

ANNUAL REPORT 2019

From *evolution* to *revolution*

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Information on MTU shares

> MTU listed in the German stock index (DAX) since September 23, 2019

> Price performance in 2019 much better than the DAX and MDAX

[T1] Share performance over the past five years

	2015	2016	2017	2018	2019
Year-end price	€90.10	€109.80	€149.40	€158.40	€254.60
Annual performance	25%	22%	36%	6%	61%



Key facts and figures with year-on-year comparison

[T2] Selected consolidated financial information and key figures at a glance

in € million (unless stated otherwise)	2019	2018	Change against previous year in %
Revenue and earnings			
Revenue	4,628.4	4,567.1	1.3
thereof: commercial engine business ¹⁾ (prior-year amounts adjusted, see segment reporting)	1,536.9	1,395.6	10.1
thereof: military engine business ¹⁾	458.7	431.1	6.4
thereof: commercial maintenance business ¹⁾	2,711.4	2,799.8	-3.2
Gross profit	931.3	851.3	9.4
Earnings before interest and taxes (EBIT)	705.6	620.2	13.8
Net income	488.4	453.3	7.7
Adjusted earnings			
Adjusted earnings before interest and taxes (adjusted EBIT)	756.9	671.4	12.7
Adjusted EBIT margin (in %)	16.4	14.7	
Net income	537.6	479.1	12.2
Balance sheet			
Total assets	7,765.3	6,850.8	13.3
Equity	2,421.2	2,144.2	12.9
Equity ratio (in %)	31.2	31.3	
Net financial debt	960.7	854.0	12.5
Cash flow			
Cash flow from operating activities	831.7	594.7	39.9
Cash flow from investing activities	-471.6	-336.1	-40.3
Free cash flow	358.3	202.9	76.6
Cash flow from financing activities	-323.6	-262.7	-23.2
Number of employees at year end			
Commercial and military engine business	6,698	6,109	9.6
Commercial maintenance business	3,962	3,622	9.4
Total number of employees	10,660	9,731	9.5
Share indicators			
Earnings per share in €			
Basic earnings per share	9.23	8.67	6.5
Diluted earnings per share	8.46	8.10	4.4

¹⁾ Before consolidation.

From *evolution* to *revolution*

MTU Aero Engines is aware of its responsibility for sustainable, emissions-free flight and is already investing today in pioneering technologies for the commercial aviation of tomorrow—and the day after tomorrow.

To this end, MTU conducts evolutionary technology-development that, combined with the use of sustainable fuels, directly reduces emissions. At the same time, it pursues revolutionary propulsion concepts—including two concepts made by MTU that combine the tried-and-true gas turbine engine with brand new technologies. The company is also investigating the potential advantages of parallel hybrid-electric systems and engines based on fuel cells.

MTU holds a prime position for this: never before has the company had such pioneering answers to the challenges of aviation as today.

The ambitious goal:

100% performance. 0% emissions.

THE FUTURE OF AVIATION STARTS TODAY.



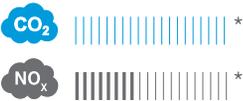
Blazing new trails: the MTU roadmap.

Paving the way for emissions-free flight.

FUTURE ENGINES		TECHNOLOGY	OPERATIONAL ENVIRONMENT				STATUS
<i>Propulsion system</i> G Gas turbine E Electric propulsion system			<i>Urban mobility</i>	<i>Commuter</i>	<i>Short & medium haul</i>	<i>Long haul</i>	<i>Technological maturity (Idea [1] - Industrialized [6])</i>
G	 2nd-generation GTF Refinement of geared turbofan technology				 		
G	 Revolutionary engine concepts Composite cycle and steam-injected and water-recovering gas turbine				 		
G	 Sustainable fuels Generated from renewable energy				 		
G E	 Parallel hybrid-electric systems Combination of turbo-machinery and electric motor				 		
E	 Batteries Electric propulsion systems for small aircraft						
E	 Flying fuel cells A propulsion technology with excellent potential			  			

MTU is conscious of its responsibility for sustainable and emissions-free flight.

In its technology roadmap, it lays out answers to the challenges of the future. Detailing evolutionary solutions and revolutionary propulsion concepts, the roadmap paves the way to emissions-free flight.

TIMELINE	CO ₂ /NO _x	NOISE
<p>2020 2030 2050</p> 	<p>Reduction in carbon dioxide (CO₂) and nitrogen oxides (NO_x) (potential)</p>	<p>Reduction in noise (potential)</p>
<p>2030</p> 		
<p>2030+</p> 		
<p>Today</p> 		
<p>2025</p> 	 <p>* with gas turbine</p>	
<p>2025</p> 		
<p>2040</p> 		

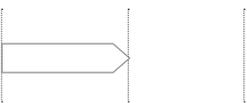


The low-emission and low-noise geared turbofan engines that power the Airbus A320neo are winning over airlines around the world; the engines are undergoing further optimization.

FUTURE ENGINES		TECHNOLOGY	OPERATIONAL ENVIRONMENT				STATUS
<i>Propulsion system</i> G Gas turbine E Electric propulsion system			<i>Urban mobility</i>	<i>Commuter</i>	<i>Short & medium haul</i>	<i>Long haul</i>	<i>Technological maturity (Idea [1] - Industrialized [6])</i>
G		2nd-generation GTF Refinement of geared turbofan technology					

Evolution:
The GTF success story continues.



TIMELINE	CO ₂ /NO _x	NOISE
<p>2020 2030 2050</p> <p>..... </p>	<p>Reduction in carbon dioxide (CO₂) and nitrogen oxides (NO_x) (potential)</p>	<p>Reduction in noise (potential)</p>
<p>2030</p> 		

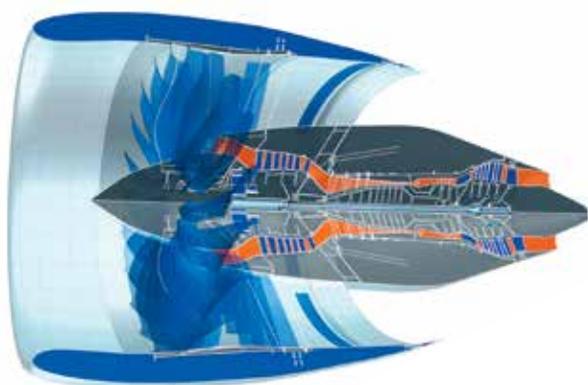
Even cleaner, quieter and more sparing of resources:

The second generation of the geared turbofan.



2nd *The geared turbofan (GTF) is a success story, setting standards for fuel and noise reduction. Development of the second generation is already underway with clear targets: further reductions in emissions, kerosene consumption and noise.*

SECOND-GENERATION GTF WITH ULTRA-HIGH BYPASS RATIO



The second-generation geared turbofan will be even quieter and more efficient.

A 75 percent cut in CO₂ per passenger kilometer and a 65 percent reduction in noise: these are the targets the European Union and the aviation sector have set to reach by 2050. However, the goal of limiting global warming to less than two degrees Celsius calls for all efforts to be accelerated.

MTU has aligned these goals with its own business activities and laid them out in its Clean Air Engine (abbreviated: Claire) technology agenda.

The first-generation geared turbofan marks the first milestone. A 16 percent reduction in fuel consumption and CO₂ emissions as well as a 75 percent reduction in noise pollution has piqued the interest of airlines all around the world.

In its second stage, Claire aims to reduce the engines' fuel consumption by 25 percent and halve noise emissions by 2030.

The next step will then focus on revolutionary concepts that reduce energy consumption by 40 percent and have the potential to avoid all emissions that are damaging to the climate.

“ There is huge potential to improve the geared turbofan concept. The developments laid out in our technology roadmap will pave the way for us to achieve a major reduction in fuel consumption and, with sustainable fuels, to make aviation largely carbon-neutral. ”



GTF engine on the test stand — MTU Aero Engines in Munich performs the final assembly and production acceptance tests on one-third of all A320neo engines.

THE **FIRST-GENERATION GEARED TURBOFAN** HAS HELPED SAVE SOME 1.4 MILLION TONS OF CO₂ EMISSIONS SO FAR; THE **SECOND GENERATION** WILL BE EVEN BETTER:

The aim is to reduce fuel burn and noise emissions by as much as 10 percentage points compared with the current model.

To achieve these figures, the developers are working on various aspects of the engine to make it lighter and more efficient overall. Optimizations they are pursuing include an integrated design for the low-pressure and high-pressure compressors, and improvements to the high-speed low-pressure turbine—here, too, in an integrated approach.

New materials such as ceramic composites will also come into play. At the same time, new coatings, additive manufacturing and increasing simulation capabilities will play an even greater role than they do in the current development and production process. When it comes to digitalization and simulation capabilities, MTU is counting on a unique research institution: the DLR Institute for Test and Simulation for Gas Turbines (SG) in Augsburg, which focuses on the virtual engine. MTU is involved in its role as a partner and contributor of ideas.

LOWER EMISSIONS, LESS NOISE*

Geared turbofan	1st generation	2nd generation
		
	 -40%	 -50%
	 -15%	 -25%

* Reduction compared to an engine from the year 2000.

In a separate development, sustainable fuels will have to be able to largely eliminate CO₂ emissions.

The success story continues

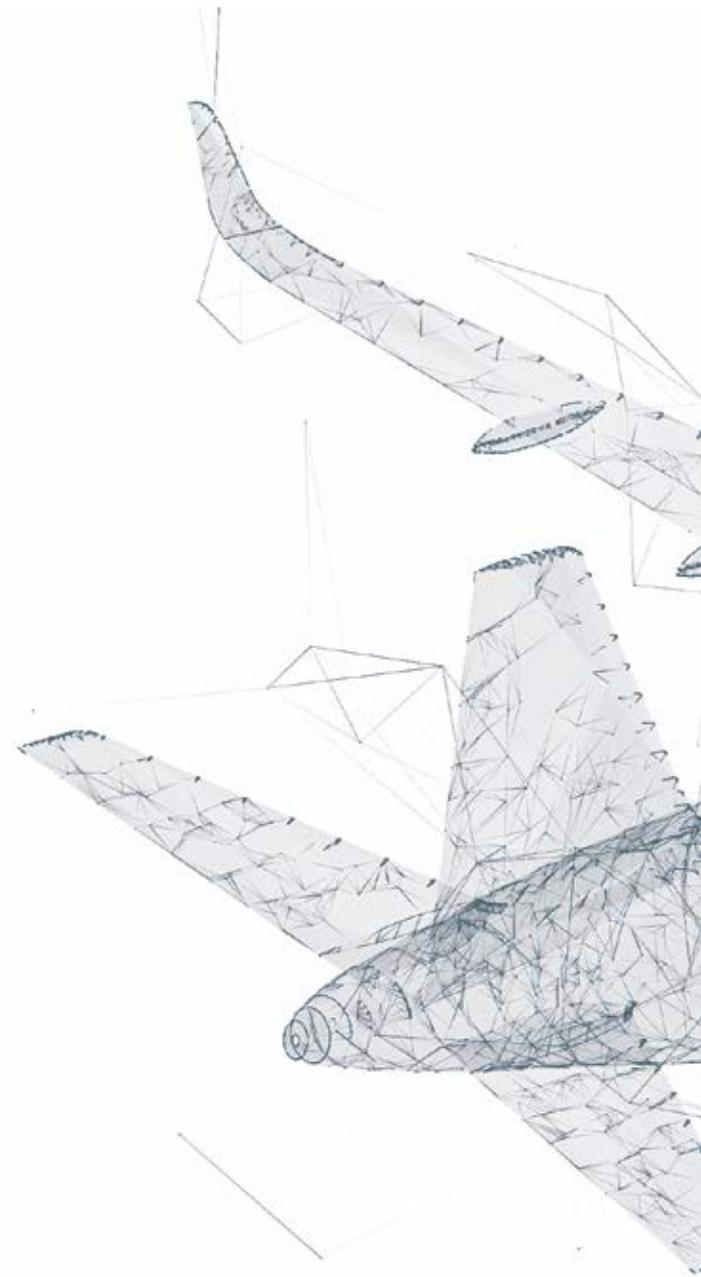
While production of the first-generation GTF is still ramping up, MTU's engineers are already working on the next generation.

Advanced level of maturity

For most of these technologies, development is at an advanced stage, and could be completed by 2027.

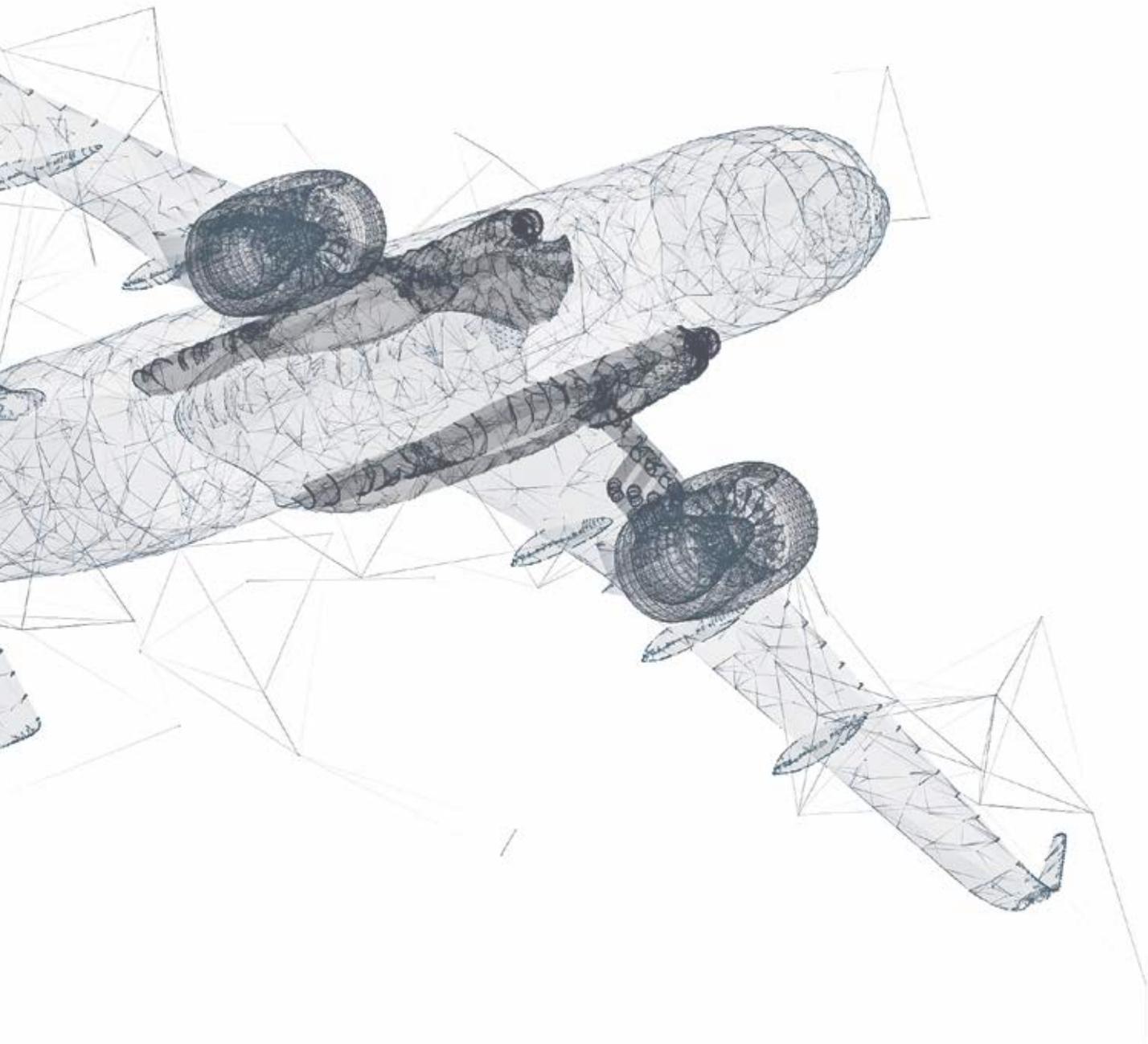
By that point, the number of air passengers is likely to rise further, making it all the more important that the engines are even cleaner and more sparing of resources than they are today.

The revolution begins:
*With new technologies
 in the gas turbine.*



*Revolutionary propulsion concepts made by MTU:
 A combination of innovative and successful technologies.*

FUTURE ENGINES		TECHNOLOGY	OPERATIONAL ENVIRONMENT				STATUS
<i>Propulsion system</i> [G] Gas turbine [E] Electric propulsion system			<i>Urban mobility</i>	<i>Commuter</i>	<i>Short & medium haul</i>	<i>Long haul</i>	<i>Technological maturity (Idea [1] - Industrialized [6])</i>
[G]		Revolutionary engine concepts Composite cycle and steam-injected and water-recovering gas turbine			 		



TIMELINE	CO ₂ /NO _x	NOISE
<p>2020 2030 2050</p> <p>..... </p>	<p>Reduction in carbon dioxide (CO₂) and nitrogen oxides (NO_x) (potential)</p>	<p>Reduction in noise (potential)</p>
<p>2030+ →</p>	<p>CO₂ []</p> <p>NO_x []</p>	<p>[Speaker icon] []</p>

Reducing emissions using pressure or steam power.



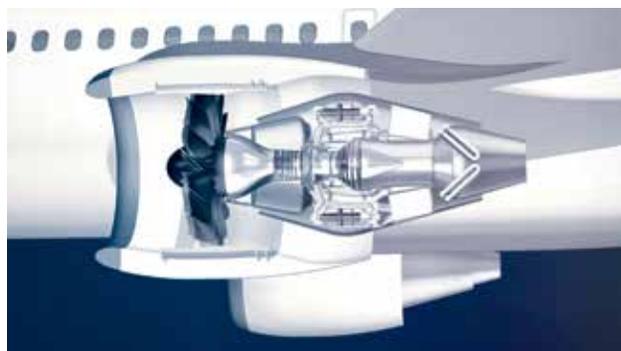
The second-generation GTF taps into the full potential of geared turbofan technology. The next step calls for revolutionary propulsion concepts that combine tried-and-true technologies with new ones. MTU is focusing its development activities on two promising concepts.

