Federal Ministry
of Defence

Air Power Development Strategy

2016

Bundeswehr
Wir. Dienen. Deutschland.

Air Power
Development Strategy

Bundeswehr
Wir. Dienen. Deutschland.

An Airbus A310 MRTT and EUROFIGHTERS mirrored in a helmet visor
(Bundeswehr/Thöne)

Contents

Preliminary Remarks / Introduction 1

The Air Power Development Strategy is a document issued by the Federal Ministry of Defence (FMoD). It supplements the Aviation Strategy of the Federal Government in the field of military aviation. While the Aviation Strategy of the Federal Government underlines the importance of the German aviation industry for the economy, the Air Power Development Strategy focuses on fulfilling the mission of the Bundeswehr on the basis of political requirements and ensuring the performance of the resulting tasks and capability development in the third dimension by aircraft.

In addition, armaments, personnel, operational readiness, routine duty, and multinational/European cooperation are seen as contributions of the FMoD to the objectives of the Federal Aviation Strategy.

The Air Power Development Strategy is based on the Defence Policy Guidelines, the Bundeswehr Concept, and other Bundeswehr documents. The Air Power Development Strategy is an integral part of the 2014 Federal Aviation Strategy. It does not present in advance any positions of the 2016 White Paper but only describes the current situation. If necessary, it will be updated following the publication of the White Paper.

The Air Power Development Strategy is an official Bundeswehr document and is applicable to the area of responsibility of the FMoD. It is a document designed for external use and describes the objectives of the FMoD in the third dimension.

In particular, the Air Power Development Strategy is part of the efforts to implement the Strategy Paper of the Federal Government on Strengthening the Defence Industry in Germany of 8 July 2015.

To ease understanding at the international level, NATO and EU capability specifications and terminology are used in this document.

[1] *Two NH90 helicopters and an ambulance during a forward aeromedical evacuation exercise at Bergen training area (Bundeswehr/König)* [2] *Maintenance work after a EUROFIGHTER flight in the QRA (Quick Reaction Alert) shelter at Ämari (Bundeswehr/Bärwald)* [3] *Night photograph at Fighter Bomber Wing 31 „Boelcke“ in Nörvenich (Bundeswehr/Bicker)* [4] *European air transport training at the largest air base in Spain (Bundeswehr/Wilke)* [5] *Rollout of Military Airbus A400M (Bundeswehr/Döpke)*

Purpose and Objective 2

The Air Power Development Strategy describes the capability profile of the Bundeswehr in the third dimension (i.e. airspace) which is necessary in order to fulfil national security objectives and outlines the required capability development, giving special attention to multinational cooperation. Ways to achieve objectives are presented on the basis of current and future aircraft. The Air Power Development Strategy is an unclassified document and is intended to inform people about required Bundeswehr capabilities in the third dimension. It presents the position of the FMoD on the requirements ensuing from NATO and EU planning goals and thus facilitates the pro-active development of possible future multinational cooperation in the fields of armaments, procurement, training, routine duty and operations. It is aimed both at interested members of the public in parliament, industry and lobby groups and at the Bundeswehr itself.

The Air Power Development Strategy also serves as a basis for the development of internal Ministry documents. The detailed roadmaps for the further development of the German air component[1] which are based on these documents pursue the capability goals of the Bundeswehr and take into special consideration the requirements of the Strategy Paper of the Federal Government on Strengthening the Defence Industry in Germany, which is aimed at ensuring multinational cooperation and maintaining and promoting key defence industrial technologies in the military aviation industry in Germany and Europe. It provides starting points for defining the objectives and orientation of the German defence industry and for international cooperation in conceptual, defence technological and operational areas. For this purpose, objectives, priority areas and measures for achieving the objectives are developed and used to create comprehensive roadmaps. These include future priorities in research and technology; innovative procurement, in-service support and operational concepts to improve operational readiness; and increased multinational cooperation in Europe.

The Air Power Development Strategy will thus help to make transparent the complex interrelations of current and future capabilities and weapon systems of the Bundeswehr in the air dimension.

The implementation of the Air Power Development Strategy will take place within the framework of Bundeswehr processes. It will be based on security requirements, political and legal considerations, financial constraints, industrial development cycles, and market opportunities.

[1] This document deliberately avoids service-specific terminology (e.g. Army aviators, Navy, and Air Force). The term „air component" is used as a synonym for military airspace users from all services.


[1]


[2]

[3]

[1] *Dust landing of an NH90-TTH medium transport helicopter of the Army (Bundeswehr/Vennemann)*
[2] *A400M large-capacity transport aircraft of Air Transport Wing 62 (Bundeswehr/Hähnel)*
[3] *EUROFIGHTERS of Tactical Air Force Wing 73 (Bundeswehr/Petersen)*

Capability Development Objectives for the Bundeswehr in the Third Dimension 3

a) Importance and Nature of Air Power

Due to its special characteristics such as range, speed, flexibility and endurance, the air component plays an important role in the portfolio of the armed forces. It provides political and military leaders with a wide range of options across the entire operational and intensity spectrum in peacetime, in crises, in armed conflicts, and as part of national and collective defence. Even in small numbers, aircraft are capable of delivering precise effects. They often enable the involvement of other forces or enhance their effect. As the first force to deploy, the air component can exert political influence at various levels of escalation and de-escalation at an early stage, even with limited commitment and sometimes even without the need to deploy to the mission area. It can thus make a decisive contribution to Germany's ability to pursue foreign policy objectives and to deterrence in an Alliance context.

Even in peacetime, the air component performs important national tasks such as the surveillance and policing of German air space and maritime waters, military search and rescue (SAR[2]) missions, the support of rescue, evacuation and liberation missions for German citizens and protected persons abroad, and worldwide air transport in humanitarian operations.

By providing reconnaissance findings, the air component makes contributions to a comprehensive situation picture which can be used as a basis for decisions by political and military leaders.

With its ability to gain and maintain control over an allocated airspace on operations, the air component lays an important foundation for the operational freedom needed by national and multinational land and sea forces – as well as for other governmental and non-governmental organisations[3]. Ensuring at least a favourable air situation and countering air threats will remain essential prerequisites for effective and efficient operations and for force protection on the ground and at sea. In addition, airborne weapon systems make important contributions to the support of forces on land and on and under the water.

Air transport forces support flexible operations by making it possible to rapidly shift the main effort and to project power. The air mobility of land forces, for example, enables them to take the initiative and to respond quickly over long distances, thus widening the range of options in the factors time, space and force. Additionally, air transport forces are an indispensable element of the casualty evacuation chain.

With its inherent capabilities, the air component thus makes a decisive contribution to the success of operations and to the settlement of military confrontations. In the event of an emergency or disaster, they support interagency rescue and relief measures for the civilian population and contribute to humanitarian aid efforts, even abroad.

[2] Bundeswehr aircraft are also used to perform search and rescue services for civil aviation, which is based on a national obligation to the ICAO and an interministerial agreement between the Federal Ministry of Transport and Digital Infrastructure and the Federal Ministry of Defence.

[3] The top priority of the air component is to establish air superiority or a desired level of control over an airspace. If they are part of a maritime task force, their objective is to establish control over an airspace at sea. The air component then maintains control over the operational area. At the same time, uncommitted forces are employed to protect and support friendly forces on the ground and at sea. The aim is to create a permissive environment in which control can be established and maintained in the entire area of operations during a follow-on operation (FoM – freedom of movement).


[1]


[2]


[3]

[1] TORNADAOS during an event to celebrate 40 years of the TORNADO (Bundeswehr/Petersen) [2] A tool cabinet is checked by German and American soldiers at Holloman Air Force Base (Bundeswehr/Schmidt) [3] Airdrop exercise of the trinational Task Force Cerberus during the multinational exercise Swift Response 2015 (Bundeswehr/Dorow)

b) Capability Development Objectives – Broad Capability Spectrum in the Alliance

German forces and their commitments in the context of NATO and the EU are based on political requirements and the international responsibility and interests of Germany.

The air component has great operational relevance and must at times be employed at short notice. The capabilities currently provided by the German air component must be maintained within the Alliance, since abandoned or suspended capabilities require more than a decade to be restored.

Cutting-edge technology is necessary, however, in order to meet the demanding requirements of the air component and to maintain an operational advantage. At the same time, the capabilities of the air component should – where appropriate and compatible with national interests – be achieved on the basis of cooperation programmes during all activities of the value chain: research and technology, development and procurement, and operational use. In this way we can to maintain a broad capability spectrum in the Alliance.

