



Committed to the mission

MILITARY ENGINE PROGRAMS





Leading engine manufacturer

Innovative, capable and reliable—with its first-class technologies, products and services, MTU Aero Engines ensures that its military partners can count on the full availability of their fleets at all times.

Military aircraft and helicopters are high-performance machines, and the demands placed on their engines are correspondingly high. As Germany's leading engine manufacturer, MTU Aero Engines has successfully met these demands for decades. Its propulsion technology for military aircraft is geared toward maximum availability and long on-wing times—and quality that military customers can rely on.

MTU brings its skills and expertise to the fore as the leading industrial company for practically all aircraft engines operated by the German Armed Forces. In addition, it plays a key role in Europe's most important military engine programs.

MTU is a major player in the industry both in Germany and internationally. The company designs, develops, manufactures, markets and supports commercial and military propulsion systems and industrial gas turbines, and offers full systems capability in engine construction. This expertise is based on the long history of a company whose roots date back to the early days of powered aviation. For more than 85 years now, the military business has formed the basis for MTU's system capabilities.

Mutual trust, proximity to the customer, reliability and expertise: these are the foundations for a successful engine partnership in the military arena. Together with its military customers, MTU works to develop and implement tailored service support concepts to meet individual requirements quickly and reliably. MTU's comprehensive support services throughout an engine's lifecycle—from development and manufacture, customized maintenance, facility and training concepts, right up to the provision of technical documentation and on-site support—benefit partners and customers such as the German Armed Forces.

This full systems expertise from a single source guarantees a high degree of flexibility, quick response times and in-depth dialog between individual areas. A tried-and-true basis for ensuring successful missions.



MTU keeps the TP400-D6 engines of the Airbus A400M running smoothly.

Power for the military

MTU technology is used in numerous powerful engines for fighter jets, helicopters and military transport aircraft.

MTU Aero Engines is one of the world's leading industrial companies for the military engines that power combat jets, helicopters and military transport aircraft. Development and production of the engines calls for the combined expertise of several highly specialized companies, including MTU. Each bringing their specialist skills to the table, the participating partners join forces to ensure the overall success of the engine program. At a European level, MTU cooperates with all of the leading players in the industry. With its technological expertise, the company provides first-class products and services, as can be seen from the examples below.

EJ200 for the Eurofighter Typhoon

A twin-shaft high-bypass engine with an afterburner, the EJ200 is built by a consortium of MTU, Rolls-Royce, Avio Aero and ITP Aero. The EJ200 is used

MTU AERO ENGINES EXPERTISE

		Low-pressure compressor	Inter-mediate-pressure compressor	High-pressure compressor	Combustion chamber	High pressure turbine	Inter-mediate-pressure turbine	Low pressure / power turbine	Thrust reverser	Casing	Gearbox	Engine control / monitoring	Maintenance, repair and overhaul
Fighter aircraft	EJ200	●		●								●	●
	F110	●											
	F414					●		●					
	Larzac 04				●	●					●		
	RB199		●	●			●		●	●	●	●	●
Helicopter	T408							●					
	MTR390				●	●				●		●	●
	T64			●	●	●					●		●
Transport aircraft	TP400-D6		●			●					●	●	

● MTU Aero Engines expertise
 ● Maintenance, repair and overhaul under the cooperation with the German Armed Forces
 ● Maintenance, repair and overhaul at MTU Aero Engines

to power the Eurofighter Typhoon, where its thrust and reliability play a crucial role in the weapon system's success. MTU developed the low-pressure and high-pressure compressors as well as the electronic engine control unit, and manufactures these components for all EJ200 volume production engines. In addition, the company is responsible for assembly, testing and repair of all engines operated by the German Armed Forces and the Austrian Armed Forces.

TP400-D6 for the A400M military transport aircraft

The TP400-D6 for the Airbus A400M military airlifter is the most powerful turboprop engine in the Western world. It is developed and built jointly by MTU, Safran Aircraft Engines, Rolls-Royce and ITP Aero. MTU is responsible for manufacturing and maintaining the TP400-D6's intermediate-pressure compressor, turbine and shaft and has a stake in several accessories. Furthermore, final assembly of all TP400-D6 production engines and engine maintenance work for the German Armed Forces takes place at MTU Aero Engines in Munich, while acceptance testing takes place on the test stand at MTU Maintenance Berlin-Brandenburg.