“ To achieve emissions-free operation, these new propulsion solutions must extend far beyond today’s technology. The only way to get there is with creativity and the courage to innovate. ”

DR. STEFAN WEBER, SENIOR VICE PRESIDENT, TECHNOLOGY & ENGINEERING ADVANCED PROGRAMS

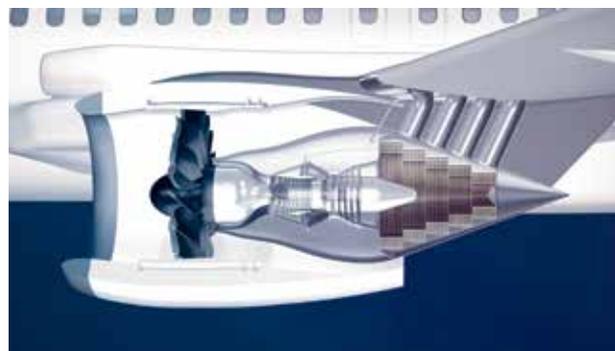
Higher bypass and overall pressure ratio, more efficient turbomachinery, weight savings, innovative materials: there are still many avenues to explore for optimizing the geared turbofan. But everyone involved understands that paving the way for emissions-free flight will require even more aggressive concepts in the coming decades. MTU is already working on these concepts. The focus is on two architectures: the composite cycle engine and the steam-injected and water-recovering gas turbine, which, in conjunction with GTF technology, open up new horizons.

COMPOSITE CYCLE ENGINE:
PROPULSION SYSTEM WITH ADDITIONAL PISTON COMPRESSOR / PISTON ENGINE



Combining gas turbines and piston engines is an approach that dates back to the 1950s—however, today’s commercial aircraft require much more power. MTU has developed and patented a new concept for this combination.

STEAM-INJECTED AND WATER-RECOVERING GAS TURBINE:
STEAM POWER PROCESS FOR WET COMBUSTION



The steam-injected and water-recovering gas turbine integrates a steam power process into the gas turbine. The aim is to use the energy in the exhaust to increase power output while reducing emissions through steam injection.



The **composite cycle concept** can be integrated into a nacelle in the same way as today's engines.



The **steam-injected and water-recovering gas turbine** requires the integration of additional components into the aircraft.

Composite cycle: High-pressure flight

In the composite cycle approach, the high-pressure compressor system is supplemented by a piston compressor and piston engine. This means the air can be compressed to an even greater extent, which significantly increases thermal efficiency, and reduces both fuel consumption and CO₂ emissions. Thanks to this technology, peak pressures can be doubled—which is impossible in conventional turbine engines. Fuel burn is further reduced by some 12 percent—while the engine remains within the same size range as today; the aircraft architecture would essentially stay the same. However, the high pressures and temperatures present major challenges in the form of NO_x emissions.

Steam-injected and water-recovering gas turbine: Steam provides more thrust

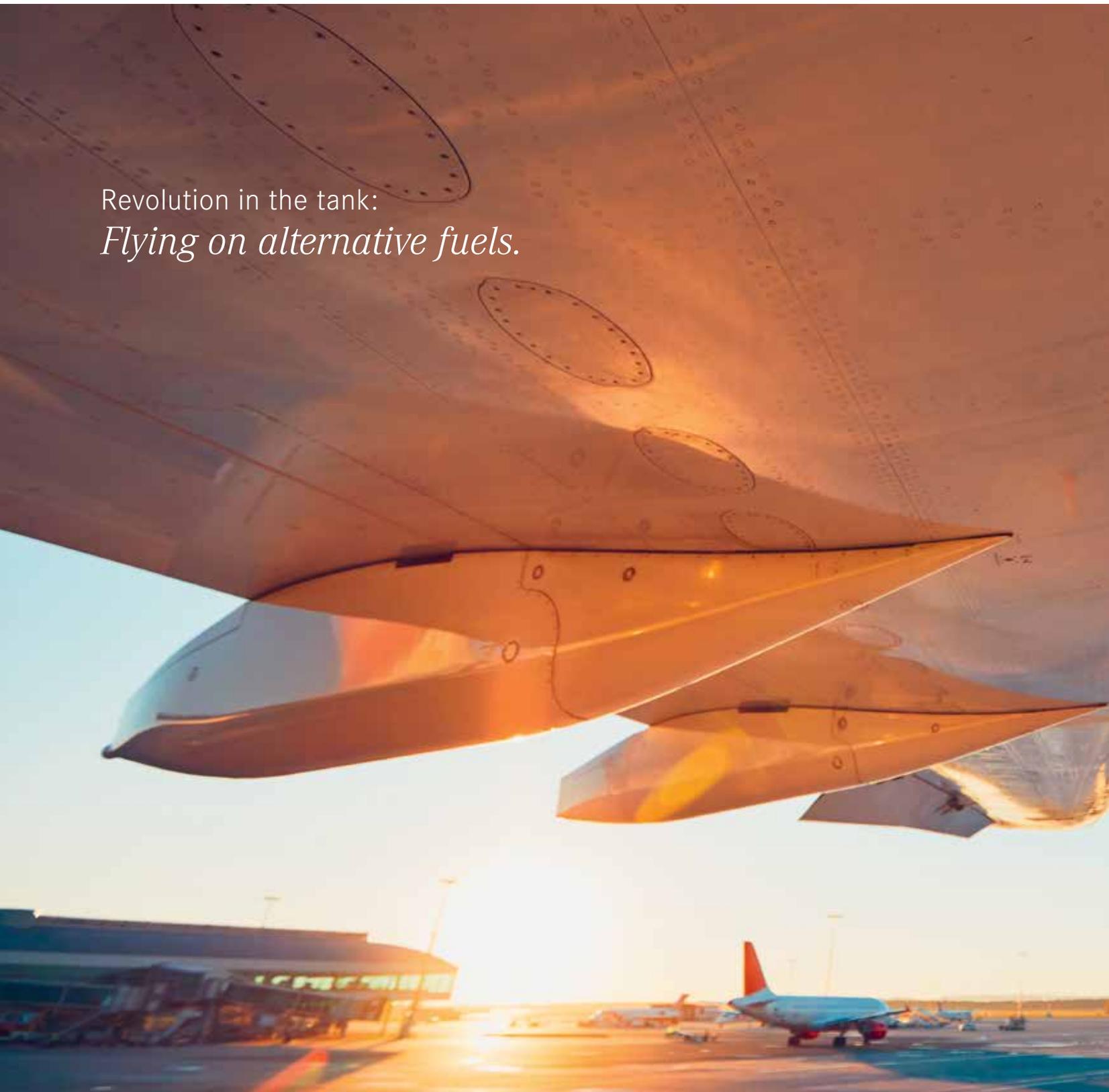
By comparison, the steam-injected and water-recovering gas turbine would probably require some slight modifications to the existing aircraft configuration. Using the thermal energy in the exhaust gas stream to generate additional power is a revolutionary idea for aviation. Water is evaporated in a heat exchanger at the engine outlet and then injected into the combustor. The requisite water is obtained from condensation from the gas turbine's exhaust gas. This method of "wet" combustion massively reduces nitrogen oxides. Using exhaust heat in this way could cut fuel consumption and hence CO₂ emissions by up to 20 percent. In addition, it greatly reduces the environmental impact by largely avoiding water vapor emissions. The greatest technical challenge here is to develop a light, compact condenser that can be integrated into the aircraft.



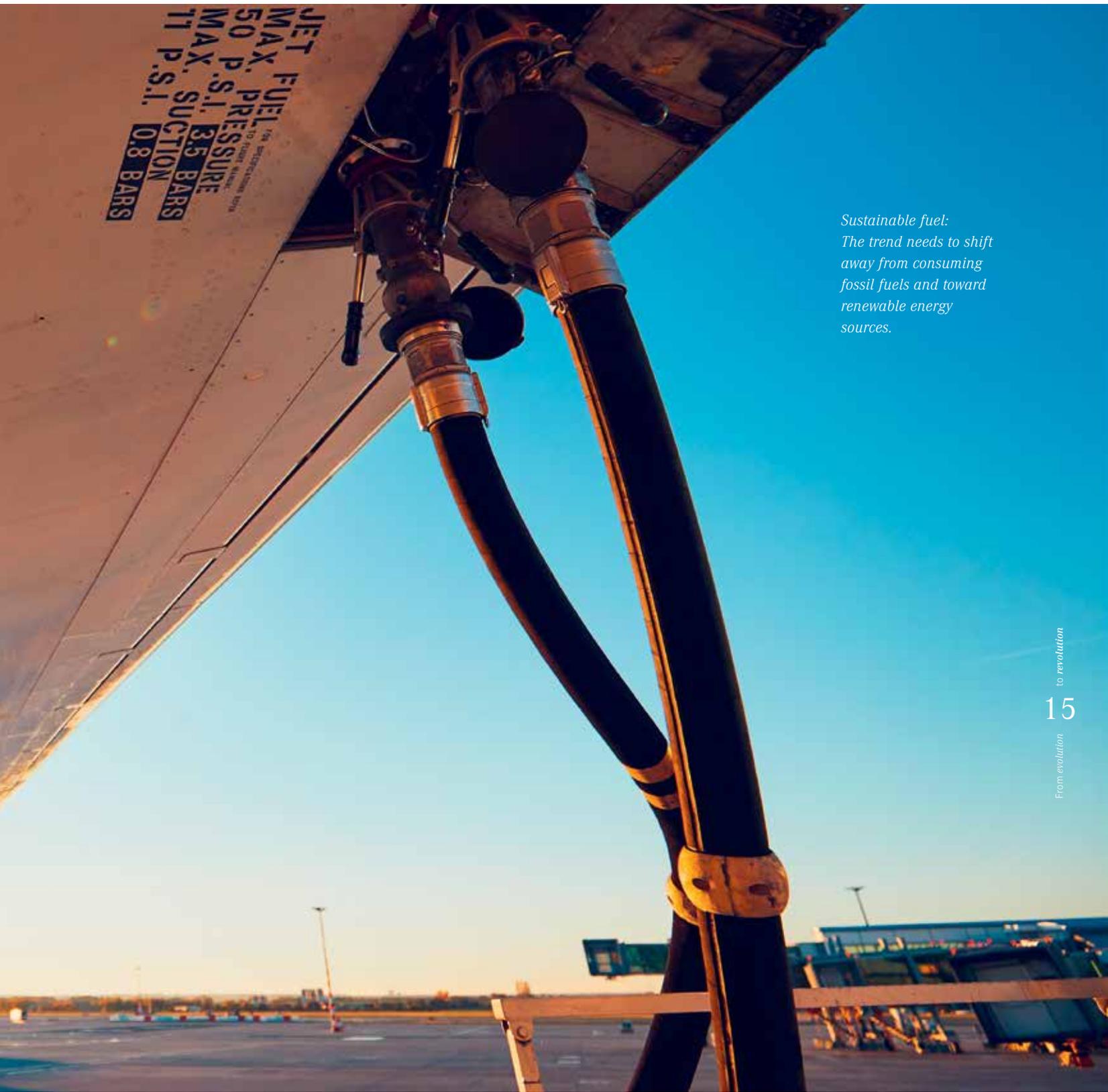
These new propulsion concepts are even cleaner, quieter and more efficient. MTU participates in research programs with German and EU funding that are developing the technology required to turn these systems into reality.

It is still too early to see which approach offers the greater commercial potential while also being technically feasible. But it is already clear that MTU has the innovative strength and the courage to provide answers to the challenges of the future.

Revolution in the tank:
Flying on alternative fuels.



FUTURE ENGINES		TECHNOLOGY	OPERATIONAL ENVIRONMENT				STATUS
<i>Propulsion system</i> [G] Gas turbine [E] Electric propulsion system			<i>Urban mobility</i>	<i>Commuter</i>	<i>Short & medium haul</i>	<i>Long haul</i>	<i>Technological maturity (Idea [1] - Industrialized [6])</i>
[G]		Sustainable fuels Generated from renewable energy			 		



*Sustainable fuel:
The trend needs to shift
away from consuming
fossil fuels and toward
renewable energy
sources.*

	TIMELINE			CO ₂ /NO _x	NOISE
	2020	2030	2050	Reduction in carbon dioxide (CO ₂) and nitrogen dioxides (NO _x) (potential)	Reduction in noise (potential)
Today	→	→	→	<p>* with gas turbine</p>	

Synthetic kerosene:

Sustainable fuels for sustainable aviation.



Today's conventional engines are already able to use alternative fuels to fly. An emissions-free future calls for synthetic fuels. They have the potential to make aviation carbon-neutral, and as drop-in fuels they can be used without modifications to existing infrastructure.

“ The idea is to shift away from consuming fossil fuels toward sustainable, renewable fuels, which are indispensable in paving the way to climate-friendly aviation. We strongly advocate their use. ”

DR. JÖRG SIEBER, HEAD OF TECHNOLOGY INNOVATION MANAGEMENT

Synthetic kerosene — The kerosene of the future is carbon-neutral and has another advantage: it is what is known as a “drop-in” fuel, which does not require any technical modifications to the aircraft and engine; in addition, the airports' existing infrastructure can be used.



Air traffic growth should be carbon-neutral starting as early as 2020; manufacturers, airlines, airports and regulatory authorities agreed on this goal a good ten years ago. To meet the Paris Agreement goal of limiting global warming to two degrees Celsius, aviation must become largely carbon-free by 2050. To this end, aircraft and engine manufacturers are all continuously working to develop their products. But this technological progress alone is not enough to achieve the climate protection goals. To make aviation sustainable, renewable and carbon-neutral fuels are a must.

MTU has been pursuing this topic for a long time. For example, it is involved in the activities at the Aviation Initiative for Renewable Energy in Germany e. V. (aireg) and at Bauhaus Luftfahrt, and is collaborating with the German Aerospace Center (DLR).

Several alternative fuels approved

Some initial manufacturing processes are now technically mature and the fuel approved for flight operations. These drop-in fuels require no modifications to the aircraft or engines, and they meet the stringent quality and safety requirements of aviation.

Currently, only biomass-based fuels are available in larger quantities. Using such fuels leads to a direct improvement in aviation's carbon footprint; to produce them, however, requires farmland and crops that would otherwise be used for food, thus putting food and fuel in competition with one another.

This explains why the future is likely to belong to synfuels, which can be produced from renewable electricity or sunlight, for instance. It would thus make most sense to site production facilities in sunny and windy regions.



Sun-to-liquid (StL) process — A sun-to-liquid plant produces kerosene from sunlight, water and CO₂. The process is already in use: in Madrid, the IMDEA Energy Institute built a unique solar facility and tested it extensively over four years. MTU was involved in the project as a member of Bauhaus Luftfahrt, the German aviation industry's think tank, which was responsible for the entire technology and systems analysis. The challenge now is to scale up the production process.

Fuels derived from electricity and sunlight

These synfuels have already made it out of the lab. The initial pilot projects show that producing them is a viable proposition. The pilots apply two different processes: power-to-liquid (PtL) and sun-to-liquid (StL). With PtL, electricity and water are converted to hydrogen by means of electrolysis. In a further process step, CO₂ is broken down into CO and synthesized with the hydrogen from the first step to produce kerosene. Only if the supply of CO₂ is extracted from the atmosphere will the process of burning the kerosene in the engine be carbon-neutral. With StL, water and CO₂ are thermochemically converted into hydrogen and carbon monoxide in a solar reactor using concentrated sunlight. The subsequent synthesis to kerosene is identical to PtL.

The challenge of mass production

Over the coming years, the challenge will be to bring synthetic kerosene production up to industrial scale. The production process is extremely complex, which makes the fuel very expensive. Stakeholders worldwide are working on how to reduce costs. The process engineering for PtL and StL is not the only hurdle to overcome: providing renewable energy and CO₂ in large quantities also poses a challenge.

It's clear that these fuels are absolutely essential for climate-friendly aviation. There is broad agreement on this across the industry.

Over the long term, hydrogen also offers possibilities as an aviation fuel, as it is more efficient and less expensive to produce than PtL; however, it requires building new infrastructure and new aircraft designs.

POWER-TO-LIQUID:

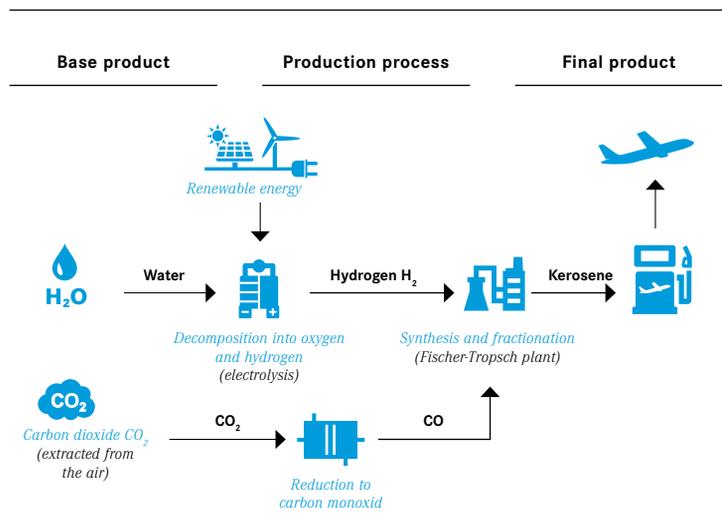
Renewable energy

+ water

+ CO₂

= kerosene

HOW WATER AND CARBON DIOXIDE BECOME KEROSENE



Power-to-liquid (PtL) process — The power-to-liquid process is a pioneering approach that uses renewable energy to produce hydrogen, synthesizes it with carbon dioxide to form hydrocarbons and processes these into a liquid fuel.

Electric flight:
The dream of emissions-free flight.



FUTURE ENGINES		TECHNOLOGY	OPERATIONAL ENVIRONMENT				STATUS
<i>Propulsion system</i> G Gas turbine E Electric propulsion system			<i>Urban mobility</i>	<i>Commuter</i>	<i>Short & medium haul</i>	<i>Long haul</i>	<i>Technological maturity (Idea [1] - Industrialized [6])</i>
G E		Parallel hybrid-electric systems Combination of turbo-machinery and electric motor					
E		Batteries Electric propulsion systems for small aircraft					
E		Flying fuel cells A propulsion technology with excellent potential					



*Air taxi with parallel hybrid-electric propulsion systems:
MTU is looking into the Silent Air Taxi.*

	TIMELINE			CO ₂ /NO _x	NOISE
	2020	2030	2050	Reduction in carbon dioxide (CO ₂) and nitrogen oxides (NO _x) (potential)	Reduction in noise (potential)
2025				 * with gas turbine	
2025				 	
2040				 	

Electric propulsion systems:

Probing the boundaries of what's physically possible.



Electric propulsion systems are an exciting prospect because they enable emissions-free aviation—provided the power is produced sustainably. Just as groundbreaking are parallel hybrid-electric propulsion systems that facilitate the use of hydrogen-powered fuel cells. Now, the focus is on harnessing technological progress and demonstrating the feasibility of these future technologies in the short term.

With their promise of emissions-free flight, battery-powered all-electric engines that run on renewable energy could catapult aviation into a new era. However, these systems come up hard against the limits of physics, because the batteries and the propulsion systems connected to them are much too heavy: batteries available today can supply only about $\frac{1}{25}$ as much usable energy as kerosene.

