldiers thanks to the facility's great competence in terms of material testing and damage analysis.

Materials, Designs, Structures

Key technologies for the development of modern defense systems are inherent in both materials and design. WIWeB offers various test methods such as microstructural analysis, nondestructive testing, mechanical testing of samples or components, and simulations of the physical and mechanical properties of materials and structures. Thanks to these test methods, new defence materials and designs can be assessed with a special focus on the particularities of military use and issues related to military operations, e.g. damage analysis, service life, and accident evaluation.

The Bundeswehr 3D Printing Center with its extensive equipment for the production of plastic and metal components as well as the Bundeswehr control centre for welding and bonding technology are also worth highlighting. The focus of research is on possible uses of 3D printing in the context of Bundeswehr logistics.

Clothing, Surface Technology, Chemical Analytics

WIWeB establishes specifications for the procurement of military clothing and personal equipment. It is also responsible for the certification of manufacturers of camouflage clothing or equipment with vector protection. Research priorities include optimizing the personal equipment of soldiers to improve endurance (wearing comfort, extreme climate conditions, body armor etc.) as well as studies on the

reduction of detectability (concealment) and clothing with specific functional features (smart textiles).

WIWeB boasts an array of surface analytical procedures that are primarily used in damage analytics and early detection of defects, the advanced development of bonding and repair procedures, and even asbestos analytics.

In the field of chemical analytics, the research facility mostly focuses on the characterisation of materials, fuels and textiles as well as the ageing and fire behavior of these substances. Further, WIWeB operates the Bundeswehr Hazardous Substance Measurement Office South.

Fuels and Lubricants, Material Protection

The availability of appropriate fuels and lubricants is a prerequisite for the mobility and, thus, the operational readiness of the Bundeswehr. Standardisation and certification ensure that fuels and lubricants remain efficient, reliable, safe, available on a long-term basis, usable in as many systems as possible and supportable with in a simple and sturdy logistics system. As the project authority for fuels and lubricants, WIWeB is also responsible for the actual fuels and POL products. This responsibility encompasses qualification and quality assurance as well as matters related to in-service support (e.g. on-condition monitoring, system behavior, tribology, alternative fuels) and obsolescence management. Other tasks include the protection of materials from environmental impacts. As the responsible project authority for paints,

lacquers and chemicals, WIWeB certifies coating systems and evaluates surface protection measures while also focusing on product processing for cleaning agents and packaging material.

Expertise and interconnection

On the basis of its capabilities, the research institute aims to understand and evaluate materials, fuels and lubricants in the context of entire systems. This requires not only interdisciplinary expertise but also connections to all parts of the Bundeswehr, the defense industry and European and international partners. The status of a departmental research institute provides the basis to specifically develop and maintain both important collaborations and the necessary knowledge through research.

German Liaison Office for Defense Materiel, USA/Canada

The German Liaison Office for Defense Materiel, USA/Canada is a subordinate agency of the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) and is based in the US federal state of Virginia.

The German Liaison Office for Defense Materiel, USA/Canada represents the Bundeswehr's interests in matters of defence technology and armaments towards the armed forces and agencies of the United States of America (USA) and Canada and the industry of these countries. Transatlantic cooperation covers a wide spectrum of defence-related technologies and various weapon systems in the domains of land, air and sea.

The agency's staff largely consists of engineers and scientists but also legal experts,



Photo: BAAINBw

The Liaison Office building in Reston, Virginia

non-technical clerical administrative personnel, and soldiers. More than half of the personnel assigned to the 51 posts are assigned to project offices:

- Rolling Airframe Missile (RAM) Project Office (RAMPO) in Arlington/VA
- NATO SEASPARROW Project Office (NSPO) in Arlington/VA
- German PATRIOT Office (GEPO) in Huntsville/AL
- Multifunctional Information Distribution System International Program Office (MIDS IPO) in San Diego/CA