Requirements must be shaped and technological leaps must be assessed so that a balance between the quality and quantity of weapon systems can be achieved in order to limit financial, time-related and technological development risks and to evaluate off-the-shelf solutions.

Reliance on industry should be increased where it is justifiable from a military point of view, where it makes economic sense, and where synergies can be used. „Justifiable from a military point of view" means that resources can be made available for mission accomplishment and that operational readiness and flexibility in the Alliance and national interests are not endangered.

[1]

[1] *EUROFIGHTER of Tactical Air Force Wing 73 „Steinhoff“ with anniversary markings (Bundeswehr/Petersen)* [2] *Demonstration during SAR MEET 2008 with a SEA KING MK 41 Navy helicopter and the FGS Berlin sea rescue cruiser (Bundeswehr/Heyng)*

The System-of-Systems Concept

The relevance, priority, development and technical implementation of capabilities of the air component are constantly changing on account of global trends, evolving threats, and political and financial constraints. As a result of long development and in-service phases, the possibility of adapting the air component to future challenges must increasingly be considered when systems are being planned and developed. This will ensure the rapid and timely introduction of necessary technical solutions.

The objective of the capability development of the German air component is therefore to establish an interoperable system of systems that makes it possible to achieve the required capabilities in an integrated multinational setting. A system of systems, in which platforms are mainly equipped with modular components (particularly armaments, sensors, and mission equipment), ensures considerable flexibility and increases the potential of multinational cooperation, e.g. by providing an additional „opt-in“ option for smaller partners. A system of systems thus makes it possible to meet changing requirements despite prolonged armaments cycles[4].

To ensure the efficient use of available resources, efforts must be made to limit the number of different aircraft types according to the principle „as many as necessary and as few as possible“. This principle does have its limits, however. We must carefully weigh up the tasks of national defence and collective defence against international crisis and conflict prevention measures and against available resources. Wherever requirements permit, it is useful to combine several capabilities on a single platform (multirole design). Capabilities provided by aircraft should also overlap. This results in equipment that is coordinated within the Alliance and that in its entirety acts as a deterrent (in this case, quantity can also be a quality). It should be noted that a capability is available for operations only when quality requirements and quantity requirements have been fulfilled (e.g. adequate sustainability), personnel have been appropriately trained, and training facilities and maintenance resources are available in sufficient quantities.

The technical implementation of the requirements to be met by the air component and the cutting-edge technology necessary for maintaining an operationally usable advantage necessitate an enormous financial expenditure that must be assessed in terms of operational effectiveness (costs versus benefits). Interoperability within the system of systems and with allied forces is a fundamental prerequisite for aircraft design.

Emphasis is also placed on the flexibility and sustainability of weapon systems. In this regard, the availability of aircraft during operations and on routine duty must be increased to achieve a maximum level of operational readiness for both personnel and materiel/equipment. As a result of the increased dependence of weapon systems on IT systems and in view of the increasing threats in cyberspace, the robustness and IT security of weapon and employment systems are of fundamental importance.

The complexity of weapon systems and their use in an integrated system will necessitate their inclusion in a common architecture. In addition, technical/logistic management and supply during routine duty and on operations also influence the performance of systems. For the system-of-systems concept to be implemented properly, systems must be able to communicate in near real time and the required data bandwidth (for encrypted data too) must be provided and protected.

[2]

[4] The following trends must be considered when analysing the threat of potential adversaries: enhanced air defence systems (anti-access, area denial, 5th generation combat aircraft), low observability, commercial off-the-shelf (COTS), hypersonic effectors, proliferation, hybrid warfare, cyberattack, automation, UAS including swarming.

Prioritisation of German Capability Contributions in the Air Dimension

Capabilities to be kept available by German forces are grouped into the following categories:

MUST

- legal and political requirements must be fulfilled; capabilities to be provided at the national level (e.g. the standing operational task of the surveillance and policing of German airspace and waters, rescue, evacuation and rescue of German citizens and protected persons abroad (personnel recovery, noncombatant evacuation operations)), support of special forces, capabilities for tasks based on national and international agreements on search and rescue services over land and sea;

- contributions for NATO and the EU based on political requirements – wherever possible as part of multinational cooperation;

- laying the foundations for operations (e.g. protection from airborne threats; ensuring air transport under threat, including the tactical air mobility of land forces, strategic and tactical aeromedical evacuation);

- protection and support of employed forces, e.g. within the context of joint fire support (JFS) and air-surface integration (ASI);

- provision of information gathered by reconnaissance.

SHOULD

- capabilities that are already provided to a sufficient extent by allies or capabilities whose availability for an operation can be ensured within the warning time;

- overlapping capabilities within the context of the flexible and efficient employment of weapon systems.

CAN

- capabilities that can be provided by commercial contractors (e.g. air transport services currently provided by SALIS (oversized/outsized cargo), parliamentary flights).

In the following, necessary developments in the domains of „command and control“, „reconnaissance“, „effects“ and „support“ will be considered, and possible roadmaps for currently available and future airborne weapon systems (including jet combat aircraft, unmanned aerial vehicles (UAV), helicopters and other fixed-wing aircraft) will be presented.

Aerial photograph taken from a Learjet of the GFD (Bundeswehr/Bicker)

German and French Transall C160 aircraft and a CASA CA/235 at Toulouse military airport during the German-French airborne exercise Colibri in southern France (Bundeswehr/Neumann)

Priority Areas and Measures to Achieve Objectives

4

a) General

Over the past 20 years, important decisions have been made about platforms and capabilities (e.g. EUROFIGHTER, A400M, NH90, etc.). These decisions will continue to shape military aviation in Europe for decades to come. The Bundeswehr nevertheless also has weapon systems that, after many years of successful service, will reach the scheduled end of their service lives within the next 10 years (e.g. CFI-53 etc.). Important decisions about the future must therefore be made in good time. Early planning is necessary in order to keep pace with technological developments and to avoid temporary capability gaps and the costly maintenance of aging aircraft and aircraft subsystems.

The aim of the following sections is to identify decisions that must be made in the near future, to make criteria transparent, and to provide a basis on which decisions can be made (e.g. on the successor to the SEA LYNX shipboard helicopter or to the CH-53 heavy transport helicopter). For weapon systems about which a decision has already been made, the strategy mainly explains how these systems are to be further developed throughout their scheduled service life and when the early development of new capabilities or follow-on systems should be initiated. The continuous development of existing weapon systems ensures that the operational readiness of aircraft can be maintained at a high technological level throughout their service lives and makes it possible to respond quickly to changing requirements.

The design of weapon systems must therefore allow for the possibility of adapting to future challenges.

On the other hand, the Air Power Development Strategy, which embraces a period of several decades due to the lives of systems, must also provide „strategic flexibility“, i.e. it must acknowledge the dynamics of continuous technological developments and changing security parameters. The Air Power Development Strategy therefore clarifies the decision-making parameters and criteria in particular for future capabilities and weapon systems and identifies the important decisions to be made.

The Strategy thus particularly emphasises the close connection between the multinational orientation of the Bundeswehr and the definition of a Future Combat Air System (FCAS). Both elements, i.e. long-term partnerships with other nations for sharing and developing capabilities in the air dimension and the organisation of the FCAS are, for the Bundeswehr with its multinational approach, closely connected and of strategic relevance for medium- to long-term decisions about capabilities and solutions.

The following sections will cover important strategic vectors and overriding policies concerning technological capabilities, industrial resources, multinationality, unmanned aviation, and the required parallel operation of two types of combat aircraft.

Participants in the National General/Admiral Staff Officers' Course (Bundeswehr/Lang)

b) Strategic Vectors

Technological Capabilities and Industrial Resources

The strategy for further developing capabilities, for example third-generation (TORNADO) and fourth-generation (EUROFIGHTER) tactical combat aircraft, in an integrated Future Combat Air System (FCAS) with various kinds of possible new platforms (e.g. Next Generation Weapon System (NextGenWS)) has a considerable influence on the required technological capabilities and industrial resources in the air dimension.

Parallel operation of two different combat aircraft types with partially overlapping capabilities ensures operational flexibility and offers an opportunity to successively replace aircraft types without temporarily losing important capabilities.

The need for key defence industrial technologies and industrial resources will therefore be determined in the foreseeable future by the capabilities required in the FCAS. For this reason, selected key national defence industrial technologies should be promoted for the further technological development of the EUROFIGHTER and the maturation of technology for a Next Generation Weapon System (NextGenWS). On account of the increasing importance of cyberspace, this explicitly includes key technologies in the fields of information technology and cyber power.