Electric air taxis to cover short distances

A new operating segment would open the door to all-electric flight: carrying a small number of passengers over short distances by air taxi. Such aircraft could enable quick travel between airports and city centers. However, the safety, commercial viability and advantages of such aircraft are as yet unproven.

So far, there are no known battery concepts suitable for powering larger passenger aircraft.

WEIGHT IS THE MAIN PROBLEM

Energy source	Relative weight Usable energy *	Efficiency
Fuel 	 1	 50%
Hydrogen  H ₂	 0.25	 60%
Electricity 	 25	 >90%

* energy source only; without propulsion system and tank

The use of batteries in aviation is likely to remain limited because they are too heavy despite their high level of efficiency. In this regard, fuel cells are more promising.



The Silent Air Taxi was unveiled to the public in 2019. MTU is involved in the development and production of the parallel hybrid-electric powertrain.

SILENT AIR TAXI:
PARALLEL HYBRID-ELECTRIC
SYSTEM WITH POTENTIAL

- **Up to 4 passengers**
- **Cruising speed > 300 km/h**
- **Range: 500 to 1,000 km**
- **Short take-off distance: < 400 m**
- **Minimal noise emissions**

Parallel hybrid-electric propulsion systems to cover longer distances

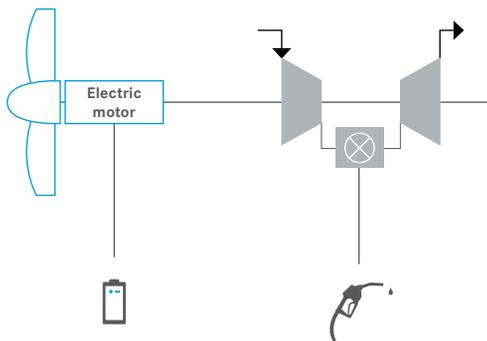
Aircraft with a parallel hybrid-electric powertrain have the potential to serve longer routes. They combine electric and conventional propulsion systems, opening up new degrees of freedom in aircraft and engine design.

One advantage of hybrid concepts is that they enable the aircraft to have distributed propulsion systems to reduce drag. Another is that engine operating points can be optimized.

However, these are offset by disadvantages such as the weight of the systems and additional losses as a result of energy conversion.

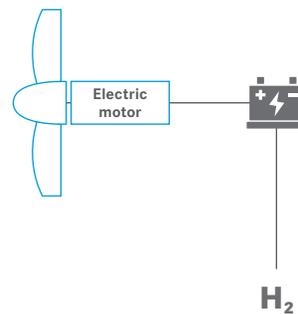
PARALLEL HYBRID

*A variety of turbo- and hybrid-electric propulsion concepts are possible.
An example: parallel hybrid.*



This engine draws its energy from conventional fuel and from the battery. The electric motor supports the gas turbine in different operating phases. If absolutely necessary, purely electric power can be used for both take-off and landing to reduce emissions around the airport.

FUEL CELLS



Fuel cells emit nothing but water, meaning they enable virtually climate-neutral and pollutant-free flight. With hydrogen as its energy source, the electric motor drives the propulsors. Whether for short-, medium- or long-haul flight, this technology could be used to power almost any application.

Are flying fuel cells the answer?

In light of this, MTU experts are working to master another technology: hydrogen-powered fuel cells. The advantage of these is that they weigh a lot less than batteries. However, they too present some challenges: first, hydrogen requires very large storage tanks. Storing gaseous hydrogen in pressure tanks is suitable only for small aircraft. Commercial aviation will rely on liquid hydrogen. Even here, though, tanks will need to be four times as large as they are today, meaning they will not fit easily into the wing; it will be necessary to modify the aircraft architecture. Second, the fuel cell generates waste heat that, unlike with conventional engines, cannot be dissipated that easily. And third, completely new airport infrastructure is required to enable hydrogen refueling.

The industry is currently working to overcome these three major challenges, in addition to the issues of commercial viability and reliability.



The Bauhaus Luftfahrt think tank, of which MTU is a member, is working on integrating hybrid-electric propulsion systems: in this concept study, an electrically driven propulsor is installed aft of the fuselage to facilitate wake-filling and reduce effective drag, thereby reducing the required propulsive power demand.

MTU's active and extensive involvement

MTU is keeping a close eye on these pioneering topics and working on them hand in hand with universities and institutes—including the German Aerospace Center (DLR)—in numerous research alliances. It is also a member of the leading think tank Bauhaus Luftfahrt. These partnerships ensure a constant flow of ideas and give MTU a foothold in engine innovations and related technologies at a very early stage.

Everyone involved is working toward the same goal: emissions-free aviation. With a view to making the dream of 100 percent performance with zero percent emissions come true.

“ We are keeping our eye on every opportunity we have to shoulder our responsibility for delivering emissions-free flight, because the future of aviation begins today. ”

LARS WAGNER, CHIEF OPERATING OFFICER

To our shareholders

26	The Executive Board
28	The MTU share

In view of the exceptional situation created by the corona crisis at the time of the publication of the 2019 annual report, MTU Aero Engines AG will forego its letter to the shareholders, as reliable prospective statements are not possible at this time.

The Executive Board



Reiner Winkler

Chief Executive Officer (CEO)

born 1961, appointed until September 30, 2024

Reiner Winkler has been CEO of MTU Aero Engines AG since January 2014. His responsibilities include human resources, strategy, corporate communications and legal affairs. From May 2005 to December 2017, Winkler was MTU's Chief Financial Officer – and during the last four years of this period, he served as CFO in addition to his role as CEO. On joining MTU in 2001, Winkler, who has a degree in business administration, was placed in charge of the finance, human resources and IT departments.

Prior to that, he was managing director for finance and controlling at TEMIC Telefunken microelectronic GmbH. Further career milestones included posts with Daimler Benz AG and Siemens AG.



Peter Kameritsch

*Chief Financial Officer (CFO) and
Chief Information Officer (CIO)*

born 1969, appointed until December 31, 2025

Peter Kameritsch has been a member of the MTU Executive Board since January 2018 with responsibility for finance and IT.

He has degrees in physics and business administration. Kameritsch joined MTU in 1999 and has worked since then in management positions in finance, investor relations and corporate strategy at various MTU locations.

Before his appointment to the Executive Board, he was Senior Vice President for Finance.

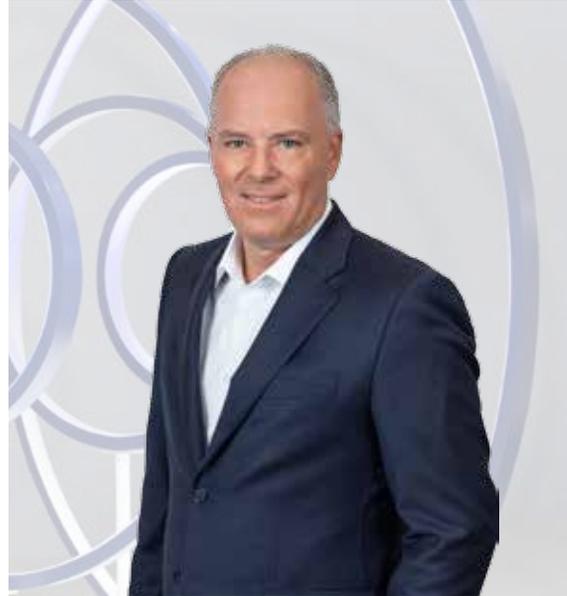


Lars Wagner

Chief Operating Officer (COO)
born 1975, appointed until December 31, 2025

Lars Wagner was appointed as MTU's Chief Operating Officer in January 2018 with responsibility for technology and development, procurement, production, assembly and quality assurance.

Wagner has a degree in mechanical engineering and an MBA. He joined MTU as Executive Vice President for OEM Operations in July 2015 after holding a number of management positions with Airbus, including international assignments, most recently in Hamburg.



Michael Schreyögg

Chief Program Officer (CPO)
born 1966, appointed until June 30, 2021

Michael Schreyögg joined the Executive Board in July 2013 with responsibility for marketing/sales and MTU's commercial and military OEM programs. In this capacity, he oversees new engine and spare parts business with OEM partners and military customers as well as after-market service activities for airlines. Since 2018, he has also been responsible for the MTU Maintenance sites.

Schreyögg joined MTU in 1990 with a degree in mechanical engineering. Since that time he has headed various commercial and military engine programs before assuming overall responsibility for the company's defense programs from 2008.

The MTU share

MTU promoted to the DAX

In 2019, MTU Aero Engines AG was included in the German blue-chip index (DAX) with effect from September 23. After 14 years in the MDAX index, MTU now ranks as one of Germany's 30 leading public corporations.

The DAX made gains at the start of 2019. From a low for the year of around 10,417 points on January 3, 2019, the index rose to the 12,000 point mark in mid-April. In the following months, the global capital markets were held back principally by the trade dispute between the USA and China. At the end of the year, there were growing signs that the tension was easing. Interest rate cuts and the robustness of the economy in the USA gave the stock markets additional tailwind. As a result, the DAX rose back above 13,000 points in early November. It closed at 13,249 points at the end of December 2019, a gain of 25.5% over the year.

The MDAX mid-cap index, which lists 60 mid-sized German enterprises, also rallied at the start of the year but was subsequently more stable than the DAX. At year end it had more than offset the temporary drop in prices in the summer and also posted a strong rise. The MDAX ended the year at 28,313 points; a gain of 31.2% during the year.

MTU shares are also included in the Stoxx Europe TMI Aerospace & Defense Index, along with companies such as Airbus Group, Safran and Rolls-Royce. This index posted a strong price performance in 2019, outperforming both the DAX and the MDAX. Over the year, the Stoxx Europe TMI Aerospace & Defense Index rose by 33.2%.

MTU shares in 2019: Price rose by 60.7%

Like the DAX index, shares in MTU started 2019 at a low for the year, with a share price of €156.20 on January 3, 2019. At the start of April, the MTU share topped €200 for the first time. After a consolidation phase, this was followed by another clear uptrend from July. The positive operating performance and orders worth over U.S. \$1.3 billion secured at the Paris Air Show heightened investors' confidence. On September 4, shares in MTU rose to an interim high of €253.40. That was the date which Deutsche Börse announced that the company would be included in the DAX index.

[T3] MTU share performance in 2019 compared with stock market indices (indexed; Dec. 31, 2018 = 100)



Following strong gains, the share subsequently suffered a slight price setback – a reaction that is often observed when a share is included in a new index. However, it regained momentum toward the end of the year, posting a high for the year of €264.80 on December 9, 2019.

Shares in MTU ended 2019 up 60.7% at €254.60. They therefore once again outperformed both the DAX and the MDAX. Market capitalization was around €13.5 billion at year end.

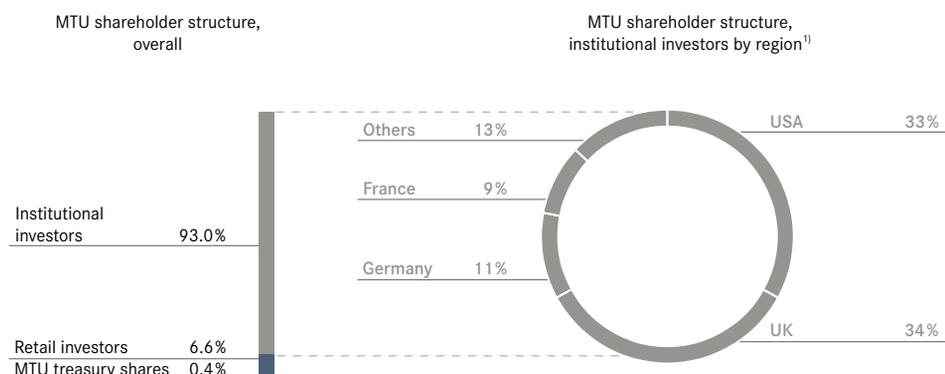
[T4] Year-on-year indicators for shares in MTU

		2019	2018
Highest price for the year ¹⁾	€	264.80	197.30
Lowest price for the year ¹⁾	€	156.20	130.30
Price at start of year ¹⁾	€	158.80	149.30
Year-end price ¹⁾	€	254.60	158.40
Performance over the year ²⁾	%	+61	+6
Market capitalization at year end	€ million	13,518	8,237
Average daily trading volume	€ million thousand shares	32 146	23 143
Earnings per share	€	9.23	8.67

¹⁾ Xetra closing price.

²⁾ Based on Xetra year-end share price (Dec. 31).

[T5] Shareholder structure



¹⁾ Approximation based on top 50 shareholders.
Source: SID, December 2019.

Lively trading in MTU shares

In 2019, the average number of MTU shares traded via Xetra trading was 146,000 shares per day, compared with 143,000 per day in 2018. The highest number of shares traded was 1,087,309 on September 20, 2019. The average daily trading volume was around €32 million (previous year: €23 million). MTU was therefore ranked 25th in the DAX index in terms of market capitalization at year end 2019 (previous year: third in the MDAX). Based on trading volume, it was 33rd in the ranking of all DAX and MDAX shares (previous year: 11th in the MDAX ranking).

High proportion of institutional shareholders

As a result of early conversions of the convertible bond, which matures on May 17, 2023, the total number of voting rights increased to 53,093,867 as of December 31, 2019, as a result of the issue of preemptive shares (Section 41 (2) of the German Securities Trading Act [WpHG]).

The free float was 99.6% on December 31, 2019. 0.4% of the shares are held by the company. Around 93.0% of the free float was held by institutional investors and 6.6% by retail investors. The majority of institutional investors are based in the UK, the USA, Germany or France. Ahead of the inclusion in the DAX, further institutional investors increased their holdings to above the 3% or 5% notification threshold. At the end of 2019, notifications under Section 21 (1) of the German Securities Trading Act (WpHG) had been received from the following institutional shareholders:

[T6] Institutional investors with voting rights > 3%

DGAP	Investor	Voting rights in %	No. of MTU shares
Aug. 21, 2018	The Capital Group Companies, USA	15.22%	7,915,441
Sept. 17, 2019	BlackRock, Inc., USA	7.29%	3,789,004
Aug. 9, 2018	Euro Pacific Growth Fund, USA	5.10%	2,650,030
Dec. 28, 2019	FMR LLC, USA	5.07%	2,644,500
Sept. 26, 2018	Massachusetts Financial Services Company, USA	4.93%	2,561,829
Aug. 28, 2019	Allianz Global Investors GmbH, Germany	3.01%	1,566,172
Nov. 27, 2019	Fidelity Investment Trust, USA	3.005%	1,562,432

Broad coverage by analysts

At the end of December 2019, 25 analysts were reporting regularly on MTU. Buy recommendations were issued by 7 of these financial institutions, while 13 gave MTU

stocks a hold rating and 5 had it on sell (previous year: 11 “buy,” 13 “hold,” 4 “sell”). The average upside target was €242.

[T7] The following financial institutions report regularly on MTU:

Alpha Value Research	Goldman Sachs	Morgan Stanley
Barclays	Hauck & Aufhäuser	Nord LB
Berenberg Bank	HSBC	ODDO Securities Research
BernsteinResearch	Independent Research	Pareto
BoA Merrill Lynch	JPMorgan Cazenove	Société Générale
Citi Global Markets Research	Kepler Cheuvreux	UBS
Commerzbank	Landesbank Baden-Württemberg	Vertical Research
DZ Bank	MainFirst	Warburg Research
Exane BNP Paribas		

Intensive investor relations work

With 23 roadshows in all the key financial centers of Europe and the USA, MTU continued to raise its market profile in 2019. The company also took part in 20 international investor conferences, including the Commerzbank German Investment Seminar in New York, Kepler Cheuvreux’s German Corporate Conference in Frankfurt and Goldman Sachs’ European Industrials Conference in London. Around 50 analysts and investors accepted the invitation to attend the group’s annual Investor and Analyst Day, which was held in Hannover on November 28, 2019. This event focused on MTU’s growth potential. In addition, numerous investors visited MTU at its headquarters in Munich. In total, around 1,200 investors made use of these opportunities for direct contact with MTU in 2019.

A key platform for dialogue with shareholders was once again the MTU Annual General Meeting held in Munich on April 11, 2019. Around 78% of the share capital with voting rights was represented (previous year: 72%).

In the annual ranking for the German Investor Relations Prize presented by Extel, WirtschaftsWoche and the German investor relations association (DIRK), MTU was ranked third among the MDAX companies. In the 2019 All-Europe Executive Team investor relations ranking by the Institutional Investor publishing house, sell side professionals awarded MTU second place in the category “Best IR Professional, Best IR Program and Best IR Team”.

Information on IR topics can be found in the Investor Relations section of the MTU website (www.mtu.de). You are also welcome to contact the IR team by calling +49 (0)89 1489-4787.

Corporate governance

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Corporate governance report

Responsible corporate management is very important to MTU. The company therefore complies with all the recommendations of the German Corporate Governance Code (GCGC). The corporate governance statement required by Section 289a of the German Commercial Code (HGB) forms part of the combined management report of the MTU Group and MTU Aero Engines AG.

Responsible corporate management

The term “corporate governance” stands for the management and oversight of a company in accordance with the principles of responsibility and long-term value creation. MTU Aero Engines AG sees good corporate governance as a natural responsibility that embraces every area of the company. That comprises mutual trust and efficient collaboration between the Executive Board and the Supervisory Board, respect for the shareholders’ interests and open and transparent communication with all stakeholders. As a company with global operations, MTU acts in compliance with the relevant national and international standards. In Germany, where the company has its headquarters, these standards are laid down principally in the Stock Corporation Act (AktG), the Codetermination Act (MitbestG) and the GCGC. In the past financial year, the Executive Board and Supervisory Board closely examined the valid version of the GCGC, dated February 7, 2017.

The Government Commission on the German Corporate Governance Code concluded a new version of the GCGC on December 16, 2019, and submitted it to the Federal Ministry of Justice and Consumer Protection for review and publication. The 2020 GCGC will take effect upon publication by the ministry in the Electronic Federal Gazette (elektronischer Bundesanzeiger) in spring of 2020.

Therefore, this report has been compiled in compliance with the 2017 version of the GCGC, which is applicable for 2019.

The Executive Board and Supervisory Board of MTU Aero Engines AG have issued the following declaration on corporate governance in accordance with Section 289a of the German Commercial Code (HGB).

Declaration of conformity with the German Corporate Governance Code by the Executive Board and Supervisory Board of MTU Aero Engines AG, in accordance with Section 161 of the German Stock Corporation Act (AktG)

The Executive Board and the Supervisory Board of MTU Aero Engines AG declare that the recommendations of the Government Commission on the German Corporate Governance Code, as published in the amended version of February 7, 2017, by the Federal Ministry of Justice in the official section of the Federal Gazette, have been and are being complied with in their entirety.