MTR390 for the Tiger combat helicopter

Developed in cooperation with Safran Helicopter Engines and Rolls-Royce, the MTR390 is a turboshaft engine featuring a free power turbine. It powers the Airbus

Helicopters Tiger support helicopter co-developed by France and Germany. MTU's workshare comprises the core engine—the combustor and gas generator turbine—and some of the engine accessories. In collaboration with ITP Aero, MTU has developed an updated version of the engine (the MTR390-E) that delivers 14 percent more power. All production engines were assembled at MTU.

Partner in U.S. military programs

As a risk-and-revenue-sharing partner of GE Aviation, MTU holds stakes in the F414, F110 and T408 programs. MTU's workshare in the T408 for the Sikorsky CH-53K heavy-lift helicopter, the latest model in the CH-53 series produced by Lockheed Martin, marks another milestone in its collaboration with its U.S. partner. MTU develops and manufactures the power turbine—the first time it has full responsibility for an entire module in a U.S. military engine program. Compared to its predecessor, the T64, the T408 is 1.7 times more powerful and delivers an 18 percent reduction in specific fuel consumption. MTU Maintenance Canada cooperates with GE Aviation in the maintenance of F108 engines and also looks after the U.S. Air Force's F138 engines.

Three T408 engines deliver all the power the CH-53K transport helicopter needs.



Power for the next generation of fighter aircraft

MTU plays a key role in the development of the new engine that will power Europe's next generation fighter aircraft.

New challenges require new solutions. When it comes to preserving military sovereignty and protecting airspace, the new solution is the Future Combat Air System, or FCAS for short. It is a system of manned and unmanned air assets, and the Next Generation Fighter (NGF) is an indispensable element at the heart of this system. The NGF is scheduled to enter service by 2040—powered by a completely new engine that goes far beyond today's capabilities: the Next European Fighter Engine (NEFE).

Strong partners

A project of this scale calls for strong partnerships. Within the EUMET (European Military Engine Team) joint venture founded by MTU Aero Engines and its French partner, Safran Aircraft Engines, and in collaboration with their main partner ITP Aero from Spain, the engine specialists are developing extraordinary technologies and engine demonstrators that meet FCAS requirements. As part of this partnership, MTU is responsible for its flagship products—the high-pressure and low-pressure compressors and the compressor intermediate case—as well as for elements of the control systems. It will also provide maintenance and support services from development through operation.

The future in the skies: The next-generation fighter aircraft.



The requirements of the new fighter aircraft call for innovative technologies in engine development.



Answering tomorrow's challenges: When the new European fighter jet takes to the skies in 2040, it will need a futureproof, high-performance engine from day one.

High mission flexibility

The requirements for a next-generation fighter aircraft have been clearly defined, among them increased survivability, maximum range and high mission flexibility. These of course go hand in hand with high availability, long operating times and plannable lifecycle costs that are as low as possible. In addition, there is a low radar signature, strong connectivity, information superiority, and protection against cyberattacks and electromagnetic effects.

Efficient maintenance

A powerful fighter needs a powerful engine. This is reflected in typical engine parameters such as robustness and reliability, and an improved thrust-to-weight ratio. Other key factors include low development and production costs, efficient maintenance, and long and plannable maintenance intervals. A further consideration is that the digital environment of the future will add new, stringent requirements concerning, for instance, the integration of radar signature aspects and the electric power offtake.

Revolutionary engine concept

To achieve these optimizations, sound technological preparation is essential. Advanced design tools, simulation methods and integrated interdisciplinary system designs are decisive in the implementation. The engine concept itself can also be greatly enhanced, for instance by using a variable cycle engine (VCE). This revolutionary technological step considerably reduces consumption, for example, and thus increases mission flexibility.

Intelligent technology

However, such an engine also requires special features in terms of components and control: a variable-capacity compressor, variable flow control, minimal increase in losses and weight, and high reliability of the adjustments. In this respect, intelligent engine technology plays a critical role and must be precisely aligned with the weapon system's utility.



Titanium blisks are made in the blisk center of excellence in Munich, the world's most modern production facility of its kind.

World-class technology

MTU constantly drives the development of innovative technologies and processes.

MTU Aero Engines is one of the world's leading development partners and a specialist in newly developed propulsion systems, such as the T408 powering the CH-53K heavy-lift helicopter and the TP400-D6 for the A400M military transport aircraft. The company also specializes in models that have been in service for many years, such as the RB199 engine for the Tornado, the EJ200 engine for the Eurofighter and the MTR390 engine for the Tiger. This experience forms a solid basis for MTU's unique expertise in the new and further development of advanced engine components and the associated control systems.

Strong in technology development

An impressive list of 200 technology projects, 2,800 patents and 500 inventors showcase the company's strength in innovation. This is the result of a comprehensive yet specialized technological process that MTU uses to implement commercial and military innovations on time and within budget. The process systematically focuses on future product requirements and strategic considerations.