Multinationality

RFor decades, armament projects for the air dimension have primarily been multinational. Financial constraints and the increasing complexity of weapon systems mean that this will remain imperative in future. Lessons learned from current cooperation projects show, however, that we must rethink our approach.

The central element of this new approach to multinational cooperation is the assumption of a lead role by a single nation for each platform. This lead role is not necessarily linked to a dominant share of the work and may also be justified by the contribution of one or more key technologies. What is instead crucial in this context is control over a process. For reasons of industrial, economic or Alliance policy, compromises must therefore be reached on other projects. This means, however, that a nation must relinquish a leading role in other fields of technology. Although there are often diverging interests at play, work should ideally be divided according to the strengths of the various countries; the distribution of work among countries should not increase the overall complexity of development and production. In addition to the lead nation principle and work sharing, it is important that there are uniform concepts and requirements so that returns to scale and synergies can be achieved. The development of different platform versions for different nations will not help us reach our goals.

This is why Germany has assumed the lead nation role for the development of a medium-altitude long-endurance (MALE) class unmanned aerial vehicle in cooperation with the partner nations France, Italy and Spain. Further cooperation on this project must be jointly negotiated.

From the perspective of the Ministry, a Next Generation Weapon System in the FCAS network can only be created in a multinational European context. A national solo effort is no longer possible for such complex weapon systems. The FMoD will soon initiate an early dialogue in Europe on common objectives, roadmaps, and options.

A European architecture of an FCAS network provides the potential required for efficient capability development and the effective maintenance of technology without confronting individual nations with unsolvable and in particular budgetary challenges. At the same time, smaller countries in particular are given the opportunity to participle in the FCAS network with small fleets. The result with regard to industry will be a targeted concentration of European technology development on the future challenges of modern weapon systems.

The future position of the FMoD on maintaining the capabilities of airborne weapon systems in the long term will be developed in the context of the planned multinational discussion on an FCAS network and will have an influence on capability development and industrial policy.

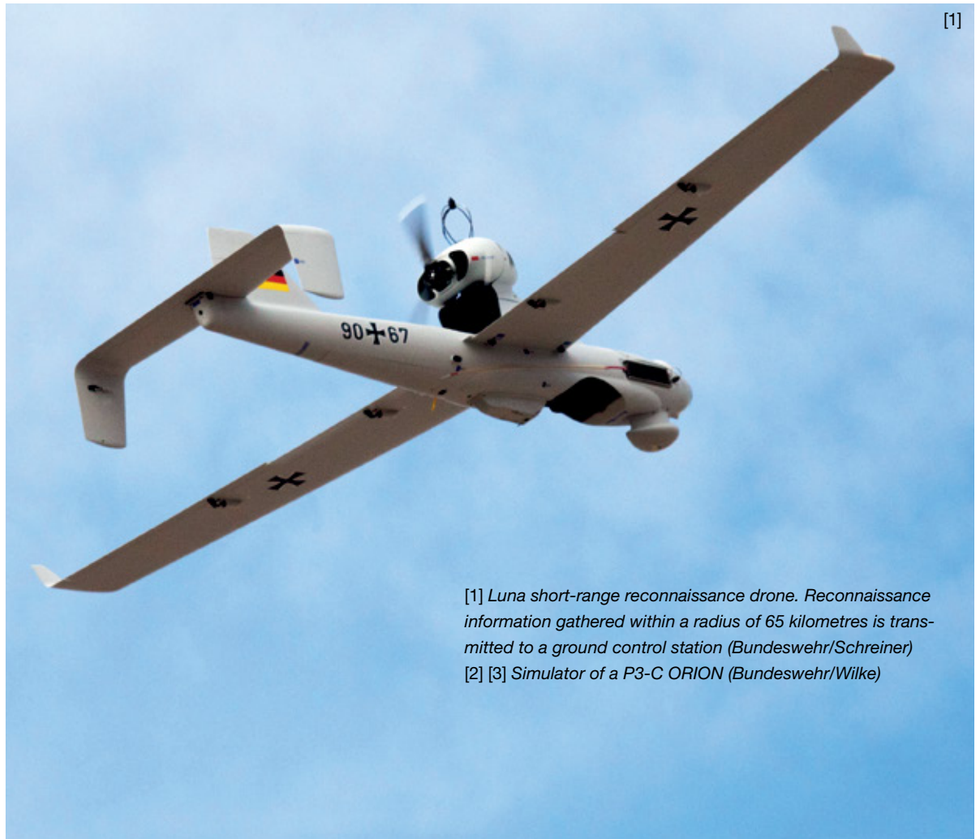
A further element of the new approach is the use of common legal regulatory frameworks for the certification and employment of personnel and materiel[5].

Only in this way can we ensure that multinationality goes beyond common development and procurement and has a successful future.

Unmanned Aerial Systems

When it comes to unmanned aerial systems, our objective is operate such systems in European airspace in order to ensure training and mission flight operations. Within the scope of risk management, the implementation of civilian equipment and certification requirements must be considered along with operational requirements.

[5] For example, the use of EMAR/DEMAR (European Military Airworthiness Requirements / German Military Airworthiness Requirements) in cooperation projects at European level.



[1]

[2]

[3]

[1] *Luna short-range reconnaissance drone. Reconnaissance information gathered within a radius of 65 kilometres is transmitted to a ground control station (Bundeswehr/Schreiner)*
[2] [3] *Simulator of a P3-C ORION (Bundeswehr/Wilke)*

NATO E-3A aircraft (AWACS) in parking position (front). In the background, a KC-135 tanker aircraft of the US Air National Guard Oklahoma (Bundeswehr/Twardy)

c) Priority Area: Airborne Command and Control

Germany has no national airborne command and control capabilities. Instead it participates in the NATO Airborne Early Warning & Control (NAEW&C[6]) system. The planned modernisation and service-life extension of this fleet (currently scheduled to end in 2025) will ensure the provision of this capability until 2035.

Preparatory measures are currently being carried out which are to be completed by the end of this decade. For the period from 2035 onwards, NATO is already considering a successor system and Germany will play an active part in this process. In mid-2016, a decision must be taken on the beginning of the concept phase, which will include studies in preparation for a selection decision document. The decision on realisation is expected to be made in 2019. The FMoD intends to participate in the successor system project. Its decision will depend on the design, cost, and multinational participation. A combination with the capabilities of other systems, e.g. the **NATO AGS** (Alliance Ground Surveillance) system, which is still in the buildup phase, will be considered in the studies (see the section on strategic reconnaissance).

d) Priority Area: Airborne Reconnaissance Network (part of joint intelligence, surveillance and reconnaissance (JISR))

This section deals with aircraft that are mainly used for reconnaissance. Many aircraft that are primarily used for delivering effects also provide capabilities for the reconnaissance network. These aircraft are only mentioned here and will be addressed in more detail in the section on the effects network.

The reconnaissance network comprises aircraft that complement one another with different sensors and areas of employment. They make a substantial contribution to information and effects superiority in the fields of imagery intelligence[7], signals intelligence[8] and hydroacoustic intelligence. They make available a broad spectrum of current and high-quality information and provide an important basis for effectively meeting the information needs of political leaders and the Bundeswehr. In addition, they effectively support tactical and operational command and control.

These reconnaissance capabilities must meet the following requirements:

- they must operate at long range, deep in the theatre, and at short and medium range;
- they must have a high availability rate and a long endurance and must be able to respond rapidly;
- they must operate in all weather at any time of the day or night;
- we must have many different systems, they must be adaptable and have new sensors.

The use of unmanned aerial systems[9] is becoming more and more important particularly in the reconnaissance network. They have long endurance, which is required for reconnaissance and surveillance, and they reduce the danger to own personnel by the physical separation of aircraft and crew. Unmanned aerial systems can currently only be used to a limited extent because they are unable to protect themselves from, for example, enemy air forces and ground-based longer-range air defence systems. For this reason, robust manned systems will therefore remain necessary in the Alliance for tactical air reconnaissance (TAR) in high-intensity conflicts.

In addition to aircraft and sensors, particular importance is also attached to near-real-time protected and secure data transfer (including beyond-line-of-sight systems), partially/fully automated processing and preparation, the storage and distribution of obtained data, and the networking of individual systems. We must not only provide the bandwidths required for data transfer but also protect against and counter cyber attacks. We must also ensure that threat information is quickly incorporated into the warning and protection systems of airborne systems.