Munich, December 2019

On behalf of the Executive Board



Reiner Winkler
CEO

On behalf of the Supervisory Board



Klaus Eberhardt
Chairman

Corporate management

Accepting responsibility – not only for its products and processes, employees, customers and partners, but in equal measure for the environment and society as a whole – forms an integral part of MTU's corporate culture. MTU is committed to sustainable development and its contribution in this area goes beyond the legal requirements. The principal focus areas of its social commitment are environmental protection, human resources policy, and community outreach projects in the neighborhoods of MTU sites. These commitments are publicly documented on the MTU website at [www.mtu.de/under/Company > Corporate Responsibility](http://www.mtu.de/under/Company/CorporateResponsibility).

The company has a Code of Conduct, which has to be observed by all employees. The Code of Conduct can be downloaded from the company's website at [www.mtu.de/under/Company > Compliance > Code of Conduct](http://www.mtu.de/under/Company/Compliance/CodeofConduct).

MTU attaches great importance to maintaining an open, ongoing dialogue with its target groups. The company communicates with these groups via many channels, including the intranet and internet, brochures, employee and customer magazines, and events. The aim is to generate broad public acceptance.

MTU insists on the finest quality for its products and services. Compliance with quality standards is verified by the relevant authorities and through internal and external audits. The quality standards are published on the MTU website under [Engines > Quality](http://www.mtu.de/Engines/Quality).

Trust-based cooperation among governing bodies

MTU is a stock corporation organized under German law. Its governing bodies are the Executive Board, the Supervisory Board and the Annual General Meeting. The close cooperation between the Executive Board and the Supervisory Board is based on trust and on intensive, ongoing sharing of information. The Annual General Meeting, in particular, offers shareholders the opportunity to put questions to MTU executives and to exercise their voting rights.

Working procedures of the Executive Board

The goal of the Executive Board in managing MTU is to create, on its own responsibility and in the company's interest, sustainable added value, taking into account the interests of its shareholders, employees and other stakeholders. The Executive Board works as a team, with its members bearing joint responsibility. The members of the Executive Board regularly discuss important actions and events within their respective remits. Their differing qualifications and professional experience are complementary. The company's Executive Board consisted of four members in 2019.

The Supervisory Board is briefed by the Executive Board in a regular, timely and comprehensive manner on the situation of the company, especially in thematically specific meetings of the Supervisory Board and Audit Committee at intervals throughout the fiscal year. The meetings address the company's strategy, the status of planning, the achievement of targets, the company's risk situation and its risk management activities. The Executive Board coordinates decisions of a strategic nature with the Supervisory Board, ensures that such decisions are implemented and discusses the progress made. To ensure the flow of information on the company's results of operations, financial position and net assets, the Executive Board has set up a process in which the Supervisory Board receives a written report on a monthly basis. Any deviations from the planned operational performance are explained in detail to the Supervisory Board. Furthermore, the Chairman of the Supervisory Board is briefed regularly and in person on the company's current situation, significant business transactions and important pending decisions.

The Executive Board also receives regular reports on compliance, i.e., on the measures taken to comply with laws and regulations as well as with company guidelines.

Material decisions by the Executive Board, especially those concerning the budget, require the approval of the Supervisory Board. More information on these matters is provided in this Annual Report in the [Report of the Super-](#)

[visory Board](#). The Executive Board's rules of procedure, along with the list of transactions by MTU Aero Engines AG requiring Supervisory Board approval, can be viewed on the company's website at [www.mtu.de/under Investor Relations > Corporate Governance](http://www.mtu.de/under-Investor-Relations).

Working procedures of the Supervisory Board

In line with statutory requirements, the Supervisory Board comprises six shareholder representatives and six employee representatives. The Supervisory Board appoints the Executive Board and monitors and advises it in the management of the company's business. In this respect, in 2010 the Supervisory Board resolved as a matter of principle to appoint new members to the Executive Board for a term of three years. Key corporate decisions require the approval of the Supervisory Board. All Supervisory Board members are qualified for these tasks and perform their duties properly. In compliance with the GCGC, only one former member of the Executive Board of MTU Aero Engines AG, namely Prof. Dr.-Ing. Klaus Steffens, has a seat on the Supervisory Board; the GCGC recommends no more than two. The Supervisory Board is responsible for assessing the independence of its own members. As a matter of principle, it considers the employee representatives to be independent. It considers that the Supervisory Board is independent if the majority of members are considered to be independent. In its present composition, this applies to all members of the Supervisory Board. Given the nature of MTU's business model and the 30 to 40-year lifecycle of its engine programs, which entail very high initial capital expenditure, the Executive Board and the Supervisory Board consider long-serving members of the Supervisory Board to be an especially valuable asset to the company and do not take the view that they must necessarily be deemed insufficiently independent after a tenure of 12 to 15 years based on this fact alone. In this way, independent advice and oversight of the Executive Board is ensured by both the full Supervisory Board and its committees.

The Supervisory Board's rules of procedure provide for the establishment of committees. MTU's Supervisory Board has four committees. Details can be found in the section headed ["The Supervisory Board."](#)

The Supervisory Board's rules of procedure contain binding provisions for dealing with conflicts of interest. Such conflicts must be disclosed and, where appropriate, may result in termination of the member's term of office. In addition, the Supervisory Board must explicitly state such potential conflicts of interest when submitting the nominations to the Annual General Meeting. In 2019, no

consulting agreements, contracts for services or similar contractual agreements existed between members of the Supervisory Board and MTU Aero Engines AG or any of its subsidiaries. Neither in this, nor any other area did any conflicts of interest arise that required disclosure.

The Supervisory Board has defined specific objectives for its composition and drawn up a profile of skills and expertise for the entire board, which it judges to be satisfactorily met at the present time. This profile forms the basis for all future nominations submitted for approval by the Annual General Meeting. The profile of skills and expertise is published on MTU's website.

In the past financial year, directors' and officers' liability insurance was in effect for the members of MTU's Executive Board and Supervisory Board. The cover includes a deductible of 10% of the loss incurred, up to a maximum of 1.5 times the board member's annual fixed compensation.

The compensation of the members of the Executive Board and Supervisory Board is based on clear and transparent criteria, which are described in the section headed "[Management compensation report.](#)"

Diversity

The diversity of its employees plays a key role in MTU's success. Therefore, diversity is very important to MTU.

Special attention is paid to the criteria of internationality and ensuring an appropriate proportion of women in the group.

In accordance with Section 111 (5) of the German Stock Corporation Act (AktG), the supervisory boards of companies that are listed or subject to the German Codetermination Act (MitbestG) are required to set target quotas for women on their supervisory and executive boards. In addition, under Section 76 (4) of the German Stock Corporation Act (AktG) the Executive Board is required to set a target quota for women at the two management levels directly below the Executive Board.

Diversity also plays an important role in the composition of the Supervisory Board. In compliance with both the German Stock Corporation Act (AktG) and the GCGC, the supervisory boards of listed companies subject to the German Codetermination Act (MitbestG) must comprise at least 30% women and at least 30% men. The Supervisory Board has four female members: Dr. Christine Bortenlänger, Anita Heimerl, Heike Madan and Prof. Dr. Marion A. Weissenberger-Eibl. Two are employee representatives and two are shareholder representatives. In addition, the Supervisory Board has set the following goal: International focus is very important for MTU as a global corporation. At least one

member of the Supervisory Board should therefore meet the criterion of "internationality." It is already the case that various members of MTU's present Supervisory Board trained or have spent a large part of their professional lives abroad. The members of the Supervisory Board should continue to contribute an international perspective.

The Supervisory Board takes the above-mentioned goals into account when submitting proposals for election by the Annual General Meeting. The same applies to the Nomination Committee, which is responsible for preparing the vote of the Supervisory Board. Since the main criterion for any proposal is still the company's interest, the Supervisory Board proposes the most suitable candidates.

The Supervisory Board's rules of procedure set an age limit for members. Their terms on the Supervisory Board automatically end at the end of the Annual General Meeting following the member's 72nd birthday. Moreover, a general limit of four terms of office has been set for serving on the Supervisory Board.

The Supervisory Board also places value on fostering diversity in appointments to the Executive Board. The members of the Executive Board have diverse qualifications and work experience, which contribute to their work. In accordance with the provisions of the German Stock Corporation Act (AktG) and the German Corporate Governance Code (GCGC), in 2017 the Supervisory Board set a target quota of 25% for female members of the Executive Board, to be achieved by 2022.

Given the structure of the management and supervisory boards of the MTU companies in Germany – namely a sole managing director and a supervisory board consisting of either three or twelve members – a target of 0% female members was set in 2017. However, the proportion of women on the Supervisory Board of MTU Maintenance Hannover GmbH currently stands at 8.33%. At management level – which comprises tier 1 (OFK), tier 2 (FK) and tier 3 (EFK) managers – the Executive Board has set a quota of 13% for women in management positions at the MTU sites in Germany. It aims to achieve this by the end of 2022.

MTU is continuing to pursue its goal of increasing the number of women on all levels. Every area of the company is called upon to work actively toward achieving this corporate objective. The company has long-established measures in place to increase the proportion of women in management and is continually driving these forward. They include, for instance, career counseling for women with potential as well as various mentoring programs.

Other measures aimed at both men and women and designed to improve work-life balance include part-time management posts, job sharing and teleworking.

Financial reporting

MTU prepares its consolidated financial statements and interim reports in accordance with the International Financial Reporting Standards (IFRSs). The Executive Board is responsible for this. The separate financial statements of the parent company are compiled in accordance with the provisions of the German Commercial Code (HGB). An internal control system, coupled with the application of uniform accounting policies, ensures that the results of operations, financial position, net assets and cash flows of all group companies are accurately presented. In addition, MTU has a differentiated system in place to identify and monitor business and financial risks.

Risk management and control system

The Executive Board is responsible for ensuring that an appropriate risk management and control system is in place. This system is described in the section headed *“Internal control and risk management system.”* The Executive Board reports to the Supervisory Board in a regular and timely manner on existing opportunities and risks, and how they are developing. The Audit Committee of the Supervisory Board discusses risk management. In accordance with Section 107 (3) of the German Stock Corporation Act (AktG), the Audit Committee is explicitly responsible for monitoring the effectiveness of the risk management system, the internal control and auditing systems, the financial reporting process and the audit of the financial statements, and, in particular, for assessing the auditors’ independence.

Compliance

The corporate culture at MTU is characterized by trust and mutual respect. Nevertheless, the risk can never be entirely ruled out that unauthorized behavior of isolated individuals might lead to contravention of the law. MTU does everything in its power to minimize this risk as far as possible, and is committed to preventing acts of misconduct, such as corruption, in the first place through regular and targeted training and to uncovering and pursuing any such acts.

The observance of legal and ethical rules and principles plays a central role in this respect. These and other aspects of compliance, such as the responsible handling of insider information, are documented in a Code of Conduct drawn up and introduced jointly by the Executive Board and the Group Works Council. This Code of Conduct embodies MTU’s corporate culture and reflects its resolve to comply strictly with the relevant laws and internal regulations. It is a group-wide guide to ethical business relations.

Compliance is an important aspect of all management functions at MTU. For example, all managers must check that every member of their staff has read and understood the Code of Conduct and abides by its rules. Reinforcement is provided by internal training.

MTU has established the position of a Compliance Officer, who is a member of corporate management and reports directly to the Executive Board. The duties of the Compliance Officer include identifying and evaluating legal and reputational risks. Where necessary, the Compliance Officer recommends additional compliance rules to the Executive Board. In addition, the Compliance Officer coordinates the measures taken in cases of suspected non-compliance. In agreement with the Works Council, the company has appointed a contact point that staff, customers and suppliers can contact if they suspect any illegal actions.

Reports on the Compliance Officer’s activities are presented at meetings of the Supervisory Board’s Audit Committee. The Audit Committee then informs the plenary meetings of the Supervisory Board via a summary of its own meetings. This includes monitoring the measures and training programs implemented by the Compliance Officer and proposing revisions to the compliance rules.

Extensive information, Annual General Meeting

In keeping with the principles of good corporate governance, MTU continually provides extensive and timely information on the company's activities and any major developments in its business situation for shareholders, shareholder associations, financial analysts, the media and other interested parties. MTU strives to ensure that all stakeholders are kept informed in equal measure.

Within reason, the chairman of the Supervisory Board is also prepared to meet with investors to talk about topics specific to the Supervisory Board. The company publishes an extensive range of information on its website at www.mtu.de. It publishes quarterly information on its business activities. Any new developments likely to have a significant impact on the MTU share price are disclosed in the form of ad hoc releases in accordance with statutory requirements.

Information is also posted on the MTU website whenever members of the Executive Board or Supervisory Board or related persons have purchased or sold MTU shares, debt instruments or share-based derivatives. Section 19 of the European Market Abuse Regulation stipulates that these persons must disclose such transactions if their value in a single calendar year reaches or exceeds €5,000 (through December 31, 2019; €20,000 from January 1, 2020).

MTU broadcasts the Annual General Meeting, including the speech of the CEO, live on the internet for those shareholders who cannot attend the meeting personally. The company supports the personal exercise of shareholder rights and proxy voting by its shareholders in part by providing voting representatives who exercise voting rights in accordance with instructions received from the shareholder, and can also be reached during the Annual General Meeting until voting begins. Shareholders also have the option of absentee voting. Shareholders can use electronic means to authorize proxies and provide voting instructions to the company's voting representatives up to the beginning of the Annual General Meeting. MTU is not informed by its service provider of the detailed content of the voting instructions until less than 24 hours before the beginning of the Annual General Meeting.

Report of the Supervisory Board



Klaus Eberhardt

Chairman of the Supervisory Board

Activities of the Supervisory Board

In this report, the Supervisory Board provides information in accordance with Section 171 (2) of the German Stock Corporation Act (AktG) on its activities in fiscal 2019 and the results of its review of the annual financial statements and consolidated financial statements. In 2019, the Supervisory Board carried out with due care the duties of oversight and advice with which it is entrusted by law and under the terms of the company's articles of association and its own rules of procedure.

The Supervisory Board regularly advised the Executive Board on the running of the company, continually supported and monitored the management of all business activities, and assured itself that the Executive Board's dealings were proper and lawful. The Supervisory Board was informed and consulted in a direct and timely manner on all decisions of consequence for the company. The Executive Board provided the members of the Supervisory Board with regular, prompt and comprehensive information on the company's situation. To ensure the flow of information on the company's results of operations, financial position and net assets, the Executive Board has set up a process in which the Supervisory Board receives a written report on a monthly basis.

The Supervisory Board was also informed in detail of any new plans and discussed strategy issues and all major projects with the Executive Board. After examination and careful deliberation, the Supervisory Board endorsed the company's strategic orientation with its focus on organic, profitable growth. The Supervisory Board passed resolutions on all transactions for which its approval was required in accordance with the law, the company's articles of association or the Executive Board's rules of procedure after reviewing and discussing them with the Executive Board. As needed, employee representatives or shareholder representatives meet in separate groups for discussions with members of the Executive Board as preparation for meetings of the Supervisory Board. Preparatory meetings can also take place without the Executive Board as necessary.

As in previous years, the Supervisory Board paid special attention to the internal control mechanisms at MTU, especially the risk management system, internal auditing and legally compliant corporate governance. The Supervisory Board examined these aspects with the support of the Audit Committee on the basis of the documents submitted to it and in dialogue with the Executive Board and reached the conclusion that the company has effective systems in place, in particular an effective internal control and risk management system for the accounting process.

The Supervisory Board's compliance monitoring activities are supplemented by those of the Audit Committee, which has a special responsibility in this respect. The internal auditors and the managers responsible for compliance regularly present their findings to the Audit Committee and report to it on the latest developments in the field of compliance.

Meetings of the Supervisory Board

The Supervisory Board held six routine meetings in 2019. No conference calls were held. Attendance at meetings of the Supervisory Board and its committees was 98.6%. Between official meetings, the chairman of the Supervisory Board was regularly briefed on the company's current situation, significant business transactions and important pending decisions. This entailed regular meetings with the Executive Board, including consulting on strategy, the status of planning, the progress of business, the company's risk situation, the risk management system and compliance.

At its meetings, the Supervisory Board and the Executive Board discussed the business performance of MTU and all its affiliated companies. The Supervisory Board reviewed the allocation of the net profit for 2018 available for distribution and approved the Executive Board's profit distribution proposal. A dividend payment of €2.85 per share eligible for the dividend was proposed to the Annual General Meeting. A further question dealt with by the Supervisory Board was the appointment of an external auditor. Following the recommendation of the Audit Committee, the Supervisory Board proposed that Ernst & Young GmbH Wirtschaftsprüfungsgesellschaft, Munich, should be appointed to audit the financial statements and consolidated financial statements and to review the half-year financial reports for 2019. The Annual General Meeting approved this proposal with a majority of 99.97%.

Further, at its meetings the Supervisory Board considered MTU's technology roadmap, especially with regard to alternative engines and fuels. It also examined the status, market development and strategy of the commercial MRO segment and the establishment of a new repair site in Serbia. Another issue was MTU's possible involvement in an engine program for a potential new mid-market airplane (NMA) to be produced by Boeing. Moreover, the Supervisory Board discussed the issuance of a new convertible bond and the partial repurchase of the convertible bond issued in 2016.

Other issues examined in detail by the Supervisory Board were the operational business plans and budget for 2020, the short-term incentive (STI) payable to the members of the Executive Board for 2018, definition of the targets and bandwidths for the award of STI payments to Executive Board members for 2019, and compliance with the German Corporate Governance Code.

Corporate governance

The Supervisory Board is convinced that the company's success is based on good corporate governance. For this reason, in 2019 the Supervisory Board once again looked in detail at the application and implementation of the German Corporate Governance Code. The Board measures the efficiency of its own activities annually, and, in the process, assesses feedback gathered in a survey prepared by an external legal firm.

In addition, the Supervisory Board explicitly stated that, in the nominations it proposes to the Annual General Meeting, it takes into account the principles of avoidance of conflicts of interest and will continue to do so. When nominating candidates for election, the Supervisory Board discloses any personal ties or business relations the candidates may have with the company, its governing bodies and/or major shareholders. This was also the case for the election in 2019. An onboarding process was developed and introduced for new members of the Supervisory Board. It acquaints new members of the Supervisory Board extensively with MTU's corporate governance and product portfolio and the working procedures of the Supervisory Board.

The Supervisory Board deems all of its members to be independent. This expressly applies to the employee representatives and to Prof. Dr.-Ing. Klaus Steffens, who ceased to be a member of MTU's Executive Board in 2004. Consequently, all Supervisory Board committees consist exclusively of independent members. Members of the Supervisory Board undertake training on their own responsibility, with support from MTU where necessary. MTU may also defray the costs of training.

Cooperation between the Supervisory Board and the Executive Board, and among the members of the Supervisory Board, was judged to be very good in 2019. No conflicts of interest arose between MTU and any member of its Executive Board or Supervisory Board.