High-tech in everything from development to production to maintenance—an excellent description of MTU.

Technologies for the engines of tomorrow

MTU has identified various future technologies for the next generation of engines and will continue developing them further. These include multi-disciplinary processes and simulations used for designing the engine concept and components—for example, the digital twin and digital modeling of systems and their components.

Manufacturing 4.0

In state-of-the-art manufacturing, products and the means of production are able to communicate and flexibly connect with each other. Cyber-physical systems enable components to identify themselves. MTU has already organized operations scheduling and production process control in partially automated production lines. Artificial intelligence and machine learning can be used to further optimize manufacturing processes. MTU's compressor blisk and blade manufacturing processes are largely automated and digitally controlled.

Robust, high-temperature materials

Any new materials for the next generation of engines have to be lightweight, extremely resistant to heat, and robust against environmental influences. To this end, MTU uses only the best metals from the latest generation in conjunction with entirely new material classes. The company focuses on inter-metallics, materials produced by powder metallurgy for manufacturing turbine blades, disks and housings.

High-tech maintenance

Together with data evaluation methods, optimized engine sensor technology improves analysis and forecasting in ongoing operations. The use of augmented reality methods and artificial intelligence in the future will serve to significantly enhance process validation and also help reduce costs in the fields of assembly and maintenance.

Innovative support: In the future, the use of augmented reality (AR) technology will accelerate maintenance and repair processes.



Specialist for the most important components

With its premium products, technologies and processes, MTU sets standards worldwide.

MTU Aero Engines has established itself as a world leader in essential engine technologies: its compressors, turbines and control technologies are among the best in the world. Advanced control systems are also an area of MTU expertise.

Efficient compressors

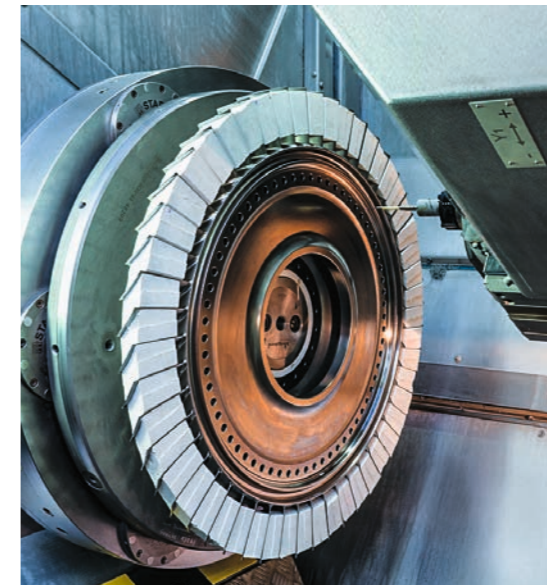
The high-pressure compressor is the heart of the engine. For more than 30 years, MTU has been developing, manufacturing, repairing, and overhauling this engine module. Today's compressors are built on the blisk principle, where the disk and blades are manufactured as a single part. Flagship MTU products that feature this technology are the military compressors for the EJ200 engine that powers the Eurofighter Typhoon and for the TP400-D6 engine that powers the A400M military transporter.

Award-winning turbines

In the field of low-pressure turbines, MTU has carved out a world-class technological position for itself in the commercial sector. An excellent example of this is its high-speed low-pressure turbine, which operates at maximum efficiency. This expertise can also be extended to the military sector. For engines to operate even more efficiently, temperatures must be increased. This in turn calls for new materials, which are already undergoing extensive testing in a technology demonstrator. The basis for the corresponding engine demonstrator is the MTR390.

The company's experience and exclusive know-how form a solid basis for the development and refinement of advanced control systems.

Assembly of a low-pressure compressor for the EJ200: MTU developed the low-pressure and high-pressure compressors as well as the electronic control unit, and manufactures these components for all Eurofighter engines.



High-tech manufacturing: Machining a blisk for the medium-pressure compressor of the TP400-D6 on a 5-axis milling system.



MTU developed not only the PECM process for manufacturing nickel blisks, but the machines as well—currently in operation in Munich.

MTU operates one of the world's most advanced manufacturing facilities for compressor rotors built on the blisk principle.

Advanced control systems

When it comes to control systems, MTU can draw on valuable experience gained from the EJ200 and MTR390 engines as well as know-how from other military programs and the commercial sector. The real-time monitoring systems the company uses in this area, along with their analysis and forecast capacities, allow it to detect damage early on and to prevent it with predictive maintenance techniques.