To ensure unrestricted flight training and operations, unmanned aerial systems must be fully integrated into the general airspace and must acquire the necessary flight certification. Legal requirements for the unrestricted operation of UAS in general airspace must be clarified, and synergies must be examined that may result from the development of procedures and technical solutions for the civilian use of UAS.

JISR and the associated (sub-)capabilities are part of the multinational studies conducted within the scope of the framework nation concept.

[6] NAEW&C is a NATO capability for air surveillance and the command and control of air operations which is based on a NATO owned and operated fleet of E-3A aircraft. There are no plans to build up a purely national capability.

[7] IMINT - Imagery Intelligence
[8] SIGINT comprises electronic intelligence (ELINT) and communications intelligence (COMINT)
[9] Systems with a maximum takeoff weight of more than 150 kg

Employment of LUNA (airborne unmanned short-range reconnaissance system) at Observation Post (OP) North (Bundeswehr/Bienert)

SIGINT

The Bundeswehr currently has a capability gap in the area of airborne, long-range SIGINT.

Such systems detect military radio traffic and radar emissions which are then evaluated to compile an electronic situation picture and to obtain data for self-protection systems. They thus make a substantial contribution to the early recognition of crises, assessments of the situation in the scope of crisis prevention, and assessments of the threat situation in areas of interest and potential theatres of operations. They thus serve to protect soldiers on operations.

Closing this capability gap continues to be an urgent requirement, but it cannot be achieved in the short term since the introduction of the EURO HAWK UAS, which was originally designed for this purpose, has been stopped. Closing this capability gap is a high priority and is to be achieved by examining the procurement and use of the TRITON UAV, in particular the aspects of flight certification and the possibility of operation in international airspace[10]. The Integrated SIGINT System (ISIS) will be installed in the carrier platform. The selection decision will likely be taken in late 2016. The first systems are expected to be delivered at the beginning of the next decade.

SIGINT requires a receiving system with a combination of several highly sensitive broadband and narrowband components in order to fulfil its different functions. Additionally, it requires CPU-intensive evaluation algorithms. Such a SIGINT system concerns national interests in sensitive areas, comprises core capabilities of German industry, and constitutes a key national defence industrial technology.

In addition, Germany is participating in the NATO capability for imagery, standoff capable and wide-area reconnaissance (NATO AGS). The NATO AGS system produces optical reconnaissance results (images) by means of a radar sensor. The NATO AGS programme includes plans for the operation of RO-4 GLOBAL HAWK HALE UAS. The decision on a possible additional national capability in this area will be taken when the platform decision on a SIGINT system is made. The possible introduction of such a capability is not planned until the middle of the next decade.

Operational and Tactical Reconnaissance

The contract for the HERON 1 operator solution **(intermediate solution)** in Afghanistan has been extended until February 2016, and an optional extension of one year has been prepared. To develop this capability and to increase its flexibility, we must replace this system while increasing the capability (including armament options) both in terms of quantity and quality.

For this purpose, Germany has assumed the lead role in the development of a European **MALE UAS** (medium-altitude long-endurance unmanned aerial system) as a **target solution**. In 2015, preparations for a joint definition study were started in cooperation with France, Italy and Spain. The objective of this study is to achieve a multinational consensus on functional requirements on the basis of sound cost estimates[11]. This also contributes to implementing a goal laid down in the current coalition agreement, namely to advance the development of a European unmanned aerial vehicle. The system will only be procured, however, when the capability requirements are met and when operation in general airspace is possible without any major restrictions. In this context, the foundations must be laid for the certification and operation of UAS in European airspace.

Since this **solution** will not be available before the middle of the next decade, there are plans to use a commercially available system until then as an interim solution for Bundeswehr operations. Options for realising such an approach are currently being examined.

For unmanned aerial vehicles, the **human-in-the-loop** principle, i.e. the possibility of immediate operator intervention, must be ensured at all times. The stance of the Federal Government will continue to be that strikes by unmanned aerial vehicles must always be under human control and must be restricted to operations mandated by the German Bundestag.

From 2019 onwards, the **medium range tactical UAS** currently used by the **land forces** (KZO, LUNA) will be replaced by a successor system. On account of their capability profile, they fit exactly into the reconnaissance architecture of the Bundeswehr. They complement the other airborne reconnaissance systems (long-range, deep theatre) and provide the tactical commander on the ground with direct access to airborne reconnaissance resources with highly flexible and robust multispectral sensors.

The naval forces are currently working on a **UAS project** for reconnaissance and identification in maritime areas of operation. This project focuses on target reconnaissance, target identification and effects assessment in operations against surface or land targets. It is an integral part of the K130 class corvettes. The system is scheduled to enter service from 2018 onwards.

The **capability to perform tactical penetrating imaging reconnaissance in the depth of the theatre of operations** also in threat situations (TAR) is ensured by the TORNADO until the end of its service life. In the medium term, we intend to integrate a laser designator pod with an enhanced sensor system into the EUROFIGHTER in order to further improve its multirole capability, to maintain our reconnaissance capability, and thus to increase flexibility on operations.

The SEA LYNX MK88 shipboard helicopter has **surface reconnaissance capabilities based on radar and infrared sensors**. A dipping sonar enables the helicopter to perform hydroacoustic subsurface reconnaissance. Since certain systems will become obsolete in the middle of the next decade, capability maintenance studies have been initiated. The introduction of a follow-on solution is scheduled for the first half of the next decade. When we assess possible solutions for procurement, we must also examine to what extent functions of the current shipboard helicopter can be fulfilled or complemented by unmanned systems.

The **capability for long-range maritime reconnaissance in surface warfare** (IMINT, ELINT) is provided by the P-3C ORION aircraft, which uses radar, electronic support measures (ESM) and infrared sensors. Following the decision to maintain this capability and to take the measures required for this purpose (replacement of wings, maintenance of flight worthiness, and replacement of the tactical management system), the P-3C ORION will be kept in service until 2035. There are plans to

[10] In the event that a Triton-based system is not feasible, two manned solutions based on a Global 5000 will be considered. One of the proposed solutions involves the Integrated SIGINT System (ISIS), which was developed for the EURO HAWK. Another proposal concerns a nondevelopmental item.
[11] Spain joined this project in October 2015.

expand its capability spectrum (e.g. wide-area reconnaissance) by the integration of additional reconnaissance resources. When it comes to subsurface reconnaissance, the aircraft must be equipped with bistatic and multistatic radar components so that it can be employed in wide-area antisubmarine warfare (ASW). In the long run, this capability should be maintained in the framework of multinational cooperation.

The **NH90 NTH SEA LION helicopter**, which will enter service in 2019, will be equipped with appropriate sensors to enable it to contribute to the generation of surface pictures.

In addition to the capabilities mentioned above, possible sensor platforms and relay stations (stratospheric platforms) will also be considered with regard to future developments. If necessary, these platforms can complement the current capability portfolio in the third dimension in addition to MALE and HALE UAS.

SEA LYNX shipboard helicopter on board the frigate FGS Bayern during Operation Atalanta (© Bundeswehr/Bartsch)

e) Priority Area: Airborne Effects Network

In the long term, the Future Combat Air System (FCAS) will form the backbone of the effects network. The FCAS is not an individual aerial platform or an individual aircraft but rather a system of systems which, in its final development stage, will deliver airborne effects across the entire capability and intensity spectrum. As a system-of-systems approach, the FCAS encompasses the capabilities of existing weapon systems (e.g. EUROFIGHTER, TORNADO, TIGER for Germany) and future weapon systems (e.g. MALE UAS and NextGenWS). The FMoD intends to define initial national concepts and operational requirements for an FCAS and thus also for a Next Generation Weapon System in 2016. This will provide a basis for multinational cooperation and for an assessment of joint capability requirements and their technological feasibility. Initial discussions with European partners are scheduled for 2016.

The Future Combat Air System (FCAS) must, for example, cover the following tasks and types of operation:

- provision of the quick reaction alert (intercept) element (QRA(I)) as part of the standing operational task of surveillance and protection of German airspace;
- defensive counterair (DCA) and offensive counterair (OCA), including suppression of enemy air defence (SEAD);
- air interdiction (AI), close air support (CAS), joint time sensitive targeting (JTST), and anti-surface warfare (ASuW);
- intelligence, surveillance and reconnaissance (ISR); see also reconnaissance network.

Apart from platforms, the right mix of weapons is required to be able to achieve appropriate effects and to prevent unintended (collateral) damage. This mix must be ensured by a cross-platform armament concept for airborne weapon systems in the FCAS.