In a joint declaration with the Executive Board dated December 10, 2019, in accordance with the requirements of Section 161 of the German Stock Corporation Act (AktG), the Supervisory Board states that MTU Aero Engines AG complies with all the recommendations of the German Corporate Governance Code. MTU's declaration of conformity is reproduced [in the "Corporate governance section" of this Annual Report](#), together with a more detailed description of the company's corporate governance system. The declaration has also been posted [on the MTU website](#).

Committee meetings

By convention, the Supervisory Board has three committees with equal numbers of employee and shareholder representatives: an Audit Committee, a Personnel Committee and – in compliance with Section 27 (3) of the German Codetermination Act (MitbestG) – a Mediation Committee. Each of these committees presents regular reports on its activities at the plenary meetings of the Supervisory Board.

A Nomination Committee, which meets on an ad hoc basis, has been set up in accordance with the recommendations of the German Corporate Governance Code. The task of the Nomination Committee is to find suitable candidates for election to the Supervisory Board. The members of this committee are Klaus Eberhardt (Chairman) and Dr.-Ing. Jürgen M. Geißinger. The Nomination Committee held one meeting in 2019 to discuss the proposal for the election of two Supervisory Board members.

The Personnel Committee comprises Klaus Eberhardt (Chairman), Dr.-Ing. Jürgen M. Geißinger and two employee representatives, Josef Mailer and Roberto Armellini. Among other things, it deals with the employment contracts of Executive Board members, including their compensation and the recommendation of candidates. Dr. Martin Kimmich, who left the Supervisory Board on May 31, 2019, was replaced by Armellini. The Personnel Committee convened twice in 2019 (with an attendance rate of 100%). Among other things, it discussed the short-term incentive (STI) payable to members of the Executive Board for 2018, the targets for the STI payments for 2019, the Supervisory Board's efficiency audit, and recommendations to the Supervisory Board concerning the appointment of Executive Board members and their compensation. As necessary, both the Personnel Committee and the full Supervisory Board meet without the Executive Board.

The Mediation Committee, whose members are identical with those of the Personnel Committee, did not have to convene in 2019.

The members of the Audit Committee are Dr. Joachim Rauhut (Chairman), Klaus Eberhardt, Heike Madan and Josef Mailer. This committee met six times in the past year and held two conference calls. Attendance was 100%. It focused on reviewing the annual financial statements, the consolidated financial statements and the combined management report, including the non-financial statement, of the MTU Group and MTU Aero Engines AG as well as the company's financial position and the annual and half-year reports and quarterly statements.

Further, the Audit Committee discussed the additional services provided by the auditors, and the granting of the audit mandate. The Audit Committee specified the key areas for the audit of the annual financial statements for 2019 and concluded the audit contract with Ernst & Young Wirtschaftsprüfungsgesellschaft. In addition, the committee obtained the auditor's statement of independence in accordance with Section 7.2.1 of the German Corporate Governance Code and also monitored the auditor's independence. Furthermore, the procedure for procuring non-audit services provided by the auditors was reviewed and affirmed and a cap was imposed on the fees for such services.

To assist the committee members in their tasks, they and all other members of the Supervisory Board received copies of the reports prepared by Ernst & Young concerning the audit of the annual financial statements, the consolidated financial statements and the combined management report. These documents were reviewed in detail in the presence of Ernst & Young. As a result, the committee recommended that the Supervisory Board should adopt the financial statements, approve the combined management report and consent to the Executive Board's profit distribution proposal.

In accordance with statutory requirements, the Audit Committee monitored the accounting process, the accounting-related internal control and risk management system and the internal auditing system, which it judged to be effective. It oversaw the company's compliance activities and received reports from the internal auditors.

Furthermore, in two telephone conferences the Audit Committee discussed the issuance of a new convertible bond and the partial redemption of the convertible bond issued in 2016. Moreover, the committee examined the issue of aircraft funding and the law to protect business secrets as well as the European Market Infrastructure Regulation (EMIR) review of certain derivative transactions.

Adoption of the annual financial statements, the approved consolidated financial statements and the management report

The annual financial statements, consolidated financial statements and combined management report of the MTU Group and MTU Aero Engines AG for 2019 were audited by Ernst & Young, Munich, whose appointment was approved by the Annual General Meeting. Ernst & Young issued an unqualified audit opinion. This was signed by Siegfried Keller and Markus Westermeier, who have audited MTU since 2014. The audit reports and documents to be reviewed were submitted in good time to all members of the Supervisory Board. The Supervisory Board conducted a thorough review of the annual financial statements, consolidated financial statements and the combined management report, including the non-financial statement of the MTU Group and MTU Aero Engines AG for 2019 and the Executive Board's proposal for the distribution of the net profit. Its review was based on the audit by Ernst & Young, on which the Chairman of the Audit Committee had reported in full to the Supervisory Board. The auditor attended the meeting of the Audit Committee of MTU Aero Engines AG on March 10, 2020, and the meeting of the Supervisory Board to discuss the financial statements on March 17, 2020, and presented the main findings of the audit. The Supervisory Board reviewed the annual financial statements, consolidated financial statements, combined management report including the non-financial statement, and the Executive Board's profit distribution proposal, and raised no objections. The company's annual financial statements and consolidated financial statements for 2019, as submitted by the Executive Board, were approved at the Supervisory Board's meeting on March 17, 2020. The annual financial statements are therefore adopted. The Supervisory Board agreed to the Executive Board's proposal for the distribution of the net profit after giving due consideration to the interests of the company and its shareholders. On March 17, the Supervisory Board approved the Executive Board's recommendation that in view of the dramatic developments of the global coronavirus pandemic, the proposal should be made to the Annual General Meeting to bring forward the net profit for fiscal year 2019 to new account. Based on the developments in the coming weeks and the ensuing consequences for MTU Aero Engines AG's business development, the Executive Board and Supervisory Board will revisit this proposal again and issue an updated proposal to the Supervisory Board as appropriate. For the same reason, MTU Aero Engines AG is postponing its Annual General Meeting. It was decided that it will not be held as scheduled on May 7, 2020, but will take place later within the legally prescribed period of eight months after the end of the fiscal year.

Changes in the governing bodies, extensions of terms of office

The term of office of Dr. Joachim Rauhut was extended. On the employees' side, Dr. Martin Kimmich left the Supervisory Board. He was succeeded on June 13, 2019, by Roberto Armellini.

The Supervisory Board would like to thank the Executive Board for its close and constructive collaboration. It would also like to thank all employees and the Works Council for their successful work and enormous commitment in 2019. Moreover, the Supervisory Board would like to thank Dr. Martin Kimmich for his many years of expert and professional service on the Supervisory Board. It is also grateful to all MTU's shareholders for the trust they place in the company.

Munich, March 17, 2020



Klaus Eberhardt
Chairman of the Supervisory Board

The Supervisory Board

Members of the Supervisory Board and the additional mandates they hold on supervisory boards or comparable oversight bodies of other business enterprises in Germany or abroad

Klaus Eberhardt

Chairman of the Supervisory Board

Independent consultant

Former CEO of

Rheinmetall AG, Düsseldorf

ElringKlinger AG

Josef Mailer

Deputy Chairman of the Supervisory Board

Chairman of the Group Works Council of

MTU Aero Engines AG, Munich

Chairman of the Works Council of

MTU Aero Engines AG, Munich

Roberto Armellini, since June 13, 2019

Second authorized representative and director of

IG Metall, Munich

RENK AG

Angelo Gross

Member of the Group Works Council of

MTU Aero Engines AG, Munich

Deputy Chairman of the Works Council of

MTU Maintenance Hannover GmbH, Hannover

MTU Maintenance Hannover GmbH

Dr. Christine Bortenlänger

Chief Executive of Deutsches Aktieninstitut,

Deutsches Aktieninstitut e.V., Frankfurt am Main

Covestro AG

Covestro Deutschland AG (Covestro Group)

OSRAM Licht AG

OSRAM GmbH (OSRAM Group)

TÜV Süd AG

Anita Heimerl

Member of the Group Works Council of

MTU Aero Engines AG, Munich

Full-time member of the Works Council of

MTU Aero Engines AG, Munich

Thomas Dautl

Director Supplier Quality and Development,

MTU Aero Engines AG, Munich

Dr. Martin Kimmich, until May 31, 2019

IG Metall Trade Union Secretary, Munich office

Linde AG

Nokia Solutions and Networks Management GmbH

Dr.-Ing. Jürgen M. Geißinger

Independent entrepreneur

Former CEO of Schaeffler AG, Herzogenaurach

AAA Accelerator Group Europe AG (Switzerland)

Hilotherm Holding AG (Switzerland)

Heike Madan

Trade union company policy department, head of the

union workplace representatives and company policy

division, IG Metall, Frankfurt am Main

Dr. Joachim Rauhut

Independent consultant

*Former member of the Executive Board of
Wacker Chemie AG, Munich*

B. Braun Melsungen AG
creditsshelf AG

J. Heinrich Kramer Holding GmbH
Stabilus S. A.

Prof. Dr.-Ing. Klaus Steffens

Independent consultant

Former CEO of MTU Aero Engines AG, Munich

Morvern Group
Poppe & Potthoff GmbH

Prof. Dr. Marion A. Weissenberger-Eibl

*Director of the Fraunhofer Institute for Systems and Inno-
vation Research ISI in Karlsruhe and holder of the Chair of
Innovation and Technology Management at the Karlsruhe
Institute of Technology*

HeidelbergCement AG
Rheinmetall AG

SUPERVISORY BOARD COMMITTEES

Personnel Committee

Klaus Eberhardt, Chairman

Roberto Armellini, since July 23, 2019

Dr.-Ing. Jürgen M. Geißinger

Dr. Martin Kimmich, until May 31, 2019

Josef Mailer

Audit Committee

Dr. Joachim Rauhut, Chairman

Klaus Eberhardt

Heike Madan

Josef Mailer

Mediation Committee

Klaus Eberhardt, Chairman

Roberto Armellini, since July 23, 2019

Dr.-Ing. Jürgen M. Geißinger

Dr. Martin Kimmich, until May 31, 2019

Josef Mailer

Nomination Committee

Klaus Eberhardt, Chairman

Dr.-Ing. Jürgen M. Geißinger

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Combined management report

The management report of MTU Aero Engines AG and the group management report for the fiscal year 2019 have been combined in accordance with Section 315 (5) of the German Commercial Code (HGB) in conjunction with Section 298 (2) of the German Commercial Code (HGB).

The MTU Group

Business activities and markets

MTU's portfolio covers the entire lifecycle of commercial and military aircraft engines and aero-derivative industrial gas turbines. The company's activities range from development, manufacturing and marketing to maintenance.

MTU has technological expertise in low-pressure turbines, high-pressure compressors and turbine center frames, and in repair techniques and manufacturing processes. It is involved in important national and international technology programs and cooperates with the top names in the industry (GE Aviation, Pratt & Whitney and Rolls-Royce).

The group also provides maintenance services for commercial aircraft engines. In the military sector, it has been the leading industrial partner to the German armed forces for decades.

MTU operates in two segments: the OEM business (Original Equipment Manufacturing) and MRO business (Maintenance, Repair and Overhaul). The OEM segment covers new commercial engines, including spare parts, and the whole of the military sector. The MRO segment comprises the commercial maintenance activities.

Group structure, locations and organization

Through its subsidiaries, joint ventures and equity investments, MTU has a presence in all key markets and regions worldwide. Further information on MTU's shareholdings is provided in the Notes to the consolidated financial statements in [Section I. "Accounting policies and principles."](#)

[T8] MTU Aero Engines worldwide



- | | | |
|--------------------------------|------------------------------------------------|--------------------------------------|
| MTU Maintenance Canada | MTU Aero Engines | MTU Maintenance Zhuhai ¹⁾ |
| MTU Aero Engines North America | MTU Maintenance Hannover | Airfoil Services ¹⁾ |
| Vericor Power Systems | MTU Maintenance Berlin-Brandenburg | |
| MTU Maintenance Dallas | MTU Maintenance Lease Services | |
| | MTU Aero Engines Polska | |
| | MTU Maintenance Serbia | |
| | EME Aero ¹⁾ | |
| | AES Aerospace Embedded Solutions ¹⁾ | |
| | Pratt & Whitney Canada | |
| | Customer Service Centre Europe ¹⁾ | |
| | Ceramic Coating Center ¹⁾ | |

¹⁾Joint ventures.

[T9] MTU's global workforce

	Dec. 31, 2019	Dec. 31, 2018	Change against previous year	
			Employees	in %
Number of employees				
Locations in Germany	8,935	8,176	759	9.3
Locations outside Germany	1,725	1,555	170	10.9
Total workforce	10,660	9,731	929	9.5

Corporate strategy

MTU's corporate strategy is geared to profitable growth and customer satisfaction. The four target areas of MTU's growth strategy are:

A balanced product portfolio – Participation in rapidly growing new programs

MTU participates in rapidly growing and high-volume military and commercial engine applications, working

with various partners in doing so. It optimizes its risk profile as well as growth opportunities through continuous participation in varying thrust classes and fields of application. MTU Aero Engines is currently focusing on ramping up production of Geared Turbofan™ engines for regional and medium-haul jets, which it has developed together with partners, and on developing GE's GE9X engine program for the Boeing 777X widebody aircraft,

for which the market launch is scheduled for 2021. These programs complement MTU's excellent positioning in the MRO segment, as the company has secured itself a share in the future aftermarket service business through its stakes in these engine programs.

In the military business, the discussion about a possible successor for the Tornado became more concrete in 2018. At the same time, preparations are under way to design a successor to the Eurofighter in Germany and the Rafale in France. In early February 2019, MTU Aero Engines, Munich, signed an agreement with Safran Aircraft Engines, Gennevilliers, France, indicating the two companies' intention to take a leading role in the development, manufacture and maintenance of the engine for the next-generation fighter jet.

The two partners aim to establish a Franco-German partnership in which both parties have an equal share in the program, assuming they receive equal funding from France and Germany.

The stake in the U.S. military program for the T408 for the CH-53K heavy-lift cargo helicopter, which was launched on the market in September 2019, gives MTU a position on the world's strongest military market.

Cutting-edge technologies – Maintaining and expanding technological leadership

MTU is currently extending its technological leadership by focusing on the development of new high-temperature materials and modern manufacturing technologies such as additive processes. In combination with optimized cyclic processes, the company is thus able to achieve even greater efficiency in the medium term with its core modules – the low-pressure turbine, high-pressure compressor and turbine center frame – and therefore greater profitability and environmental friendliness, while simultaneously reducing component weight.

The aviation and aerospace industry and the EU Commission have drawn up a joint Strategic Research and Innovation Agenda (SRIA), which sets targets for engines up to 2050. On a long-term perspective, MTU aims to achieve emission-free aviation. It is therefore cooperating with research institutions and industrial partners on assessing revolutionary engine concepts such as new cyclic processes and electric propulsion systems and demonstrating their potential at an early stage of development.

The digitalization of products, services and value creation processes is also growing in importance. This can be seen, for instance, in the extensive use of simulation techniques in all areas of development through to the virtual engine.

Enhanced competitiveness – Increased productivity accompanied by a reduction in capital tie-up

MTU encourages a culture of continuous improvement in order to secure its competitiveness. The focus here is on optimizing structures, processes and capital tie-up in all areas of the company. Digitalization and automation technologies (Industry 4.0) play a key role here.

The goal is to continue to optimize MTU's supply chain and its production and service network in terms of delivery capability, quality and costs.

MTU regards responsible economic activity as an important criterion of its competitiveness, and acts in harmony with its sustainability strategy.

Innovative corporate culture – Motivated employees in a creative environment

Highly motivated, skilled workers are crucial to the successful growth of the MTU Group. MTU's corporate culture places emphasis on personal development and achievement coupled with a strong sense of social responsibility.

The trend toward digitalization is set to change the work environment and tried-and-tested management methods. More scope and greater responsibility for employees as well as short decision paths are key elements of an innovative corporate culture. All employees are encouraged and empowered to contribute their own ideas and translate them into new products and services, innovative business models and improved processes.

The company promotes cultural and individual diversity, flexible working conditions and high-quality basic and further training opportunities for its workforce.

MTU is confident that activities with a long-term focus, targeted investments and continuous development of the corporate culture will enable it to achieve its strategic objectives.

Key performance indicators

MTU is managed on the basis of key performance indicators adopted by the Executive Board. These performance metrics are derived from the operational business plans and provide guidance for management of the company that is geared to sustainable and profitable growth. A planning and control system and a value-oriented management compensation system are used to facilitate decisions that create a suitable environment for implementing the corporate strategy.

[T10] Performance indicators

in € million	2019	2018	Change against previous year	
			in € million	in %
Revenue	4,628.4	4,567.1	61.3	1.3
Adjusted EBIT	756.9	671.4	85.5	12.7
Adjusted EBIT margin (in %)	16.4	14.7		
Free cash flow	358.3	202.9	155.4	76.6

The value-driving key performance indicators of adjusted EBIT, revenue and free cash flow define the range within which MTU operates in terms of profitability, growth and liquidity.

For a definition of adjusted EBIT, which is the most important of these KPIs, please see the [reconciliation to adjusted key performance figures in the "Results of operations" section](#). Another indicator monitored by the company is the adjusted EBIT margin, which shows the relationship between adjusted EBIT and revenue.

The purpose of optimizing cash flow is to ensure that the group maintains its financial strength. MTU determines its free cash flow by combining its cash flow from operating activities with its cash flow from investing activities and eliminating components of the latter (non-recurring cash flows) that lie outside the operational management of the core business. For the reconciliation of the free cash flow, non-recurring cash outflows – comprising payments for the acquisition of shares in engine programs, payments in connection with interest-bearing loans and financial assets held for the purpose of liquidity management – are eliminated from the cash flow from investing activities.

[T11] Free cash flow

in € million	2019	2018	Change against previous year	
			in € million	in %
Cash flow from operating activities	831.7	594.7	237.0	39.9
Cash flow from investing activities	-471.6	-336.1	-135.5	-40.3
Non-recurring cash flows	-1.8	-55.7	53.9	96.8
Free cash flow	358.3	202.9	155.4	76.6

**Research and development
Framework conditions and goals**

An increasingly mobile society, limited natural resources and rising environmental awareness all call for innovative solutions – especially when it comes to aircraft engines. MTU has established technological leadership in its core competencies of low-pressure turbines, high-pressure compressors, turbine center frames, and high-tech manufacturing processes and repair techniques. This provides a solid basis for refining existing engines and developing new propulsion concepts.