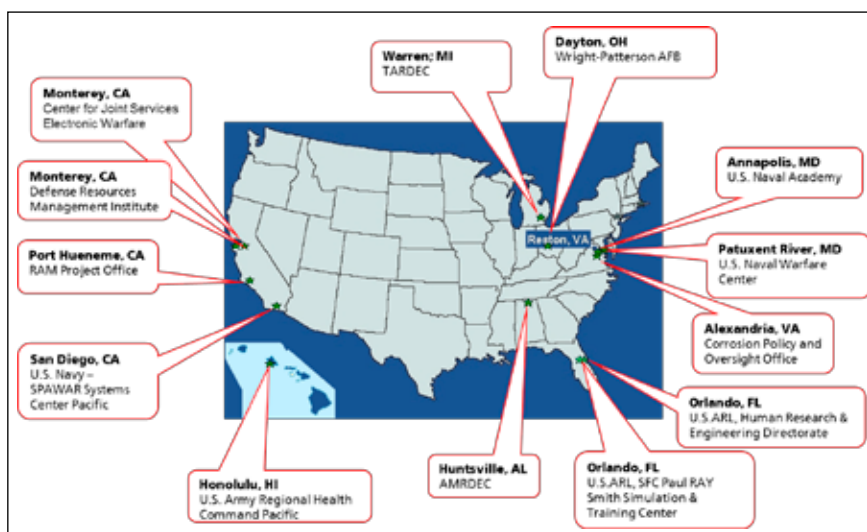
Personnel are also employed at liaison offices at US Army and Air Force facilities. The agency's range of tasks and activities is oriented toward employing the available national resources as efficiently and effectively as possible in the context of bilateral and multilateral cooperation. The aim of our work is to strengthen national military and industrial capabilities and bring about the development of joint standards and interoperable solutions for the mission-oriented equipment of the armed forces.

In this spirit, the German Liaison Office for Defense Materiel, USA/Canada is a competent point of contact for initiating and coordinating armaments cooperation with the

USA and Canada in the field of research and technology as well as joint development and procurement programmes and contributes to maintaining and developing the capabilities of the national defence industry. Other focuses of its work are the acquisition of US and Canadian defence goods for the Bundeswehr and the management of personnel exchange programmes with defence engineers and defence scientists (Engineers and Scientists Exchange Program, ESEP) as well as administrative personnel (Administrative and Professional Personnel Exchange Program, APEP) of both nations. Fig. 2 shows the current duty locations of the 110th ESEP/34th APEP groups. Within the scope of these programmes two participants in these two groups were, again, sent to Canada. Ideally, posts in bilateral or multilateral projects are identified by US agencies, as it has happened in the case of the Naval Surface Warfare Center in the Ship Self Defense Department, Rolling Airframe Missile (RAM) project in Port Hueneme, CA. Here, a defence engineer of the 110th ESEP/34th APEP group is working in the RAM project, as he did in Germany before, but now on the US side. As a consequence, an intense, direct and project-related transfer of knowledge takes place.

Moreover, within the scope of the cooperation with US agencies in the field of compliance demonstration considerable progress has been made recently, namely the conclusion of a Test and Evaluation Program (TEP) MoU (Memorandum of Understanding). For the Bundeswehr, this MoU provides the opportunity to use test and evaluation facilities of all US armed services. In return, the US Department of Defense (DoD) will get access to the German technical centers and research institutes. In addition, the MoU can be used as a basis for conducting joint tests and trials and for loaning equipment necessary for these tests and trials.

From a German perspective, the MoU has distinctive advantages over the Foreign Military Sales (FMS) cases that were needed before the MoU was concluded. The conclusion of FMS contracts was, despite the low level of complexity, at times rather tedious



Graphic: BAAINBw

Duty locations ESEPIAPEP

and required the involvement of several US agencies. Now, a specific activity only requires the negotiation of a separate project agreement (PA) based on the MoU, which is considerably faster to implement.

In addition to the tasks described above, the Liaison Office assumes quality management tasks for products ordered in the USA and

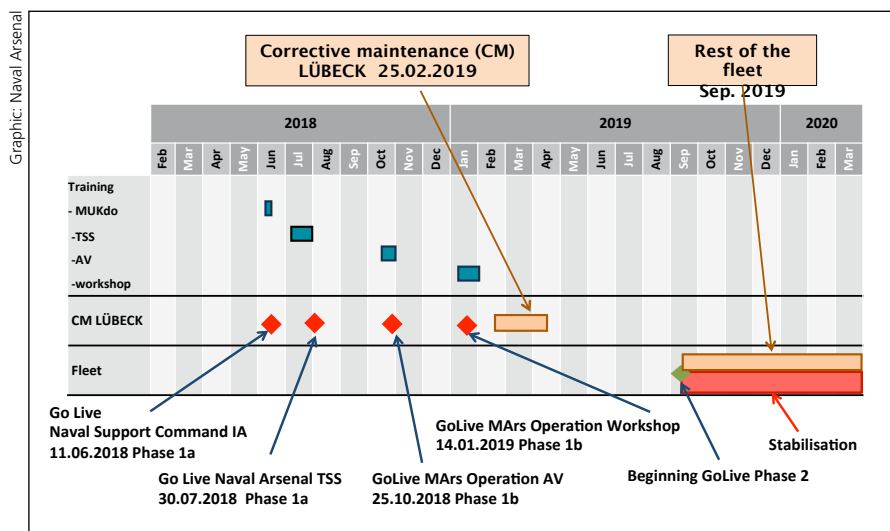
Systems Expertise of the Future

The F125 class frigate is a key project for the German Navy, the German naval ship-building industry and the Naval Arsenal. The intensive use of this class of ships will entail new challenges for the Naval Arsenal, which will also have a major impact on the arsenal's working methods and work structures.