In the foreseeable future, the **EUROFIGHTER** will be a mainstay of Germany's manned combat aircraft fleet and will be an important German contribution to the FCAS. According to current plans, the delivery of these aircraft will be completed by 2018. The EUROFIGHTER is an important capability platform of the Bundeswehr for ensuring the sovereignty of national airspace (QRA(I)) and conducting defensive counter-air operations.

In order to fulfil the QRA(I) task, to ensure education and flight training activities, and to meet international operational commitments, Tranche 1 should be used until it is no longer cost effective in the context of operational requirements.

With the GBU-48, the EUROFIGHTER[12] will have an initial capability for offensive counter-air operations. This is an initial step towards multi-role capability.

With this in mind, we must augment the capabilities of Tranche 2 and Tranche 3A EUROFIGHTER aircraft. This increase in capability should primarily be coordinated with the EUROFIGHTER partner nations on the basis of a common configuration. There are plans for **improvements in air/ground capability** (including the integration of additional weapons, such as a short-range missile by 2020 and a medium-range weapon from 2020 onwards), improvements of command and control assets and, in conjunction with the TORNADO, contributions to the suppression of enemy air defence (SEAD) and to anti-surface warfare (ASuW). The EUROFIGHTER will likely not be fitted with special weapons for these roles before 2025. The decision on this matter must be considered in the context of developments concerning the NextGenWS.

The **multirole capability** of the EUROFIGHTER must therefore be enhanced. For this reason, it will be equipped with new sensors (AESA radar, LDP with reconnaissance

[12] Tranche 2 and Tranche 3A

component).

In order to sustain the capabilities of the EUROFIGHTER well beyond 2040 so that it can be a mainstay of the FCAS, we must assume that Tranche 2 and 3A aircraft will have a life of more than 25 years. In the next two years, we must consider and analyse with our partner nations the technological possibilities of a mid-life upgrade (MLU) and a life extension programme (LEP) in order to sustain capabilities (e.g. through obsolescence management and the adaptation of avionics to future technologies) and the related costs. We must also consider the future use of the NextGenWS, which will be developed on a multinational basis, as a complementary platform to the EUROFIGHTER in the FCAS. With regard to the current EUROFIGHTER project phase, multinationalisation must be further increased in the short and medium term in order to increase the user group for further development and operation and thus to achieve effects of scale and to ensure technologies and industrial capacities. The FMoD will support the participation of new partners.

With the upgrade of the **TORNADO** to ASSTA 3[13], the foundation has been laid for sustaining the operational capability of this weapon system. With the augmentation of capabilities of the EUROFIGHTER, the future focus of the TORNADO will be on SEAD and the employment of heavy weapons (e.g. GBU-24 and MAW TAURUS[14]).

According to current plans, the TORNADO will be kept in service until the mid-2020s. In order to provide enough time for the development and procurement of a successor system and to maintain the capability spectrum within the context of FCAS, studies are being carried out to determine whether the in-service period can be prolonged by stretching the remaining flight hours or whether a service life extension of the TORNADO until the mid-2030s is possible. The studies are assessing the technological risks and economic efficiency of these options with a view to reducing risks. A decision will likely be made in 2016.

With its AGM-88B Block III A guided missile (HARM), the TORNADO is the mainstay of the SEAD capability. Among other things, this missile no longer meets the requirements with regard to target location mechanisms and intelligent terminal control to increase hit probability.

Depending on the decision to extend the service life of the TORNADO, it may be necessary to introduce a follow-on solution for the engagement of ground-based air defence systems.

A NextGenWS is envisaged as a future complementary system to the EUROFIGHTER in the FCAS network and in some areas as a potential successor of the TORNADO. It must thus be geared to the future requirements of airborne weapon systems. A focus must be placed on possible options for using capabilities in an Alliance context. The resulting capability requirements should be defined in a complementary approach, taking into account the augmentation of capabilities for the EUROFIGHTER, the capabilities of the MALE UAS target solution, technological developments, trends, and threats.

The **NextGenWS** could be unmanned, manned or optionally manned. This decision should be taken on the basis of further analyses and in the context of a European solution.

In order to seamlessly maintain the current capabilities of the Bundeswehr, the initial operational capability of a NextGenWS must be achieved before the TORNADO reaches the end of its service life. In accordance with the strategic vector, this should be implemented in a multinational context. With the definition of concepts and operational requirements for an FCAS in 2016, the foundations will be laid for European cooperation.

When it comes to **attack helicopters**, the capabilities of the **TIGER** multirole support helicopter must be maintained and extended in the long term. Initial steps in this direction are currently being examined in the multinational TIGER Capability Assurance Programme (TIGER CAP). On account of its sensor and vision systems, its mission-tailored modular weapon systems, its ability to fight by day and night and in adverse weather conditions, the TIGER is an important mainstay of air support for ground forces and of airmobile operations. The fielded gun, rocket and missile armaments must be regenerated in the medium to long term in the scope of capability maintenance (e.g. HOT guided missile, STINGER air-to-air missile system) or must be improved in the scope of capability augmentation.

[13] Evolution soft- and hardware TORNADO.
[14] An integration of a long range Air to Surface stand off missile (like for example MAW TAURUS) is currently not intended for the EUROFIGHTER.

[1]

[2]

[1] *A TIGER ASGARD-F attack helicopter landing at Camp Werdeck (Bundeswehr/Vennemann)* [2] *Aerial photograph taken from a Learjet of the GFD (Bundeswehr/Bicker)*

The TIGER capability platform will continue to cover the following tasks and types of operation:

- support of ground forces operations;
- integration into the JFS system (RW-CAS, FAC(A))[15], escort of ground forces and helicopters;
- antitank defence;
- armed reconnaissance;
- engagement of high-value targets.

[15] Rotary wing close air support, forward air controller (airborne).

Winching a person with the SEA LYNX shipboard helicopter (Bundeswehr/Bienert)

CH-53GE transport helicopter in very-low-level flight (Bundeswehr/Vennemann)

Combat aircraft, UAS and attack helicopters complement one another. Combat aircraft can engage targets at longer distances more rapidly, and the weapons of combat aircraft usually deliver greater and more extensive effects than the weapons of attack helicopters. Combat helicopters play an important role in operations, because they are able to move through obstructed terrain and thus, for example, fly under enemy air defence. In its role as a forward air controller (airborne) (FAC(A)), an attack helicopter can also designate targets for combat aircraft.

The **SEA LYNX MK88A** will remain in service until the middle of the next decade. As an integrated detection, transport and weapon carrier component, it provides important sub-capabilities of the overall combat vessel system. These sub-capabilities include

- special maritime reconnaissance (surface and subsurface maritime picture);
- IMINT;
- subsurface warfare;
- surface warfare;
- maritime tactical mobility support (tactical sup port for specialised/special forces).

These sub-capabilities must soon be ensured by a suitable successor system. The floating platforms currently in use and multinational cooperation should also be considered in the planning process.

The engagement spectrum of the **P-3C ORION** against subsurface targets must also be maintained beyond the foreseeable end of use of the MK46 torpedo. In this context, the capability to engage underwater targets in shallow water by means of depth charges must be achieved – if appropriate, on a multinational basis. As part of wing replacement, initial foundations are being laid for equipping this aircraft with guided missiles for use against surface and land targets.

f) Priority Area: Future Air Support System

This support system comprises rotary-wing and fixed-wing **air transport assets**. Studies must be conducted to determine what support capacities will have to be provided in and by the Bundeswehr in future. The focus will remain on air transport activities under threat, including the tactical air mobility of land forces, aeromedical evacuation, noncombatant evacuation operations, personnel recovery, direct tactical support of special operations forces (SOF-Air), and air-to-air refuelling. Airlift requirements in non-threat scenarios can be met by commercial providers to a limited extent.

The **A400M** transport aircraft, which is currently entering service and will continue to be fielded until 2019, will form the backbone of the German air transport fleet for the coming years. The A400M is designed for air transport, including the transport of forces for vertical insertion, aeromedical evacuation, and aerial refuelling tasks[16], and will replace the C-160 Transall in the foreseeable future. There is at present no need to procure another transport aircraft of this class.

According to information provided by the manufacturer, there will be significant delays in the delivery and technical capability augmentation of the A400M compared to original planning. For this reason, the in-service phase of the C-160 TRANSALL will be extended with improved self-protection equipment in order to sustain the protected tactical airlift capability until 2021.

To maintain the capability cluster provided by the **A310 MRTT**, (including **airlift and aerial refuelling**), the procurement of an alternative system is currently being examined. Participation in the joint procurement of A330 MRTT, which is planned by the Netherlands, Belgium, Norway and Poland, with a view to establishing a **Multinational Multi-Role Tanker Transport Fleet** (MMF) is currently being given primary consideration. The objective is a multinational solution. A quantitative extension of capabilities, particularly in the fields of aerial refuelling and troop airlift, is required in the Alliance.