The main focus of MTU's R&D activities is to improve overall engine efficiency as a means of reducing both fuel consumption and emissions. This can be achieved by lowering the fan-compression ratios/increasing the bypass ratios, thereby improving thrust efficiency, increasing temperatures and overall pressure ratios to improve thermal efficiency, and enhancing component efficiency. Furthermore, in aviation, reducing weight also significantly influences fuel consumption. Key components in this respect are MTU's low-pressure turbine and high-pressure compressor, which feature high pressure ratios, low weight and high efficiency ratios, and the heavily loaded turbine center frame. Enhancing these technologies is an ongoing task for MTU.

MTU's medium- to long-term goals for the development of new commercial engines fully comply with the voluntary commitment made by the European aviation industry and research community, which have formulated ambitious targets for air traffic up to 2050 in their Strategic Research and Innovation Agenda (SRIA):

[T12] Long-term targets¹⁾

	SRIA 2020	SRIA 2035	SRIA 2050
Fuel consumption – air traffic	-43%	-60%	-75%
Fuel consumption – engines	-20%	-30%	-43% ²⁾
NO _x emissions – mainly engines		-84%	-90%
Noise – mainly engines		-55%	-65%

¹⁾ Changes per passenger-kilometer compared with the reference base (2000).

²⁾ Assuming comparable improvements in aircraft and engines.

However, the target of limiting climate change to less than 2°C (2015 Paris Agreement) requires accelerating all activities. The SRIA targets are not enough to accomplish this and must be overhauled.

MTU has bundled its targets in the technology agenda Claire (Clean Air Engine), which will be accelerated in view of the new conditions and extended to include technologies that enable moving toward emission-free aviation.

The first stage is the Geared Turbofan™ (GTF), which was developed in partnership with Pratt & Whitney and entered series production in early 2016 for the Airbus A320neo. The GTF reduces fuel consumption and hence carbon dioxide emissions by around 16% ([see also “Commercial engine programs”](#)).

Proof-of-concept studies for the next stage show that further improvements are possible on the basis of the GTF engine configuration. The aim is to achieve an even lower fan compression ratio and further improve thermal efficiency by means of higher temperature and pressure ratios. The goal is to cut fuel consumption by 25% and to halve noise emissions.

The third stage of the Claire program will see the introduction of revolutionary new features. MTU is pursuing two different concepts, for which it conducted studies in 2019:

- / Heat engines featuring innovative cyclic processes beyond conventional gas turbines, which promise a significant improvement in thermal efficiency.
- / Electric propulsion systems, ranging from electric batteries to hybrid systems (gas turbine and battery) and fuel cells. In particular, fuel cells in combination with sustainably produced hydrogen have the potential to provide sufficient power and reach for commercial aircraft and enable emission-free aviation in the long term.

In both concepts, the main focus is on rapid demonstration and validation of the feasibility of critical technologies. Therefore, in 2019, applications for subsidies were submitted under the German aviation research program LuFo and the Bavarian program to foster technology. The plan is to carry out ground tests on new heat engines with innovative cyclic processes, and to use a Dornier Do228 as a test platform for the electric propulsion systems.

**Technologies for key engines of the future
Commercial engine programs**

The most significant innovation in the area of aircraft engines in recent decades is the Geared Turbofan™ (GTF) engine developed by MTU in cooperation with Pratt & Whitney. Unlike conventional turbofans, in which the fan and low-pressure turbine run at the same speed on a single shaft, the GTF links the two components using a reduction gear. This allows the fan with its larger radius to rotate more slowly, while the low-pressure turbine rotates faster. Consequently, lower fan pressure ratios (high bypass ratios) are achieved, thereby improving thrust efficiency, increasing the efficiency of the fan and the low-pressure turbine, while cutting fuel consumption and carbon dioxide emissions by 16% each and reducing the noise level by 20 EPNdB, bringing it well below certification level. What is more, the engine is lighter because the low-pressure turbine and low-pressure compressor require fewer stages. In the GTF project, MTU is responsible for developing and manufacturing the high-speed low-pressure turbine, the front half of the high-pressure compressor and four brush seals. In addition, MTU assembles 30% of serially produced engines for the Airbus A320neo and carries out acceptance tests for these engines. It is also a partner in the MRO network.

The certification of the new Embraer E-Jet E175-E2, powered by the PW1900G engine, by the aviation authorities in Brazil, the USA and Europe in April 2019 was the most important milestone in the GTF engine program in 2019. In November 2019, the first two compliance engines for the smaller Embraer E175-E2 were delivered to the aircraft manufacturer.

The first flight by an Airbus A319neo with a PW1100G-JM engine took place in April 2019. The last of the three Airbus models in the neo family (A319neo, A320neo and A321neo) with PW1100G-JM is thus nearing regular use on commercial passenger flights. In January 2019, Pratt & Whitney and MTU celebrated the 1,000th PW1100G-JM engine for the A320neo after an assembly and delivery period of just 18 months. (For comparison: it was ten years before its predecessor, the V2500, reached the 1,000 delivery threshold.)

Geared Turbofan™ engines are being used by five different aircraft manufacturers. With firm orders and options for over 10,000 units placed by the end of 2019, the GTF is becoming a major commercial success.

[T13] MTU – Geared Turbofan™ engine programs

Engine	MTU program share	Aircraft manufacturer	Aircraft type
PW1100G-JM	18%	Airbus	A320neo
PW1200G	15%	Mitsubishi	SpaceJet
PW1400G-JM	18%	Irkut	MC-21
PW1500G	17%	Airbus	A220
PW1700G	15%	Embraer	E-Jet E175-E2
PW1900G	17%	Embraer	E-Jet E190-E2 / E195-E2

Based on the same core engine but without a reduction gear, the PW800 family of engines is a variation of the Geared Turbofan™ engine. The Gulfstream G600 business jet with a PW815 engine was certified by the U.S. aviation authority and the first aircraft was delivered to a customer.

When it comes to engines of the highest thrust class for long-haul aircraft, MTU is participating in General Electric's GE9X for the new Boeing 777X by developing and manufacturing the extremely demanding turbine center frame. The product definition for serial production of the engine was completed in the reporting period and the first MTU series modules were delivered to General Electric. The first flight by the 777X with the GE9X engine took place in early 2020.

Military engine programs

The T408 (formerly GE38) is the first U.S. military program in which MTU has been involved right from the development phase. The T408-1B engine powers the CH-53K heavy-lift cargo helicopter that Sikorsky has developed for the U.S. Navy. The first series engine was delivered to the U.S. Navy in September 2019.

The EJ200 engine powers the Eurofighter and is in service with numerous air forces. A long-term evolution (LTE) program to extend the capability of the Eurofighter is currently under consideration. In response to this, the EJ200 engine is to be revised, including introducing state-of-the-art technology to increase its thrust and extend its range. Consequently, an EJ200 LTE study commenced in the reporting period. The aim is to offer the customer NETMA three options for a possible engine upgrade from 2020.

Germany and France are planning to introduce the new Future Combat Air System (FCAS) from 2040. A key component in this air defense system is a new fighter jet, which is scheduled to come into service as from 2040. A central element in this new jet is the Next European Fighter Engine (NEFE), for which MTU and Safran will be the joint lead for development, production and after-sales support. MTU will be responsible for the high- and low-pressure compressors and the low-pressure turbine. Safran will be responsible for the combustor, high-pressure turbine and the afterburner. The first phase of a joint concept study for the NEFE engine was completed in 2019.

New areas of business

New technologies enable the construction of smaller, autonomous aircraft, which are opening up new areas of business. For example, e.SAT GmbH has designed a low-noise four-seater aircraft that can use small airfields in residential areas, significantly reducing individual travel times, especially in less developed regions. At the Paris Air Show in June 2019, MTU signed a memorandum of understanding on participation in the development and construction of a hybrid electric propulsion system for the planned Silent Air Taxi. Series production of this aircraft is scheduled to start in 2024 and it will be an excellent demonstrator for further future technologies such as propulsion systems based on fuel cells.

Component technologies

MTU has built up a technological lead in the fields of low-pressure turbines, turbine center frames and high-pressure compressors and aims to build on this. Continuous development of these technologies is thus necessary.

For the A320neo, Pratt & Whitney and MTU are planning a PW1100G-JM engine with greater thrust and efficiency. An improved high-pressure compressor has been developed for this and was successfully tested by MTU in the reporting period.

The integrated design of the compressor system – comprising the low-pressure compressor, inter-compressor duct and high-pressure compressor – is a key module to improve the next generation of the Geared Turbofan™. Together with partners, MTU is therefore building a two-shaft compressor test rig at the German Aerospace Center in Cologne. In July, detailed measurements in the inter-compressor duct were taken in extensive tests.

MTU and GE Aviation have performed extensive rig testing at Graz University of Technology (TU Graz) to allow shorter turbine center frames (TCFs) with an increased gradient and lower pressure losses in the future. For

this purpose, a turbine center frame similar to the GE9X was measured in detail with an upstream high-pressure turbine stage in differing operating conditions.

Digitalization

The trend toward digitalization and networked supply chains heralds the fourth industrial revolution, after the invention of the steam engine, the automated production line and the computer. People, machines, plants, logistics and products communicate and cooperate with each other, so that, for example, production is largely self-organizing. An interdisciplinary working group is defining MTU's specific demands and requirements. MTU is examining the entire product lifecycle and the entire MTU value chain from development to manufacture and maintenance.

To realize digitalization, MTU has appointed digital transformation managers whose role is to support the MTU centers in the implementation of their digitalization roadmaps, analyze current IT trends and strengthen collaboration between the centers and sites.

A focal area at MTU is the use of simulation tools in material design and manufacture. The goal is to integrate these two processes using computer simulations, and to align all the parameters with each other in such a way that the result is a component with the desired characteristics. This method enables a large number of options to be tried out in a short time, resulting in significant cost savings and better product features.

In its Digital Twin project, MTU has started to replicate all phases in the lifecycle of physical engines and production facilities in models. This data can be used to simulate and validate engine architectures, optimize production processes and carry out predictive maintenance.

Materials

Test facilities for critical components are essential for the development of new materials, production processes and progressive construction methods. In addition, testing expertise and capacity are a key growth factor in the competition for partnership in new engine programs. MTU has therefore combined all component testing facilities in a new center of competence in which it has invested over €25 million. In all, 65 different test methods such as structural, rotation, vibration, bombardment and endurance tests are bundled in this test center. At its heart is a multi-functional centrifugal test station which can realize uniquely complex test structures and loads. The new components testing center was officially opened in October 2019 in the presence of Judith Gerlach, Bavaria's Minister of State for Digital Affairs.

Manufacturing and maintenance technologies

Additive manufacturing processes are opening the way to new methods of production. These processes involve using a laser to fuse very thin layers of powder material applied in succession to build up entire components. MTU is one of the first companies to use additive manufacturing in volume production, to make the borescope eyepieces for PW1100G-JM engines. Preparations are under way to introduce this type of process to manufacture complex components such as center frame struts and bearing housings. The longer-term plan is to create new designs that would be either impossible or very costly to implement using traditional technology.

Further industrialization and automation of additive manufacturing is needed to reduce costs and speed up processes. MTU has therefore initiated the IDEA project (industrialization of digital engineering and additive manufacturing) with 14 partners. The focus is on a holistic view of the entire process chain, including coupling hardware and software, using digital twins, and through end-to-end data formats, process simulation and process control systems. The project is supported by the German Federal Ministry of Education and Research. Ultimately, demonstration components will be manufactured on two pilot lines.

In recent years, MTU has carved out a leading position as a manufacturer of blisk rotors for compressors. For the blisks made of nickel-based alloys, which are extremely difficult to process and which are used in the aft stages of high-pressure compressors, MTU has developed a new electrochemical material-removal process (Precision Electrochemical Machining – PECM). By working with an

extremely small inter-electrode gap, in the micrometer range, PECM accomplishes much greater reproduction precision, thus enabling manufacture of the required extremely complex blade geometries.

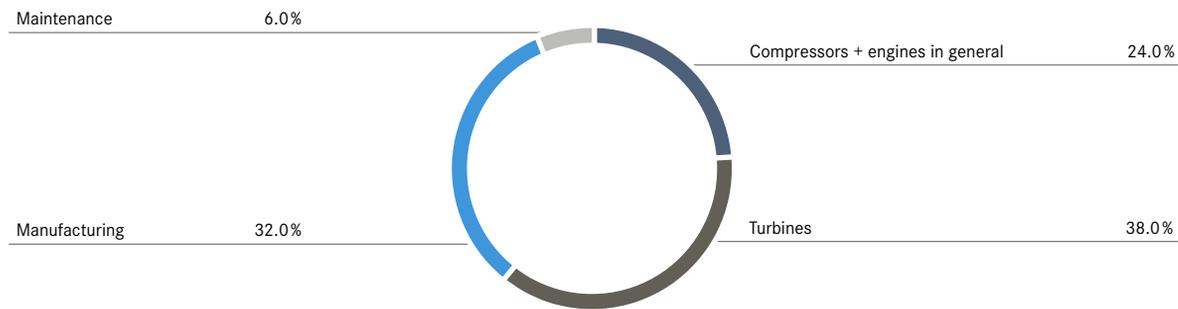
So far, profile grooves for turbine disks have been produced by broaching. Since turbine disks are also made of materials with high heat resistance that are time-consuming to process and cause heavy wear, MTU aims to transfer PECM technology from compressor blisks to turbine disks. In the reporting period, the company therefore signed a cooperation agreement with a toolmaker on the development of PECM equipment for grooves on turbine disks. Initial development has already taken place and indicates that PECM can produce grooves with sufficient accuracy and high surface quality. Series production of GTF disks is scheduled to start in 2023.

Carefully thought-through management of engine fleets to improve engine availability and reduce costs is very important to customers. A creative workshop with representatives of MTU's commercial maintenance sites and airline customers was therefore organized as part of the MTU Innovation Engine to develop custom-tailored solutions for customers. In the future, customers will automatically be offered various scenarios for the use of engines, for example, the phase-out of engines, early replacement of components, or the use of the engine on alternative routes.

Protecting technology assets (intellectual property)

As of December 31, 2019, MTU's patent portfolio contained 1,090 patent families (3,740 individual patents). A patent family is a set of identical patents registered in various countries. As of the reporting date, this portfolio covered the following fields of technology:

[T14] Breakdown of MTU's patent portfolio by field of technology



Cooperation in science and research

For decades, cooperation with universities and research institutes has been a fixed element of the research and development work at MTU. For instance, specimen engines are made available to universities and colleges, and MTU experts give lectures or supervise students writing internship reports, theses and dissertations. Furthermore, students are given support with assignments and final reports. In addition, MTU honors outstanding achievements by awarding the annual Heilmann prize to a young scientist meriting recognition for achievements in engine technology.

Strategic alliances have been established with research partners in order to strengthen ties between universities and industry, and to safeguard MTU's innovative capabilities. In recent years, these partnerships with leading German universities and research institutions have been

consolidated, and six centers of competence focusing on specific areas of research have been set up with the aim of optimizing collaboration. The new DLR Institute of Test and Simulation for Gas Turbines in Augsburg is currently being ramped up. The "Virtuelles Triebwerk" (virtual engine) digital research and development platform and a unique testing center for validation of new engine solutions are being created here. Based in Munich, Bauhaus Luftfahrt is a visionary think tank with an international dimension that pursues unconventional, holistic and interdisciplinary research. It brings industry and science together under one roof, focusing primarily on exploring the socioeconomic, political and ecological aspects of aviation, designing visionary aircraft, unearthing promising technologies for the future and carrying out knowledge management.

Investment in research and development

[T15] Research and development expenses

in € million	2019	2018	Change against previous year	
			in € million	in %
Commercial engine business (OEM)	198.7	186.6	12.1	6.5
Military engine business (OEM)	7.9	9.5	-1.6	-16.8
Commercial maintenance business (MRO)	7.7	5.1	2.6	51.0
Total research and development expenses	214.3	201.2	13.1	6.5
less: customer-funded expenses	31.0	23.9	7.1	29.7
Company-funded expenses	183.3	177.3	6.0	3.4
Expenditure meeting recognition criteria for assets				
less: commercial and military engine business (OEM)	80.4	80.2	0.2	0.2
less: commercial maintenance business (MRO)	2.1	1.4	0.7	50.0
Amortization of capitalized development costs	21.7	15.3	6.4	41.8
Development costs recognized in adjusted EBIT	122.5	111.0	11.5	10.4
thereof: amounts accounted for as revenue or cost of goods sold	56.7	50.3	6.4	12.7
thereof: amounts accounted for in profit or loss as development costs	65.8	60.7	5.1	8.4

Research and development expenses totaled €214.3 million in the reporting period, which was 6.5% higher than in the previous year. Research and development expenses, measured as the percentage of revenue of overall research and development expenses, amounted to 4.6% of revenue, somewhat higher than the prior-year level of 4.4%.

Externally funded development expenses amounted to €31.0 million (prior year: €23.9 million), with most of this coming from public grants for research and development for quieter and more fuel-efficient engines.

Company-funded development expenses are funded out of the group's own resources. If the criteria for capitalization are met, the development expenses are recognized as internally generated intangible assets or as other assets if consideration is paid (acquired development work), and amortized over their useful life. Company-funded expenses are disclosed in [Note 3 "Research and development expenses" in the Notes to the consolidated financial statements](#).

Investment in intangible assets that meet the capitalization criteria totaling €80.4 million (prior year: €80.2 million) posted by the OEM segment (commercial and military engine business) mainly relates to the engine programs of the Pratt & Whitney GTF™ family of engines, the GE9X and the PW800.

The amortization of capitalized development costs recognized in the revenue and costs of goods sold relates principally to the Pratt & Whitney GTF™ family of engines.

Business environment

Macroeconomic conditions

The global economy grew by 2.3% in 2019.

The U.S. economy continued its uptrend, growing by 2.3% in 2019. This growth was boosted by strong private consumer spending and the considerable tax breaks offered by the U.S. government.

The eurozone recorded moderate growth of 1.2% in 2019. The weak economy in Europe was an expression of tense trading relationships and a slowdown in the growth of trade, in particular with China, as well as the political uncertainty.

Growth reported by the Chinese economy for 2019 came to 6.1%. China's economic output in the reporting period was adversely affected by a decline in investment and consumer spending growth. The continuing trade dispute between China and the USA had an impact on growth.

The average price for one barrel of North Sea Brent crude oil was U.S. \$64 in 2019. Compared with the previous year, this was a moderate decline, which was advantageous for airlines (previous year: U.S. \$71).

Sector-specific conditions within the aviation industry

Airlines continued their positive development in 2019. This is due to factors including strong demand in passenger traffic and increased aircraft utilization.

According to an estimate by the International Air Transport Association (IATA), global passenger volumes increased by 4.2%. However, growth in demand varied from region to region - rising by 4.1% in North America, by 4.2% in Europe, and by 4.8% in Asia.

According to the IATA, airlines generated a profit of around U.S. \$26 billion in 2019. This means that 2019 was the tenth consecutive profitable year for the industry.