Manufacturing at its best

Engines used in military operations are subjected to extremely high stresses that vary greatly depending on the mission and operating environment. For these components, MTU has developed special production processes and continuously optimizes them. MTU has also established itself as one of the world's leading blisk manufacturers. At its site in Munich, Germany, the company operates one of the most advanced production systems for compressor rotor blisks.

Rotors featuring a blisk (blade integrated disk) design, originally developed for the EJ200, are now used in compressors for commercial engines, too.

High-tech processes

Among the most important high-tech processes are laser caving to produce cooling air holes in high-pressure turbine airfoils, as well as adaptive milling, broaching, friction welding and precise electrochemical machining (PECM). Additive manufacturing processes are also gaining in importance. One of these is selective laser melting, which helps produce or repair complex components almost without the need for conventional tooling. Further advantages afforded by additive processes are a markedly greater freedom of design, shorter production times, faster innovation cycles, lighter components with added functionality, and lower development costs. MTU achieved a breakthrough in engine production when it introduced additive processes to its operations in 2013: it is one of the first companies to manufacture components using such methods on an industrial scale.



EJ200 teamwork: Specialists from the German Air Force work side by side with MTU experts as part of their collaboration.

Strong together: The maintenance cooperation with the German Armed Forces is a model of success.

Two strong partners in cooperative engine maintenance

MTU's collaboration with the German Armed Forces is an excellent example of a service concept tailored to a customer's specific needs. MTU supports a large share of Germany's propulsion systems, and in 2002, it was the first company to successfully establish a cooperation of this kind with the German Armed Forces. Since 2014, work on the EJ200, RB199 and MTR390 programs has been performed under the same roof in Erding, Bavaria. MTU experts work side by side with specialists from the German Armed Forces to maintain the military's engines. The combination of MTU's technical expertise and the military's operational experience ensures highly industrialized and cost-effective maintenance activities. Involving military personnel in maintenance and repair work, quality assurance, logistics and service support in this way secures the assessment skills and technical abilities of the German Air Force and Army over the long term. The partnership is to be further expanded, the ultimate goal being to ensure full availability of the engines operated by the German Armed Forces at all times.

develop even smarter analysis models based on a higher sensor density, which will further perfect this process. As a result, operators will be able to schedule maintenance before an incident results in unplanned downtime, thus increasing availability of their weapon system. With CORTEX Military, MTU is taking a new type of fleet management software originally developed for commercial applications and launching it for the first time in a military program. In addition, the use of augmented reality (AR) and artificial intelligence (AI) in the future will accelerate maintenance and repair processes.

Comprehensive service

Going by the motto "Committed to the mission," MTU aims to satisfy all its military customers' operational requirements. The company offers the full range of services: technical customer support, as-needed spare parts support, smooth fleet management, thorough compilation and maintenance of documentation, and tailored training opportunities. These service support concepts can be flexibly adapted to the lifecycle of the engine in question and the customer's specific setup and requirements, and thus provide the comprehensive support they need to ensure smooth operations.

Intelligent maintenance solutions

Military customers can rely on MTU's premium services at all times.

In addition to conventional maintenance and smart repairs, customers of MTU Aero Engines benefit from a comprehensive range of services that are precisely tailored to satisfy the needs of its military partners.

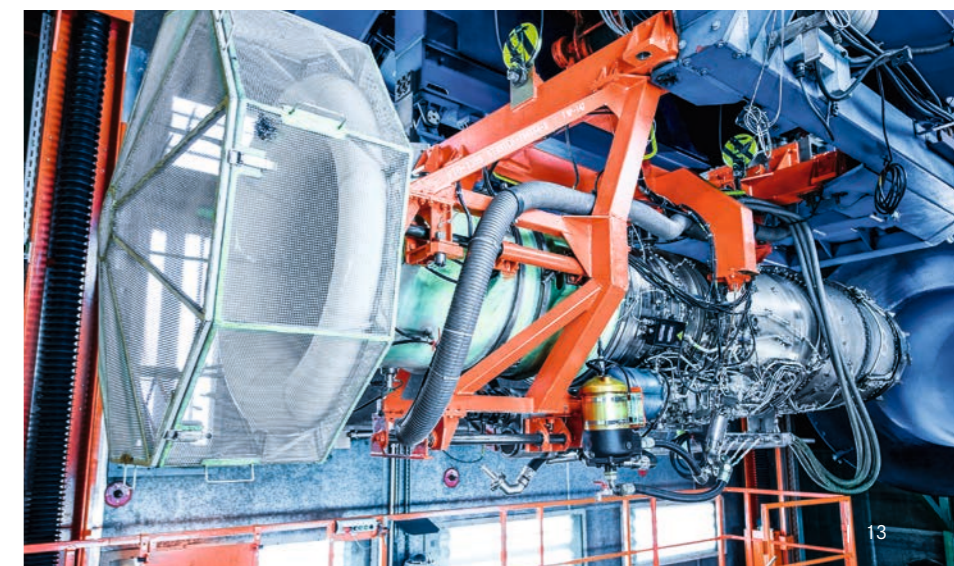
Innovative repairs increase availability