Preparations are currently being made for the creation of a future **heavy transport helicopter**, as the **CH-53** will presumably reach the end of its service life in the next decade. The selection decision is scheduled for late 2016, the contract will be concluded in 2018, and delivery will commence in 2022. The multirole heavy transport helicopter will contribute to airlift, including the air mobility of land forces, aeromedical evacuation, the support of special operations forces, and personnel recovery including CSAR and noncombatant evacuation operations.

The NH90 is expected to be completely fielded by 2021. The land forces will thus have a tactical air mobility asset for several years to come. The possibility of extending the capability of the NH90 in the areas of aerial command and control and manned-unmanned teaming with UAS must be examined. To ensure the long-term capability of the NH90, appropriate modernisation programmes (a mid-life upgrade (MLU) or a capability assurance programme (CAP)) are being prepared for the second half of the coming decade.

[16] The aerial refuelling of helicopters is envisaged, and possibilities are currently being examined for the technical realisation of this capability.

[1] *H145M LUH SOF helicopter, German Air Force design. At its facility in Donauwörth, Airbus Helicopters (formerly Eurocopter) presents the light utility helicopter in hangar 9 on the occasion of its initial flight on 27 November 2014 (Bundeswehr/Vennemann)*

In late 2015 and early 2016, the first light utility helicopters for special operations forces **(LUH SOF)** will be fielded. This helicopter will be used for direct tactical support of special operations forces (SOF-Air). In future, additional priority areas in the capability spectrum of helicopters could be opened up by the LUH in order to complement the capabilities of major helicopter systems and to effectively extend the overall capability spectrum of helicopters. Weapon systems that are already in service or currently being fielded should be given particular consideration, since existing logistic and training systems can be used.

The SEA KING system of the naval forces will be replaced by the **NH90 SEA LION** naval transport helicopter from 2019 to 2023. It will be employed as a shipboard helicopter on Class 702 combat support ships, and its capability spectrum will cover special maritime reconnaissance (surface maritime picture), IMINT (in-the-atre imagery intelligence), anti-surface warfare (ASuW, short and very short range and confined and shallow waters (CSW)), maritime tactical mobility support (tactical support of specialised/special operations forces) and air transport (heliborne airlift, airborne tactical support of special operations forces, tactical aeromedical evacuation). In addition, it will ensure land-based search and rescue operations over the North and Baltic Seas.

With regard to the tasks of aeromedical evacuation and escorted air medical evacuation, the FMoD has proposed an initiative for establishing a multinational helicopter unit in Germany under the Framework Nations Concept. Initial contacts with potential partner nations have been made, a decision on the establishment of a multinational helicopter unit (MHU) will be taken no later than 2018, and the realisation phase will start in 2022. The participation of interested partner nations would be based on the principle of burden sharing and would allow various types of involvement, such as reliance on 22 optional German NH90 helicopters or the provision of helicopters from participating nations.

In the long run, the use of unmanned and optionally manned systems for logistic support tasks must be examined with a view to extending support capabilities.

Aircraft and Weapons Roadmap 5

The goals, priority areas, and measures presented in the preceding chapters set the course for industry in the context of a broader whole-of-government implementation of the Federal Government Strategy Paper for Strengthening the Defence Industry.

a) Armaments Policy

German system suppliers as well as the national equipment industry, which is mostly characterised by small- and medium-sized companies, are established partners of the Bundeswehr. Some 100 military aviation industry companies in Germany play a decisive role in shaping the operational and Alliance capability of the Bundeswehr in the air dimension. Today, more than 22,000 highly qualified people in this sector ensure the operational readiness of the Bundeswehr's airborne weapon systems. Combat and cargo aircraft, unmanned aerial vehicles, jet engines, satellites, helicopters, IT systems and equipment components ranging from landing gear to flight control computers are among the globally recognised products developed and manufactured in Germany.

The core business activities of the German military aviation industry encompass the entire product life cycle from research and development, through production, to maintenance, support and services.

The Bundeswehr cooperates with industry to optimise the availability of airborne weapon systems.

In order to ensure the material availability of such highly complex systems at home and abroad, the Bundeswehr must work even closer with industry when it comes to system support, maintenance, and contributions of the equipment industry.

The German defence aviation industry contributes subsystem expertise and in the case of rotary-wing aircraft and jet engines also system design expertise to the European aerospace industry. This expertise includes the ability to responsibly plan, design, develop, manufacture, integrate and approve and then to operate and provide support for the above-mentioned systems and important subsystems. A common effort must be made to maintain these German elements in a European context in accordance with the German Government's aviation strategy. This approach will ensure independent evaluation and advisory skills and the operational readiness of the German air component.

The major system manufacturers play a central role in maintaining the expertise of the aerospace industry, which otherwise mainly consists of small- and medium-sized companies. When it comes to major programmes and maintenance, system manufacturers help by maintaining supply chains and expertise for the systems in the best possible way. Alongside this, the Federal Government supports small- and medium-sized businesses through a multitude of regulations such as the tendering provisions of the Act against Restraints on Competition and tendering and contract regulations. From the special perspective of ensuring the mission of the Bundeswehr and developing its capabilities, certain areas of armaments policy can be used to illustrate roadmaps and options.

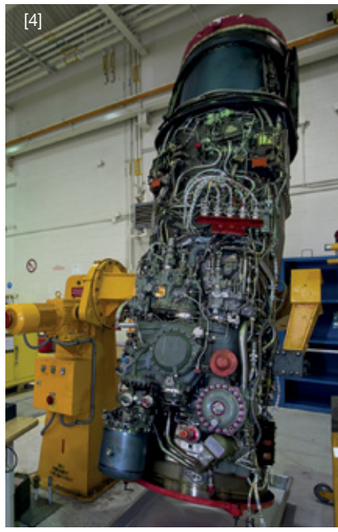
Multinational Cooperation

In Europe, airborne weapon systems have been developed and manufactured in bilateral, trilateral and multilateral projects for several decades. While in the 1950s and 1960s, U.S. aircraft were manufactured under licence, the Transall and TORNADO aircraft and finally the EUROFIGHTER, A400M and TIGER programmes initiated the development of an independent, European defence aviation industry. This industry remains, however, regionally fragmented. This is a result of the dominance of national industrial policy interests but also of military capability requirements. These have shaped the complex and consensus-oriented programme structures. In contrast to other market segments, however, there has been further progress in industrial integration at the European level.


[1]


[2]


[3]


[4]

[1] *Federal Minister of Defence Ursula von der Leyen, NATO Secretary General Jens Stoltenberg, Norwegian Minister of Defence Ine Marie Eriksen Søreide, and Dutch Minister of Defence Jeanine Hennis-Plasschaert (from left to right) visit the NATO Very High Readiness Joint Task Force exercise NOBLE JUMP 2015 (Bundeswehr/Kazda)*
[2] *Testing of the Taurus cruise missile in South Africa (Bundeswehr/Adolfs)* [3] *Postflight inspection of a turbine (SKA/IMZBw)*
[4] *Borescope inspection of a TORNADO engine at Holloman Air Force Base (Bundeswehr/Schmidt)*
[5] *Afterburner test of a EUROFIGHTER of Tactical Air Force Wing 31 „Boelcke" (Bundeswehr/Hohlbein)*


[5]

EUROFIGHTER in hangar at Tactical Air Force Wing 74 in Neuburg (Bundeswehr/Schulze)

Owing to the small quantities it sometimes requires, the Bundeswehr can only carry out future aviation programmes of the Bundeswehr in development and procurement projects together with partner nations. It is therefore important to learn from past experience and, on the part of governments, to fully implement the lead-nation principle. The objective must be that the European nations, in particular those with a national industry which are organised in the Letter of Intent (LoI) network[17], take the next step toward an integrated European industrial and military structure. This means less sovereignty in minor matters (e.g. division of labour in a programme) and greater sovereignty in major matters (e.g. a portfolio of multinational programmes providing capabilities fast and effectively). The only promising approach here is the lead nation principle, which assigns military responsibility to a nation and industrial responsibility to a company.