Airbus and Boeing delivered 1,243 aircraft in 2019, a drop of 23% compared to the previous year. The decline was notably caused by the grounding of Boeing's 737 Max from March 2019 onward. Boeing was not able to offset this decline through other models such as the 737NG. MTU has no involvement in the 737 engine. Deliveries of the other Airbus and Boeing aircraft programs grew by a total of 7.4%. Engines that benefited included those with an MTU participation, such as the PW1100G-JM for the A320neo family and the GENx for the Dreamliner. The global fleet grew by 1.9% in 2019 (source: Cirium Fleets Analyzer).

The order backlog for commercial aircraft with more than 100 seats has remained strong. It includes aircraft from Airbus and Boeing as well as the Russian MC-21 from Irkut and the Chinese COMAC C919. Compared with 13,900 in 2018, the order backlog in 2019 dropped only slightly to 13,600 orders (source: Cirium Fleets Analyzer).

According to an estimate by the General Aviation Manufacturers Association (GAMA), 724 business jets were delivered in the reporting period, a rise of 3% compared to 2018.

Overall assessment of the business environment

The global economy recorded growth of 2.3% in 2019. Demand in passenger traffic was strong and continued to rise in 2019 at a rate of 4.2%. Due to the grounding of the Boeing 737 Max, 23% fewer aircraft with more than 100 seats were delivered compared to the previous year; without this effect, deliveries would have been up year on year. At 13,600 orders, the order backlog for commercial aircraft with more than 100 seats has remained strong.

Financial situation

The following explanatory comments and analyses are based on the audited MTU consolidated financial statements for the fiscal years ending December 31, 2019 and 2018. The consolidated financial statements were drawn up in accordance with the International Financial Reporting Standards (IFRSs) issued by the International Accounting Standards Board (IASB), to the extent that these have been adopted by the European Union.

In accordance with IFRS requirements, new and revised standards and interpretations were applied for the first time in the financial statements for 2019. Their impact on the net assets, financial position and results of operations of the group are described in detail in the [Notes to the consolidated financial statements under "Accounting standards, interpretations, and amended standards and interpretations applied for the first time in fiscal year 2019."](#)

The exchange rates used for converting the MTU Group's key foreign currencies into euros are the following official rates set by the European Central Bank:

[T16] Foreign currency exchange rates

Currency	ISO code	Rate at reporting date		Average rate	
		Dec. 31, 2019 €1 =	Dec. 31, 2018 €1 =	2019 €1 =	2018 €1 =
U.S. dollar	USD	1.1234	1.1450	1.1195	1.1810
Canadian dollar	CAD	1.4598	1.5605	1.4855	1.5294
Chinese renminbi	CNY	7.8205	7.8751	7.7355	7.8081
Polish zloty	PLN	4.2568	4.3014	4.2976	4.2615

Results of operations

Group

Revisions of accounting policies

MTU has been applying the new standard IFRS 16, “Leases,” since January 1, 2019. For information on the resulting changes in reporting practice, please refer to the [Notes to the consolidated financial statements in Section I, “Accounting policies and principles.”](#)

Until December 31, 2018, revenue from engine maintenance orders in the OEM maintenance business was also recognized by the OEM segment because the orders were placed with MTU Aero Engines AG by the syndicate leader (OEM) as part of equity investments in the commercial engine program. However, since this order volume constitutes commercial maintenance revenue in economic terms, this revenue has been allocated to the MRO segment since January 1, 2019. The previous year’s figures have been restated accordingly.

Order backlog

MTU’s order backlog consists of firm customer orders that commit the group to delivering products or providing services, plus the contractual value of service agreements. As of December 31, 2019, the order backlog (after consolidation) amounted to €19.8 billion (previous year: €17.6 billion). An order increase was recorded for new orders and service agreements of the Geared Turbofan™ programs, in particular.

Revenue

The increase in revenue is largely attributable to the development in the commercial and military engine business (OEM). Revenue in this segment (before consolidation) rose by €168.9 million, from €1,826.7 million (adjusted) in the previous year to €1,995.6 million. The revenue growth in the OEM segment is attributable to the year-on-year increase in spare parts sales. The commercial maintenance business (MRO) saw a slight drop of €88.4 million in revenue (before consolidation), from the previous year’s (adjusted) figure of €2,799.8 million to €2,711.4 million. The fall in revenue should be viewed in the context of altered ordering practice between the group companies MTU Maintenance Hannover GmbH, Langenhagen, Germany, IAE International Aero Engines AG, Zurich, Switzerland, and MTU Maintenance Zhuhai Co. Ltd., Zhuhai, China (see “Revenue by operating segment” on page 107 of the Annual Report 2018). Without this change, growth adjusted for currency effects in the MRO segment would have been around 7%.

Cost of goods sold and gross profit

Despite a higher volume of business, the cost of goods sold was reduced slightly. Taken together with the rise in revenue, this development led to a higher gross profit, which resulted in an improvement in the gross margin, defined as the ratio of revenue less the cost of goods sold to revenue, from 18.6% in the previous year to 20.1% in the reporting period. This development is marked, in particular, by the realized product mix in the OEM and MRO segments, the above-mentioned altered ordering practice and the development of the U.S.-dollar exchange rate during the reporting period.

Reconciliation to adjusted key performance figures

The reconciliation serves to factor special items out of the key earnings figures of the group and its business segments. In this way, the success of managing operating activities is measured. The adjusted earnings figures furthermore support comparability over time, and between MTU and other companies.

MTU utilizes the following adjusted key performance figures in its financial reports: adjusted earnings before interest and taxes (adjusted EBIT), the adjusted EBIT margin, and adjusted net income. The earnings figures do not come under the provisions of the International Financial Reporting Standards (IFRSs); they are to be seen as an addition to the key financial indicators reported pursuant to IFRSs. In the interests of ensuring comparability of the EBIT figure, it is adjusted for the contributions resulting from the “effects from purchase price allocation” and the “effects from the increase in the stake in IAE-V2500.” As of January 1, 2004, MTU passed

[T17] Consolidated income statement

in € million	2019	2018	Change against previous year	
			in € million	in %
Revenue	4,628.4	4,567.1	61.3	1.3
Cost of goods sold	-3,697.1	-3,715.8	18.7	0.5
Gross profit	931.3	851.3	80.0	9.4
Function costs	-225.7	-231.1	5.4	2.3
Earnings before interest and taxes (EBIT)	705.6	620.2	85.4	13.8
Net financial income/expense	-39.0	-12.9	-26.1	<-100
Earnings before income taxes	666.6	607.3	59.3	9.8
Income taxes	-178.2	-154.0	-24.2	-15.7
Net income	488.4	453.3	35.1	7.7
Basic earnings per share (in €)	9.23	8.67	0.56	6.5
Diluted earnings per share (in €)	8.46	8.10	0.36	4.4

into the ownership of Kohlberg Kravis Roberts & Co. Ltd. (KKR), following the latter's purchase of 100% of the MTU shares from the then DaimlerChrysler AG. In the context of the acquisition, assets, liabilities and contingent liabilities were identified in accordance with IFRS 3 and measured at fair value. Since then, the identified intangible assets, in particular, have resulted in substantial scheduled amortization. The latter are referred to collectively as "effects from purchase price allocation." The contributions from the "effects from an increase in the stake in IAE-V2500" result from the increase in the stake in the V2500 program in 2012, which is capitalized as an acquired program asset and is accounted for as a reduction of revenue over its estimated economic life of 25 years.

Similarly, the effect of special items is eliminated from earnings before income taxes. To establish adjusted earnings before income taxes, net interest income/expense and the interest shares in other financial income/expense connected with provisions for pensions and liabilities from pensions and plan assets are added to adjusted EBIT. All other components of financial income/expense that are influenced by the U.S.-dollar exchange rate, such as the effects of exchange-rate hedging, are adjusted.

The adjusted amount of earnings before income taxes is used to determine the adjusted amount of net income. The normalized income taxes are calculated on the basis of the expected average tax rate for the group (fiscal year 2019: 29%). The profit/loss of companies accounted for using the equity method does not form part of the tax basis.

[T18] Reconciliation of the consolidated income statement

in € million	2019			2018		
	As reported	Special items	After adjustment	As reported	Special items	After adjustment
Revenue	4,628.4		4,628.4	4,567.1		4,567.1
Cost of goods sold	-3,697.1		-3,697.1	-3,715.8		-3,715.8
thereof: depreciation/amortization due to purchase price allocation/increase in the stake in IAE-V2500		51.3	51.3		51.2	51.2
Gross profit	931.3	51.3	982.6	851.3	51.2	902.5
Research and development expenses	-65.8		-65.8	-60.7		-60.7
Selling expenses	-118.5		-118.5	-115.1		-115.1
General administrative expenses	-84.8		-84.8	-83.6		-83.6
Other operating income and expenses	-39.3		-39.3	-17.2		-17.2
Profit/loss of companies accounted for using the equity method	80.0		80.0	43.8		43.8
Profit/loss of equity investments	2.7		2.7	1.7		1.7
Earnings before interest and taxes (EBIT)	705.6	51.3	756.9	620.2	51.2	671.4
Net financial income/expense	-39.0	6.6	-32.4	-12.9	-1.6	-14.5
Earnings before income taxes	666.6	57.9	724.5	607.3	49.6	656.9
Income taxes	-178.2	-8.7	-186.9	-154.0	-23.8	-177.8
Net income	488.4	49.2	537.6	453.3	25.8	479.1

Earnings before interest and taxes (EBIT)

Despite the growth in revenue, the cost of goods sold was reduced. This positive earnings effect was boosted by an almost twofold rise in the profit/loss of companies accounted for using the equity method, which substantially offset the increase in function costs. Earnings before interest and taxes (EBIT) consequently improved by €85.4 million (13.8%) compared with the previous year. The EBIT margin rose by 1.6 percentage points to

15.2% (previous year: 13.6%). Adjusted earnings before interest and taxes (adjusted EBIT) rose by €85.5 million (12.7%) compared with the previous year. The adjusted EBIT margin increased by 1.7 percentage points to 16.4% (previous year: 14.7%).

Net financial income/expense

MTU's net financial income/expense deteriorated by €26.1 million in the past fiscal year, resulting in a net expense of €-39.0 million (previous year: net expense of €-12.9 million). This deterioration is attributable, in particular, to foreign exchange valuation effects, higher interest expense for bonds and notes and, to a lesser extent, the interest expense to be taken additionally into account from leases now recognized due to the first-time application of IFRS 16.

Earnings before taxes (EBT)

In particular, the good operating performance and the development of the U.S.-dollar exchange rate had a positive impact on earnings before taxes. Overall, EBT rose by €59.3 million to €666.6 million (previous year: €607.3 million).

Income taxes

Income tax expense amounted to €178.2 million in the fiscal year 2019 (previous year: €154.0 million). The effective group tax rate, calculated on the basis of earnings before taxes, was 26.7% (previous year: 25.4%). Information on the reconciliation of the expected tax expense to the actual tax expense is provided in [Note 10 "Income taxes" in the Notes to the consolidated financial statements](#).

Net income

Net income increased by €35.1 million (7.7%) to €488.4 million (previous year: €453.3 million) and, correspondingly, adjusted net income by €58.5 million (12.2%) to €537.6 million (previous year: €479.1 million).

Consolidated statement of comprehensive income

In the consolidated statement of comprehensive income, net income amounting to €488.4 million (previous year: €453.3 million) is reconciled with the total comprehensive income for the period of €422.4 million (previous year: €364.0 million).

Income and expense items directly recognized in other comprehensive income in the reporting period, net of deferred taxes, relate essentially to actuarial losses from pension obligations and plan assets totaling €66.1 million (previous year: €4.0 million).

Earnings per share

Basic earnings per share amounted to €9.23 (previous year: €8.67). Taking into account the shares from convertible bonds that may be issued, diluted earnings per share came to €8.46 (previous year: €8.10).

Net profit available for distribution

For an explanation of how the net profit available for distribution is determined on the basis of the financial statements in accordance with the German Commercial

Code, please refer to [Notes to the consolidated financial statements in Section VII. "Determination of the net profit available for distribution on the basis of the annual financial statements."](#)

OEM segment

Revenue

Revenue in the OEM business (before consolidation) increased to €1,995.6 million year on year (previous year adjusted: €1,826.7 million).

Revenue in the commercial engine business rose by €141.3 million (10.1%) to €1,536.9 million. The engines that generated the largest shares of this revenue in the reporting year were the V2500, the CF6-80C/E as well as the GEnx for Boeing's 787 Dreamliner and 747-8.

Revenue in the military engine business was higher than in the previous year, rising by €27.6 million (6.4%) from €431.1 million to €458.7 million. The main source of this revenue in the reporting period was the EJ200 engine for the Eurofighter as well as the RB199 engine for the Panavia Tornado and the TP400-D6 for the A400M military transporter.

[T19] Revenue and adjusted EBIT (OEM) – prior-year amounts adjusted

in € million	2019	2018	Change against previous year	
			in € million	in %
Revenue	1,995.6	1,826.7	168.9	9.2
Cost of goods sold	-1,380.3	-1,277.6	-102.7	-8.0
Gross profit	615.3	549.1	66.2	12.1
Gross margin (in %)	30.8	30.1		
Adjusted EBIT	495.6	431.4	64.2	14.9
Adjusted EBIT margin (in %)	24.8	23.6		

Adjusted earnings before interest and taxes (adjusted EBIT)

Operating earnings benefited in particular from the realized product mix, especially the higher earnings contributions in the spare parts business relating to the V2500 program, together with higher demand for spare parts for older GE Aviation engine types. The result from equity accounting of PW1100G-JM Engine Leasing LLC., East Hartford, USA, and the development of the U.S.-dollar exchange rate during the reporting period were additional drivers. These effects outweighed the impact resulting from the ramp-up of the new engine programs,

particularly the PW1100G-JM. Overall, adjusted EBIT improved by €64.2 million (14.9%) compared with the previous year while the adjusted EBIT margin rose by 1.2 percentage points, from 23.6% in the previous year to 24.8%. In line with the development of adjusted EBIT, EBIT improved to €446.7 million in the reporting period, compared with €382.6 million in the previous year. Information on adjusted earnings is provided under [Reconciliation to adjusted key performance figures in the "Results of operations" section](#).

Capital expenditure

Capital expenditure on intangible assets came to €78.1 million (previous year: €71.8 million) and essentially related to the capitalization of self-generated development work for the Pratt & Whitney GTF™ engines and for the GE9X and PW800 engine programs. Capital expenditure on property, plant and equipment amounted to €209.2 million (previous year: €127.5 million) and related principally to other equipment, operational and office equipment and construction in progress required in respect of the expansion of production capacities for the Geared Turbofan™ programs. Expenditure on program assets and acquired development work at €15.8 million (previous year: €59.5 million) related principally to the Pratt & Whitney GTF™ engine family and the PW800 program.

Employees

The average number of employees in the OEM segment increased by 593 to 6,498 (previous year: 5,905).

MRO segment

Revenue

MTU's revenue in the commercial maintenance business (before consolidation) decreased by €88.4 million (3.2%) to €2,711.4 million (previous year: €2,799.8 million). The fall in revenue should be viewed also in the context of altered ordering practice between the group companies MTU Maintenance Hannover GmbH, Langenhagen, Germany, IAE International Aero Engines AG, Zurich, Switzerland, and MTU Maintenance Zhuhai Co. Ltd., Zhuhai, China (see "Revenue by operating segment" on page 107 of the Annual Report 2018). Without this change, growth adjusted for currency effects in the MRO segment would have been around 7%.

The main revenue driver was the V2500 engine for the A320ceo, followed by the PW1100G-JM for the A320neo and the CF34 that powers various business and regional jets.

[T20] Revenue and adjusted EBIT (MRO)

in € million	2019	2018	Change against previous year	
			in € million	in %
Revenue	2,711.4	2,799.8	-88.4	-3.2
Cost of goods sold	-2,396.4	-2,498.5	102.1	4.1
Gross profit	315.0	301.3	13.7	4.5
Gross margin (in %)	11.6	10.8		
Adjusted EBIT	260.9	239.7	21.2	8.8
Adjusted EBIT margin (in %)	9.6	8.6		

Adjusted earnings before interest and taxes (adjusted EBIT)

Due to the fact that the cost of goods sold declined faster than revenue, the gross margin improved from 10.8% in the previous year to 11.6% in the reporting period. Adjusted EBIT consequently improved by €21.2 million (8.8%) compared with the previous year and the adjusted EBIT margin rose by one percentage point, from 8.6% in the previous year to 9.6%. EBIT developed in line with adjusted EBIT, rising to €258.5 million in the reporting period compared with €237.3 million in the previous year. Information on adjusted earnings is provided under [Reconciliation to adjusted key performance figures in the "Results of operations" section](#).

Capital expenditure

Capital expenditure on intangible assets and property, plant and equipment increased by €118.1 million to €191.6 million (previous year: €73.5 million). This was primarily due to capacity-related new and replacement purchases, which led to an increase in other equipment as well as operational and office equipment. MTU continued to expend capital in the growing business of short-term engine leasing as well as in MRO licenses for existing and new engine programs. Information about capital expenditure on financial assets is provided under ["Financial position."](#)

Employees

In order to cope with the high workload at the MRO locations, the average number of employees in the MRO segment was increased by 343 to 3,829 (previous year: 3,486).

Financial position

Principles and objectives of financial management

The main objectives of financial management are to ensure that the group always has access to adequate liquidity, to avoid financial risks, and to safeguard financial flexibility. In order to ensure its liquidity and reduce risks, MTU makes use of various internal and external funding sources with differing maturities.

Liquidity forecasts are based on the group's operational and strategic planning, flanked by a monthly rolling (short-term) liquidity forecast.

The cash flow from operating activities in the business segments represents the group's main source of liquidity. Moreover, MTU utilizes a cash pooling system to transfer the surplus liquidity of individual group companies to other group companies whose cash flow does not cover their funding requirements. This reduces external borrowing requirements and the associated interest expense. MTU also makes use of a variety of

internal and external financing instruments to safeguard its liquidity, including corporate bonds, loan agreements, lease arrangements and company pension plans. For information on the group's capacity to raise funds through authorized and contingent capital, please refer to [Note 24 "Equity" in the Notes to the consolidated financial statements](#).

Financing instruments

The banking policy, procedures for the approval of banking relationships, loan agreements, liquidity and financial asset management, and the management of currency and interest rate risks are set down in the treasury principles. It is a basic principle of the group that its lines of credit are administered centrally at group level by the treasury department.

The group maintains good business relationships with a number of different partner banks, and in this way avoids being too heavily dependent on a single institution. The partner banks are required to have a long-term credit rating of at least investment grade.