LogITU-F125 project. This project will also enable the Naval Arsenal to process all future maintenance activities for the units afloat in SASPF. This project solution will be tested during a pilot project, namely the corrective maintenance of the frigate LÜBECK in 2019. The Naval Arsenal's infrastructure dates back to the 1960s and is no longer up to today's or even future standards of a maintenance shop for modern naval units. Numerous construction projects will be completed over the course of the next few years as part of the site-related development concept. This includes the planned demolition of old infrastructure as well as the construction of new buildings for future-oriented workshops, and it further includes a dry dock and a hangar, thus enabling the Naval Arsenal to support increasingly bigger and sophisticated naval units and to ensure their maintenance.

The Naval Arsenal will need young skilled workers, master craftsmen and technical civil servants of all career paths as well as administrative officers and legal experts in the administration and contract processing departments in order to reduce the average age of the workforce. Direct recruitment makes it possible to attract employees with an academic background. When it comes to finding skilled workers, the Naval Arsenal's apprenticeship workshop, where up to 60 apprentices are trained each year, has proved to be an advantage. Since 2013, the arsenal has been hiring again young skilled workers that underwent an apprenticeship at the Naval Arsenal. The Naval Arsenal's cooperation with the Jade University of Applied Sciences in Wilhelmshaven, where students can complete a technical degree course with integrated career training for civil servants in the higher-intermediate technical administrative service, has also made it easier to combat recruiting challenges. In north-western Germany, the Naval Arsenal is a pilot agency for this kind of cooperation within the major organisational element Equipment, Information Technology and In-Service Support and provides training to ten students each year.

All of the above-mentioned measures, from the renewal of infrastructure, preparations for the F125 class frigates and the continued SASPF implementation to recruitment, will be implemented by the Naval Arsenal over the course of the next few years while maintaining day-to-day operations. In addition, the necessary preparations for the supplementary procurement of the class 130 Corvette, the German-Norwegian joint project U212 Common Design (CD) as well as the multi-role combat ship MKS 180 have already begun.



The frigate LÜBECK as pilot project for corrective maintenance

conducts these tasks in accordance with the contractually agreed acceptance criteria. To this end, the agency cooperates with US and Canadian government quality assurance authorities on a regular basis.

At present, the probably most important defence cooperation between the Federal Republic of Germany and the United States of America is the Rolling Airframe Missile project. Current activities focus on the development of the Block 2B RAM missile and the preparations for equipping the K130 corvettes and the MKS 180 multirole combat ships (2nd lot) with RAM launchers.

Summing up, the German Liaison Office for Defense Materiel, USA/Canada is building up the mutual trust needed for effective transatlantic armaments cooperation by way of continuous dialogue with the US and Canadian partners.

The Naval Arsenal

The Naval Arsenal in Wilhelmshaven is responsible for maintenance activities above unit level for ships, boats and shore-based facilities of the German Navy. In its work-shops, specially qualified personnel repair the weapons, command, control and employment systems of the ships and boats. As far as the repair of ship and boat hulls and the components of a ship in a classic sense is concerned, such as shipbuilding and engineering systems and devices, repair contracts are awarded by the Naval Arsenal to shipyards and equipment manufacturers on a competitive basis.

As ships are meant to stay in the operating area for two years, the Naval Arsenal will have to prepare for long-distance support over extended periods of time. The personnel must therefore be capable of understanding and analysing these ships so as to provide technical support for the system of systems. Furthermore, technical staff must comply with all of the relevant health requirements in order to be able to travel to the ships' operating areas and perform any on-board maintenance activities the ship crews can no longer carry out themselves. The development of the Naval Arsenal's remote maintenance capability based on the arsenal's reference systems is also a major priority; the related remote maintenance concept has already been completed. Secure Bundeswehr communication channels ensure the data connection between the Naval Arsenal and the ships in the operating area. Not only does the technical realisation of the so-called Marine Maintenance Channel (MMC) need to be put into practice, the MMC also requires an organisational framework. It has been agreed with the Navy that the ship's command retains the authority to connect to the systems and devices of naval ships. The first test of real-time remote maintenance with MMC at the Corvette MAGDEBURG in the operating area in 2016 was a success.

An offline SASPF system is meant to ensure the logistic IT support of the F125 class frigates, which will be realised as part of the

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