Lessons learned in cooperative procurement programmes over the past decades with different approaches to work and risk sharing, commercial contracting, and project management should be taken into account in future cooperative projects. The clear assignment of responsibilities in projects is often politically difficult but is essential for the success of such cooperative programmes. This is illustrated by development programmes that have been established according to the lead nation principle. In addition, there is often an apparent contradiction between the generally justified demand for an unbiased search for solutions and the frequently necessary early agreement on a specific solution when armament projects are conducted in the framework of cooperative programmes. In order to address this issue, use of the Integrated Planning Process is to be geared more towards the requirements of multinationality. In any case, customers in multinational programmes decide on a design that is as uniform as possible in order to reduce development and procurement costs. Meeting military requirements has top priority. The challenges of such complex projects can be met by assigning clear national lead functions (if possible on the part of both the contractor and the customer) in armaments cooperation projects on the basis of the NATO framework nation concept. In this context, Germany must be prepared to accept the lead function of other nations and to responsibly lead projects where it has the lead function.

Research and Technology

At present, the technological activities of national military aviation are essentially limited to applied basic research and capability-oriented research. The Federal Ministry of Defence intends to remain committed to cooperation in selected subareas and to support the German defence aviation industry in developing advanced technology for future armaments projects. This applies in particular to unmanned aviation and technologically sophisticated subsystems.

The German defence aviation industry is in a position to contribute key technologies to the European **MALE UAS** and also to a **NextGenWS**. In terms of armaments policy, Germany should endeavour to ensure total system capability for UAS and the required technological know-how for its certification and unrestricted integration into general air traffic in order to maintain our ability to adapt to new challenges.

In future, the EUROFIGHTER will form a mainstay of our combat aircraft fleet, which is the core of the FCAS. We must prepare technologies for maintaining and extending capabilities in the context of a mid-life upgrade (MLU) and, if necessary, for a complementary system (NextGenWS).

Overall, we must examine what technological measures and modern management procedures can be used to improve the operational readiness, security and mission effectiveness of airborne weapon systems.

What all airborne weapon systems have in common is the need for powerful, reliable and low-maintenance engines, future-proof, modular avionics, and increased survivability in heavily defended airspace.

In addition, developments in the manufacturing of robust airborne weapon systems are also of great importance. This includes the capability of the air component to conduct reconnaissance and deliver effects across the entire information space.

Concepts are required which keep repair and maintenance times as short as possible in order to **increase the availability of aircraft** for operations and training. Studies must be conducted to determine whether it would be sensible to use civilian commercial procedures in the military. Future-proof materials must be used and maintenance procedures must be established which allow for a high availability rate even in theatre (e.g. battle damage repair).

In order to develop and mature technology in the fields of UAS, FCAS, NextGenWS and legal regulatory frameworks such as the DEMAR regulations and in order to improve operational readiness, the resources of the Bundeswehr, other ministries and the defence aviation industry in Germany and Europe must be pooled in a sensible way. For this purpose, the Federal Ministry of Defence will prepare a **military technology roadmap** in accordance with recommendations from the dialogue between the FMoD and industry and present together with other ministries. The necessary integration of research facilities and industry is intended to start in 2016. Subsequently, the R&T concept of the air and space systems R&T task area will, if necessary, be updated.

System Design Responsibility

Assigning system design responsibility (SDR) in an armament project is, from the point of view of the Bundeswehr, essential for addressing and managing risks. This offers the defence aviation industry the potential for technological and commercial growth since significant parts of the value creation process are with the prime contractor and compensation for the resulting risks can be received. In multinational military aviation programmes, every participating nation attempts to gain as much responsibility as possible for their national defence aviation industry. For the German Government, it is desirable that companies in Germany assume the role of prime contractor in promising armament projects. Relinquishing such a role in return for appropriate and guaranteed compensation is justifiable and sensible in political negotiations according to the principle of „less sovereignty in small matters in return for greater sovereignty in large matters."

Maintaining National Supplier Structures

NIn addition to the major corporations, small and medium-sized companies form the backbone of the defence aviation industry and are an important driver of innovation. Small and medium-sized companies make important contributions on their own, together with other small and medium-sized companies, and as partners of major corporations. The subsystem and equipment industry, which is characterised by small and medium-sized companies, contributes to a robust and powerful development, manufacturing and supply chain.

Longer phases without new procurement programmes and significantly reduced fleet sizes in the Bundeswehr, however, have reduced the economic basis for small and medium-sized suppliers. From an economic point of view, they can no longer remain on the market and maintain appropriate capacities. These capacities may be critical resources which, if required, cannot be readily reproduced.

[17] 2001 Framework Agreement concerning Measures to Facilitate the Restructuring and Operation of the European Defence Industry (Germany, France, UK, Italy, Sweden and Spain)

The major corporations have primary responsibility for managing this risk of loss of competence in supply chains. The German Government's policy for small and medium-sized companies must take these conflicting interests into appropriate account. As far as possible and admissible, the Bundeswehr will ensure that German small and medium-sized systems manufacturers and suppliers are given a long-term perspective regarding services for the armed forces. This is linked in particular to the further implementation of the strategy paper of the German Government on strengthening the defence industry.

Cost Control, Planning Predictability, and Avoidance of Unnecessary Complexity

A 2014 study of important armament projects, structures and processes identified and quantified shortcomings regarding technical, chronological and economic planning and the management of the complexity of some larger Bundeswehr procurement programmes, in particular those for airborne weapon systems. While major projects are regularly extended, their environments change at an ever increasing pace. The cycle of planning, development, procurement and in-service support can no longer keep up with rapid political, technological and operational changes. The Armaments Agenda aims to tackle these shortcomings with comprehensive and coherent armaments management, which is designed to make improvements for both customers and suppliers.

A main focus of improving cooperation between the government and industry will be the introduction of **joint risk management**, which is currently being used in the NH90 NTH SEA LION project.

Concepts for In-Service Support

Concepts for in-service support must be defined at an early date for each military aviation project. Future users must be kept in mind. These concepts can then be incorporated into the development and procurement phases.

The process of in-service support management, which begins with planning in the analysis phase of each aviation project, ensures the operational readiness of weapon and operational systems throughout their entire life cycle and takes into account operational and economic aspects. The resources of the Bundeswehr and industry must be augmented, maintained and continuously enhanced in order to ensure the technical implementation and subsequent technical and logistic support of all measures for the further development of airborne platforms and their adaptation to current and future requirements. The increasing share of support services provided by industry must be taken into account. Appropriate concepts and contractual structures must be designed so that capacities and capabilities of the defence aviation industry can be maintained even if the number of orders decreases. In return, industry must assume responsibility in particular with regard to performing contractual obligations and to increasing operational readiness.

The current approach has proven to be successful for maintaining Bundeswehr competence in logistics but is too complex in terms of the division of tasks between industry and the Bundeswehr. The experience of other nations with performance-based logistics promises a simpler division of tasks and improved economy. This approach allocates a larger number of tasks to industry, which in turn contractually guarantees availability levels at fixed prices. Gains in efficiency achieved by simpler and improved processes are shared. The experiences of partner nations and the lessons they have learned should point the way ahead for Germany. A graduated approach with initial pilot tests is desirable in order to overcome practical obstacles (such as maintaining skills in the Bundeswehr).

A pilot at Holloman Air Force Base in New Mexico (Bundeswehr/Schmidt)

b) Personnel and Operational Readiness

Qualified personnel and operational materiel are the foundations on which the Bundeswehr will accomplish its current and future tasks. These issues are therefore among the strategic priority areas on the way to a Bundeswehr that is fit for the future.

The Bundeswehr is only ready for operations when, in addition to operational materiel and personnel, other factors such as logistics, information technology, infrastructure, training and exercises are coordinated with one another. Coordinating these factors and optimising the associated processes is a central objective of the reorientation of the Bundeswehr and the Armaments Agenda.

The operational readiness of the Bundeswehr must be ensured if it is to fulfil its national and international tasks and obligations. This applies in particular to ongoing operations, obligations in the context of the NATO Defence Planning Process and the European Headline Goal, permanent tasks (policing of German air space and maritime waters and SAR), routine duty, and training.

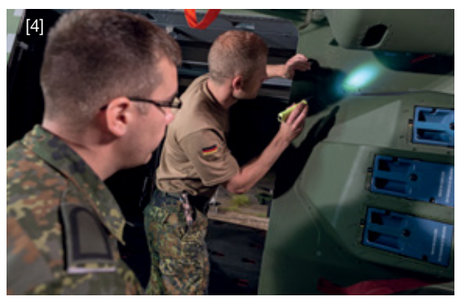
Simulation will become even more important in order to reduce the amount of expensive and limited resources needed for training and exercises. Simulation also makes it possible to present operational and exercise scenarios that in reality would be expensive or impossible. Modern simulation systems are being used for effective and realistic training that satisfies the complex requirements of operations involving airborne capability platforms.