Innovative repair techniques optimize engine availability and reduce costs. Based on its many years of experience and a fully integrated development process, MTU is constantly refining its high-tech repairs so that lifecycle costs continue to decrease. Other examples of the company's comprehensive repair expertise include patching blisk rotors and adaptive milling to restore damaged compressor blade tips, as well as innovative coating methods for protecting compressor blades from erosion.

Intelligent maintenance concepts

By using engine health monitoring (a method for extensive tracking of various engine parameters) and analyzing the condition of the engine based on this data, MTU experts can detect unusual operating conditions and identify countermeasures before the problem even occurs. MTU plans to

An RB199 on the test stand: MTU now focuses on spare parts production, repair and service offerings for the engine that powers the Tornado.



First-class quality

As a technology leader, MTU has a reputation for reliability and excellence in all its products and services.



Careful scrutiny: The human eye is and will remain an important inspection instrument.

Certifications

- ISO 9001:2015
- ISO 45001:2018
- EN 9100:2018
- EMAS

Approvals

- Certificate of approval as a Contractor for German Armed Forces Aeronautical Equipment (development, manufacturing and maintenance company) as per A1-275/2-8901 and regulation (Bereichsvorschrift, BV) C1-275/2-8956
- Design organization approval as per EASA Part 21J
- Production organization approval as per EASA Part 21G
- Maintenance organization approval as per EASA Part 145
- Repair station approval as per CFR 145
- Maintenance organization approval as per CAR 573
- Maintenance organization approval as per CAR 145
- Maintenance organization approval as per CCAR 145
- Maintenance organization approval as per DEMAR 145
- Authorized Economic Operator (AEO)

International specifications

- Preparation of technical documentation as per ASD S1000D
- Material management as per ASD S2000M

MTU Aero Engines delivers products and services that fulfill the highest standards of quality and reliability. To ensure these standards are upheld, the company places particular emphasis on continuous improvement in its engine development, production and maintenance activities. All products and processes are continuously monitored and subjected to regular internal audits to identify and leverage all improvement potential. MTU's production sites also rely on resource-conserving processes that are energy- and material-efficient. "Repair beats replacement" is the company's sustainable concept for success, both in civilian as well as in military maintenance—it increases cost-effectiveness and conserves resources. The success of any company is contingent on the expertise and commitment of its workforce, and MTU's employees are highly motivated and highly qualified specialists in their fields.

The company also puts the development of its employees' professional and personal skills high on the agenda. In this way, MTU makes sure its workforce remains highly qualified and internalizes the exacting quality standards stipulated by the company and its military partners—putting them into practice in day-to-day operations and continually developing them. First-class quality management ensures consistently high quality standards across all parts and components. MTU holds the approvals listed to the left authorizing the company to develop, manufacture and repair airworthy engine components and modules.



Premium products and excellent performance: That's what MTU stands for.

Full power ahead

MTU will continue to be a capable, reliable partner in the military programs of today and tomorrow.

With its broad portfolio of products and maintenance services for commercial and military engines, as well as innovative technologies, products and maintenance services, MTU Aero Engines is in an excellent position for the future. As a well-established player in the industry, the company has secured stakes in major next-generation programs.

Besides the long-term plans for the future European fighter aircraft powered by the Next European Fighter Engine (NEFE), today's military programs provide opportunities for the armed forces to close skills gaps.

Tornado successor

MTU is in a prime position for a stake in the successor to the Tornado. Today, the Eurofighter with its EJ200 engine is already the European option for the timely replacement of the Tornado. The German industry involved, which includes MTU as Germany's leading engine manufacturer, jointly supports this project.

Powering ahead into the future

With GE Aviation's T408, MTU has codeveloped the engine for one of the world's most advanced and powerful helicopters: Lockheed Martin's heavy-lift helicopter, the Sikorsky CH-53K. With its 18 percent share of the program, MTU is responsible for the power turbine in this pioneering engine.

Committed to mission success

Thanks to its experience in the military business, its technological expertise and its know-how in supporting engines across their entire lifecycle, MTU is well positioned to find and implement the best solution for its military customers. The company will continue to prove itself a reliable partner to the military—now and in the future.



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