[1] *Flight instructor and captain during Euro NATO Joint Jet Pilot Training (ENJJPT) (SKA/IMZBw)*
[2] [3] *Pilot briefing at Holloman Air Force Base in New Mexico (Bundeswehr/Schmidt)*
[4] *Maintenance work on a CHALLENGER aircraft (Bundeswehr/Twardy)*


[1]


[2]


[3]


[4]

c) Routine Duty, Training and Operations in a Multinational Environment

International cooperation can create synergy and help share and reduce burdens. Two examples are the European Air Transport Command (EATC) in the area of air transport and the results of the helicopter initiatives (e.g. exercises and training courses of the Helicopter Training Programme) in the context of EDA. The Bundeswehr itself already provides training for European partner nations at the International Helicopter Training Centre in Bückeburg. There are plans to further expand the International Helicopter Training Centre as part of the Framework Nations Concept. In addition, the Bundeswehr cooperates with the armed forces of the Netherlands in the field of air mobility through its Rapid Response Forces Division and with the armed forces of France in training for the TIGER combat helicopter. The establishment of an international combat training centre for airmobile elements of land forces is in the planning phase and will be operated under the Framework Nations Concept.

The German Air Force has for years conducted highly successful training for combat aircraft crews as part of Euro NATO Joint Jet Pilot Training.

It is important to further expand multinational aircraft programmes and develop them in order to integrate capabilities in a multinational fashion along the lines of ongoing cooperation programmes of the land forces.

d) Single European Sky / European Military Airworthiness Requirements

The Single European Sky (SES) is an initiative of the European Union to harmonise and completely overhaul air traffic management in a total of 41 European nations. The research and development programme of the Single European Sky process is called Single European Sky Air Traffic Management Research (SESAR).

In order to avoid operational and security restrictions and to minimise costly upgrades of military aircraft without impeding the overall SES I SESAR process, the SES I SESAR programme must be actively supervised and organised at all levels.

At the same time, the aim is to **harmonise military certification regulations** at the European level. The common goal is to incorporate the European Military Airworthiness Requirements (EMAR) into national law in order to facilitate cooperation at the European level. In addition to the implementation of EMAR, the German Aviation Act will be amended in order to delegate legal entities under private law with sovereign tasks. This will provide the Bundeswehr with greater opportunities for cooperation with industrial partners.

EUROFIGHTER of Tactical Air Force Wing 73 „Steinhoff“ (Bundeswehr/Petersen)

6 Way Ahead and Roadmap Priorities

The strategy of the German Government for maintaining and promoting key defence technologies[18] defines a prioritised set of technologies which are to be maintained and promoted at national or European level. In this context, the Air Power Development Strategy further develops this approach for the air dimension. The Air Power Development Strategy gives an overview of current and planned air capabilities that are or should in future be provided by Bundeswehr aircraft.

It states the expected challenges and planned priorities for and in military aviation in Germany both for the Bundeswehr and, as a consequence, for the defence industry. Prioritisation is necessary in order to ensure a realistic and financially feasible concentration of efforts against a backdrop of limited resources and in view of European competition.

The priorities outlined in this document are derived from the requirements of the Bundeswehr. However, since the satisfaction of demand is primarily carried out and ensured by industry, requirements must be adapted. When implementing its strategies, the FMoD will consider the needs, market situation and strength of industry and use its own instruments in the areas of research and technology, procurement, multinational cooperation, export support, and M&A options in order to ensure satisfaction of the Bundeswehr's capability requirements.

The Air Power Development Strategy has defined three priorities which should also be reflected in German armaments policy.

Unmanned aviation is a key capability of the European defence industry and should be shaped by significant industrial contributions from Germany (our ambition is to act as a general contractor and ensure know-how, particularly with regard to certification and integration into controlled airspace).

The long-term R&T plans of the FMoD on technology development and maturation in selected areas will be summarised in a military technology roadmap and presented together with other ministries.

The operational readiness of airborne weapon and employment systems must be further improved by modern approaches, such as performance-based logistics, which involve the German defence aviation industry and take into account the principle of cost effectiveness.

European cooperation is necessary in armament projects for the third dimension, which involve major investments and economies of scale. The Bundeswehr has evaluated and learned the lessons of the past decades. There is a need for a new multinational approach that is more collaborative and more effective. This approach must be based on a clear lead nation principle for each development programme.

In strategic terms, agreement on the further course of action with regard to the FCAS, and thus also to the Next Generation Weapon System, is of crucial importance. Germany will advocate a coordinated course of action in this matter, particularly with regard to the major industrial nations. Only when the important strategic question of operational requirements for an FCAS and thus for the NextGenWS has been settled by the major nations can fundamental decisions on the FCAS be taken in a reasonable and consistent manner.

[18] Federal Ministry for Economic Affairs and Energy (Ed.): Strategy Paper of the Federal Government on Strengthening the Defence Industry, Berlin, 8 July 2015.

The Air Power Development Strategy is based on current requirements and must be adapted to foreseeable changes. A regular review is therefore necessary. Necessary changes should be reported to FMoD Branch Plg I 4.

References

Defence Policy Guidelines of 27 May 2011

Bundeswehr Concept of 1 July 2013

1st Report on the Dialogue between the FMoD and the Federation of German Security and Defence Industries (BDSV) of 29 June 2015

Aviation Strategy of the Federal Government of March 2014

Strategy Paper on Strengthening the Defence Industry of 8 July 2015

Acronyms and Abbreviations

A2/AD: Anti-access / area denial

AESA: Active electronically scanned array radar, also referred to as E-SCAN

AGS: Alliance Ground Surveillance

AI: Air interdiction

ASI: Anti-surface integration

ASuW: Anti-surface warfare

ASW: Anti-submarine warfare

CAP: Capability assurance programme

CAS: Close air support

CCA: Close combat attack

COMINT: Communication intelligence

COTS: Commercial off-the-shelf

CSAR: Combat search and rescue

CSW: Confined and shallow waters

DaCAS: Digitally aided CAS

DCA: Defensive counter air

DEMAR: German Military Airworthiness Requirements

EATC: European Air Transport Command

EDA: European Defence Agency

ELINT: Electronic intelligence

EMAR: European Military Airworthiness Requirements

ESM: Electronic support measures

EU: European Union

FAC(A): Forward air controller (airborne)

FCAS: Future Combat Air System

FMoD: Federal Ministry of Defence

FGS: Federal German Ship

FoM: Freedom of movement

GBU: Guided bomb unit

IMINT: Imagery intelligence

ICAO: International Civil Aviation Organisation

ISIS: Integrated SIGINT System

ISR: Intelligence, surveillance and reconnaissance

JFS: Joint Fire Support

JISR: Joint intelligence, surveillance and reconnaissance

JTST: Joint time sensitive targeting

LDP: Laser designator pod

LEP: Life extension programme

LoA: Level of ambition

LoI: Letter of intent

LO: Low observability

LUH SOF: Light utility helicopter special operations forces

M&A: Mergers and acquisitions

MALE: Medium altitude long endurance

MHU: Multinational helicopter unit

MLU: Mid-life upgrade

MMF: Multinational multirole transport tanker fleet

MRTT: Multi-role tanker transport

NAEW&C: NATO Airborne Early Warning System

NATO: North Atlantic Treaty Organisation

NEO: Noncombatant evacuation operation

NextGenWS: Next Generation Weapon System

NTH: Naval transport helicopter

OCA: Offensive counter air

QRA(I): Quick reaction alert (intercept)

SALIS: Strategic airlift interim solution

SAR: Search and rescue

SASE: Safe and secure environment

SDR: System design responsibility

SEAD: Suppression of enemy air defence

SES: Single European Sky

SESAR: Single European Sky air traffic management research

SIGINT: Signals intelligence

SOF: Special operations forces

TAR: Tactical air reconnaissance

UAS: Unmanned aerial system

UAV: Unmanned aerial vehicle

Editorial Information

Published by
Federal Ministry of Defence,
Office of Strategic Armaments Management
Stauffenbergstraße 18
10785 Berlin

Last amended
December 2015

Layout and design
Bundeswehr Editorial Service

Photo captions
Bundeswehr/Stefan Petersen

Picture credits
Bundeswehr
EADS

Printed by
FMoD Branch IUD III 2, Berlin

Additional information
Visit us at
www.bmvg.de
www.bundeswehr.de

Bundeswehr

Wir. Dienen. Deutschland.