[T21] Material external financing sources

Type of financing	Maturity date	Currency	Interest rate
Registered bond	June 12, 2028	€	Fixed interest rate
Convertible bond 2016	May 17, 2023	€	Fixed interest rate
Convertible bond 2019	March 18, 2027	€	Fixed interest rate
Note purchase agreement	March 27, 2021	€	6-month Euribor + margin
Revolving credit facility	Oct. 28, 2023	€	Euribor rate + margin
Money market facility	Daily (at call)	€	Fixed interest rate
Lease liabilities	Various	€	Fixed interest rate

The availability of these financial resources is unrestricted. The revolving credit facility, which was not fully utilized at the reporting date, provides MTU with additional scope in its financing activities.

The factors considered when choosing financing instruments are flexibility, credit terms, the profile of maturity dates, and borrowing costs. Material sources of financing include standard market covenants requiring the group to ensure that its performance indicators remain within defined limits. MTU complied with the contractual obligations arising from such covenants as of December 31, 2019, and as of the end of every quarter of the reporting year. Further information on financing instruments is provided in [Note 28 "Financial liabilities" in the Notes to the consolidated financial statements](#). Material agreements in relation to a change of control subsequent to a takeover bid are set out in the section titled ["Disclosures under takeover law."](#)

The [Risk report and Note 37 "Financial risk" in the Notes to the consolidated financial statements](#) provide information on MTU's approach to the financial risks inherent in financing and measurement, the methods used to hedge interest rate and currency risks, and price, default and liquidity risks.

As in previous years, MTU did not engage in any off-balance-sheet financing transactions in the reporting period, such as the sale of receivables in connection with asset-backed securities or obligations toward special-purpose entities.

Net financial debt

Net financial debt serves as an indicator of the MTU Group's financial situation and is defined as the difference between gross financial debt and current financial assets. MTU's net financial debt increased by €106.7 million (12.5%) compared with the amount as of December 31, 2018.

[T22] Net financial debt

in € million	Dec. 31, 2019	Dec. 31, 2018	Change against previous year	
			in € million	in %
Bonds and notes	100.3	100.2	0.1	0.1
Convertible bonds	562.4	482.5	79.9	16.6
Financial liabilities to banks	40.1	54.4	-14.3	-26.3
thereof: note purchase agreement	30.1	30.1		
thereof: revolving credit facility		14.5	-14.5	-100.0
thereof: other liabilities to banks	10.0	9.8	0.2	2.0
Loans from third parties		34.7	-34.7	-100.0
Lease liabilities	147.0	10.0	137.0	>100
Financial liabilities arising from acquisition of stakes in programs	300.0	350.4	-50.4	-14.4
thereof: financial liabilities arising from increase in the stake in IAE-V2500	270.5	301.9	-31.4	-10.4
Gross financial debt	1,149.8	1,032.2	117.6	11.4
less:				
Cash and cash equivalents	139.5	99.0	40.5	40.9
Loans to third parties	49.6	59.7	-10.1	-16.9
Loans to related companies		19.5	-19.5	-100.0
Financial assets	189.1	178.2	10.9	6.1
Net financial debt	960.7	854.0	106.7	12.5

Bonds and notes

MTU AG issued a registered bond effective June 12, 2013, for a total nominal amount of €100.0 million. The registered bond matures on June 12, 2028, and is subject to interest of 3.55% p.a., payable in arrears on June 12 of each year, for the first time on June 12, 2014. The registered bond, net of transaction costs and including a discount of €2.7 million, is measured at amortized cost.

In the event of a change of control, every bondholder is entitled to declare due part or all of his/her registered bond holding for the nominal amount plus any accrued interest. A change-of-control event occurs if a qualifying rating downgrade takes place in the course of the change of control. This condition is deemed to be met if (1), during the change-of-control period, a rating previously granted by a rating agency to MTU or to its registered bond is withdrawn or is changed to below investment grade (equivalent to or higher than Baa3 (Moody's) or BBB- (Fitch or S&P)), or if (2), at the time of the change

of control, no investment-grade rating has been awarded by a rating agency to MTU or to its registered bond, and no investment-grade rating is issued for the registered bond in question within the change-of-control period.

Convertible bonds

On May 17, 2016, MTU Aero Engines AG issued a convertible bond in the form of a preferential unsecured debenture with a face value of €500.0 million. This bond is convertible into new and/or existing registered non-par-value shares in the issuing company. The convertible bond has an original maturity of seven years and is divided into units of €100,000. It bears a nominal interest rate of 0.125% p.a., payable annually in arrears.

Bondholders have been entitled to convert their convertible bond certificates into common shares of MTU Aero Engines AG since June 27, 2016. The initial conversion price was set at €124.7701, which represents a premium of 50% above the reference rate at the bond issue date.

Under the terms of issue of the convertible bond, MTU has the right to recall the issued bond units at their nominal value (plus accrued unpaid interest) at any time on or after June 16, 2020, subject to a period of notice of minimum 30 days and maximum 60 days, either (i) if the quoted price of the common share rises to or above 130% of the applicable conversion price over a defined period, or (ii) if no more than 20% of the nominal value of the convertible bond issue is outstanding. In such a case, and within the above-mentioned period of notice of minimum 30 days and maximum 60 days, the bondholders have the right to demand that MTU convert their investment into shares, rather than a cash consideration.

On September 10, 2019, MTU Aero Engines AG bought back from its creditors a nominal amount of €275.0 million of the convertible bond issued in 2016, which it canceled with value date September 30, 2019. Moreover, MTU Aero Engines AG received conversion notices from creditors of this convertible bond with a nominal amount of €134.9 million. The outstanding nominal amount as of December 31, 2019, thus comes to €90.1 million.

In 2019, MTU Aero Engines AG issued a convertible bond in the form of a preferential unsecured debenture, for a total nominal amount of €500.0 million. This bond is convertible into non-par-value common shares in MTU. The convertible bond has an original maturity of seven and a half years and is divided into units of €100,000. It bears an interest rate of 0.05% p.a., payable annually in arrears.

Bondholders will be entitled to convert their certificates into common shares in MTU Aero Engines AG starting on September 18, 2024. The initial conversion price was set at €378.4252, equivalent to a premium of 55% above the reference rate.

Under the terms of issue of the convertible bond, MTU has the right to recall the issued bond units at their nominal value (plus accrued unpaid interest) at any time on or after April 8, 2025, subject to a period of notice of minimum 30 days and maximum 60 days, either (i) if the quoted price of the common share rises to or above 130% of the applicable conversion price over a defined period, or (ii) if no more than 20% of the nominal value of the convertible bond issue is outstanding. In such a case, and within the above-mentioned period of notice of minimum 30 days and maximum 60 days, the bondholders have the right to demand that MTU convert their investment into shares, rather than a cash consideration.

Financial liabilities to banks

Note purchase agreement

MTU Aero Engines AG issued a note purchase agreement on March 28, 2014, for a total nominal amount of €30.0 million and with a maturity date of March 27, 2021. The note purchase agreement has a variable interest rate corresponding to the six-month Euribor rate plus a percentage margin. The initial interest rate amounted to 1.72%. The interest is calculated and paid twice a year, in March and September.

Revolving credit facility

As of December 31, 2019, the group had access to a revolving credit facility of €600.0 million with five banks, which runs until October 28, 2023. A total of €36.0 million had been drawn down under this credit line in the form of guarantees as of December 31, 2019 (previous year: draw-downs totaling €51.1 million, of which €36.6 million in the form of guarantees). The remaining available amount of €564.0 million (previous year: €548.9 million) ensures the group's financial flexibility in the medium term. The credit utilized is subject to interest at the customary market reference rate plus an additional margin. The unused amount of the revolving credit facility is subject to a loan commitment fee.

Other liabilities to banks

Other liabilities to banks relate to financing MTU's participation in a supply agreement with a manufacturer of business jets in the previous year.

Lease liabilities

Lease liabilities relate to liabilities under leases recognized using the effective interest rate method. The increase during the fiscal year is essentially due to the application of IFRS 16. For information on their accounting treatment and a summary of the corresponding capitalized lease assets, please refer to [Section I. "Accounting policies and principles"](#) and [Note 38 "Leases" in the Notes to the consolidated financial statements](#).

Financial liabilities from the increase in the stake in IAE-V2500

The purchase price agreement signed by MTU in the fiscal year 2012 in order to increase its stake in the V2500 engine program by 5 percentage points to 16% made it necessary, among other things, to recognize a deferred financial liability contingent upon the number of flight hours performed over the next 15 years by the fleet of V2500 engines in service at the time of the stake increase. The nominal volume of this liability as of December 31, 2019, was U.S. \$335.2 million (previous year: U.S. \$387.8 million). This liability under contracts extending to mid-2027 is part of a hedging relationship in respect of revenue generated in U.S. dollars.

Financial liabilities arising from new stakes in engine programs

The financial liabilities arising from increased or new stakes in engine programs mainly relate to program lifetime-related payments for the acquisition of shares in commercial engine programs, in particular the Pratt & Whitney GTF™ engine family and the PW800, which are deemed to represent financing agreements in view of their long-term nature.

Contingent liabilities and other financial obligations

At the reporting date, the best estimate of contingent liabilities was €142.2 million (previous year: €92.0 million). As part of its ordinary activities the group furthermore incurred other financial liabilities exceeding the liabilities reported in the consolidated balance sheet at the end of the reporting period. They relate to contractual obligations to acquire intangible assets, property, plant and equipment, and leased items. Please refer to [Note 39 "Contingent liabilities and other financial obligations" in the Notes to the consolidated financial statements](#) for detailed information on contingent liabilities and other financial obligations.

Capital expenditure

[T23] Capital expenditure by class of asset

in € million	2019	2018	Change against previous year	
			in € million	in %
Intangible assets	128.9	73.3	55.6	75.9
Property, plant and equipment	350.0	199.5	150.5	75.4
Financial assets	143.7	173.3	-29.6	-17.1
Program assets and acquired development work	15.8	59.5	-43.7	-73.4
Total capital expenditure	638.4	505.6	132.8	26.3

Capital expenditure on intangible assets

Capital expenditure on intangible assets in 2019 includes an amount of €75.5 million (previous year: €68.7 million) relating to self-generated development work on engine programs in which MTU holds a stake. Detailed information on capital expenditure on intangible assets is provided in [Note 14 "Intangible assets" in the Notes to the consolidated financial statements](#).

Capital expenditure on property, plant and equipment

Additions in the fiscal year 2019 mainly related to the area of other equipment, operational and office equipment totaling €141.1 million (previous year: €71.2 million) as well as advance payments and construction in progress amounting to €150.2 million in the reporting period (previous year: €102.4 million). Capital expenditure relates to the expansion of production capacity at the MTU locations in Munich and Hannover, Germany, and Rzeszów, Poland. Furthermore, additions of rights of use from leases due to the first-time application of IFRS 16 amounting to €53.5 million must be taken into account in the reporting period. Further information on capital expenditure on property, plant and equipment and the first-time application of IFRS 16 is provided in [Note 15 "Property, plant and equipment" and under Section I "Accounting policies and principles" in the Notes to the consolidated financial statements](#).

Capital expenditure on financial assets

Capital expenditure on financial assets, which totaled €143.7 million in 2019, includes an amount of €141.1 million (previous year: €157.4 million) relating to additions for companies accounted for using the equity method. These additions mainly concern the expenditure in connection with MTU's stake in the IAE-PW1100G-JM engine leasing business and the establishment of

EME Aero, the joint venture launched in conjunction with Lufthansa Technik. Further additions relate to the profit shares resulting from the profit retention of equity investments in associates (especially MTU Zhuhai) and joint ventures. Additional information on financial assets is included in [Note 16 “Financial assets” in the Notes to the consolidated financial statements](#).

Capital expenditure on program assets and acquired development work

Capital expenditure on other assets due to acquired program assets and acquired development work relates mainly to the engine programs of the Pratt & Whitney GTF™ engine family. Additional information on other assets is included in [Note 17 “Acquired program assets, development work and other assets” in the Notes to the consolidated financial statements](#).

Liquidity analysis

One of MTU’s key performance indicators is free cash flow. MTU determines its free cash flow by combining its cash flow from operating activities with its cash flow from investing activities and eliminating components of the latter (non-recurring cash flows) that lie outside the operational management of the core business. The free cash flow of €358.3 million (previous year: €202.9 million) therefore excludes these non-recurring cash flows, otherwise included in cash flow from investing activities. The items in question are payments made to acquire stakes in engine programs amounting to €29.0 million (previous year: €23.4 million) and proceeds related to interest-bearing loans in connection with aircraft and engine financing agreements amounting to €-30.8 million (previous year: proceeds of €-79.1 million).

[T24] Consolidated cash flow statement (abridged)

in € million	2019	2018	Change against previous year	
			in € million	in %
Cash flow from operating activities	831.7	594.7	237.0	39.9
Cash flow from investing activities	-471.6	-336.1	-135.5	-40.3
+ Non-recurring cash flows	-1.8	-55.7	53.9	96.8
Free cash flow	358.3	202.9	155.4	76.6
- Non-recurring cash flows	1.8	55.7	-53.9	-96.8
Cash flow from financing activities	-323.6	-262.7	-60.9	-23.2
Translation differences	4.0	-3.0	7.0	>100
Change in cash and cash equivalents	40.5	-7.1	47.6	>100
Cash and cash equivalents at the beginning of the reporting period	99.0	106.1		
Cash and cash equivalents at the end of the reporting period	139.5	99.0		

Cash flow from operating activities

The cash flow from operating activities in 2019 amounted to €831.7 million, which was €237.0 million (39.9%) higher than the previous year’s figure of €594.7 million. The main drivers of this positive development were the profitable cash-effective business growth as well as accompanying measures to optimize the amount of working capital tied up compared with the previous year, together with the reclassification of payments in connection with leases from cash flow from operating activities to cash flow from financing activities due to the first-time application of IFRS 16.

Cash flow from investing activities

The cash outflow from investing activities in the fiscal year 2019 amounted to €471.6 million (previous year: €336.1 million). Capital expenditure on intangible assets recognized in the income statement amounted to €127.7 million (previous year: €72.1 million) and mainly

comprised capital expenditure on development assets for the Pratt & Whitney GTF™ engine family, the GE9X program, and the PW800 program. Furthermore, MTU invested in additional shareholdings and licenses in the aftermarket business. Capital expenditure on property, plant and equipment, excluding the proceeds from asset disposals, amounted to €298.7 million, compared with €184.4 million in the previous year. This increase is consistent with the expansion of MTU’s production capacity at the locations in Germany and Poland, in particular. The net gain/loss on financial assets was mainly due to capital contributions in respect of equity investments and the repayment of loans provided as part of aircraft financing activities. Expenditure on program assets and acquired development work at €21.9 million (previous year: €48.4 million) related primarily to the engine programs of the Pratt & Whitney GTF™ engine family and the PW800 program.

Cash flow from financing activities

In the fiscal year 2019, MTU had a net cash outflow from financing activities of €323.6 million (previous year: €262.7 million). This net cash outflow was essentially caused by the net effect resulting from the partial repayment of the convertible bond 2016 and the issue of the convertible bond 2019, the repayment of other financial liabilities and the dividend payment for the fiscal year 2018 as well as the reclassification of payments made in connection with leases from cash flow from operating activities to cash flow from financing activities due to the first-time application of IFRS 16.

Change in cash and cash equivalents

The amount of cash and cash equivalents rose by €40.5 million, from €99.0 million in the previous year to €139.5 million. The reason for this increase is that the improved operating cash flow compared with the previous year more than offset the higher cash outflows from investing and financing activities.

Net assets

Changes in balance sheet items

[T25] Consolidated balance sheet of the MTU Group

in € million	Dec. 31, 2019		Dec. 31, 2018		Change against previous year	
	in € million	in %	in € million	in %	in € million	in %
Assets						
Non-current assets						
Tangible and intangible assets	2,263.3	29.1	1,872.0	27.3	391.3	20.9
Other assets	1,891.7	24.4	1,843.9	26.9	47.8	2.6
Total non-current assets	4,155.0	53.5	3,715.9	54.2	439.1	11.8
Current assets						
Inventories	1,278.6	16.5	995.8	14.6	282.8	28.4
Receivables/other assets	2,192.2	28.2	2,040.1	29.8	152.1	7.5
Cash and cash equivalents	139.5	1.8	99.0	1.4	40.5	40.9
Total current assets	3,610.3	46.5	3,134.9	45.8	475.4	15.2
Total assets	7,765.3	100.0	6,850.8	100.0	914.5	13.3
Equity and liabilities						
Equity	2,421.2	31.2	2,144.2	31.3	277.0	12.9
Non-current debt						
Provisions	1,002.1	12.9	900.9	13.2	101.2	11.2
Liabilities	1,128.1	14.5	1,001.4	14.6	126.7	12.7
Total non-current debt	2,130.2	27.4	1,902.3	27.8	227.9	12.0
Current liabilities						
Provisions/income tax liabilities	195.4	2.5	213.0	3.1	-17.6	-8.3
Liabilities	3,018.5	38.9	2,591.3	37.8	427.2	16.5
Total current debt	3,213.9	41.4	2,804.3	40.9	409.6	14.6
Total equity and liabilities	7,765.3	100.0	6,850.8	100.0	914.5	13.3

Assets

In the fiscal year 2019, the total of intangible assets amounted to €89.8 million (previous year: €40.2 million). This increase was mainly driven by development costs in connection with engines of the Pratt & Whitney GTF™ engine family and for the PW800 and GE9X engines, which more than offset the corresponding scheduled amortization.

Property, plant and equipment rose by €301.5 million (previous year: €63.8 million). In addition to the capitalization of rights of use from leases in connection with the first-time application of IFRS 16, the growth is attributable to capital expenditure on other equipment, operational and office equipment, and construction in progress in respect of the expansion of production capacities at MTU's locations in Germany and Poland.

The increase in non-current other assets was primarily attributable to the positive development of business and additional injections of capital to companies that are accounted for using the equity method in the consolidated financial statements. The injections of capital serve to finance the growing engine leasing business and to establish additional capacity for the maintenance and repair of aircraft engines. A negative effect on assets resulted from the repayment of sales financing alongside a decline in program assets. With a view to reducing foreign exchange risks, a portfolio of U.S. dollar forward foreign exchange contracts was in place at the end of 2019 with a term to February 2023 and a nominal volume of U.S. \$2,750.0 million.

Within inventories, the holdings of raw materials and supplies increased by €196.1 million to €618.4 million (previous year: €422.3 million), and finished products and work in progress rose by €93.2 million to €646.8 million (previous year: €553.6 million). The sales to inventory ratio was 4.1 (previous year: 5.0).

The total of trade receivables fell to €922.8 million (previous year: €1,051.2 million). Compared with the level as of December 31, 2018, contract assets, net of the corresponding contract liabilities, increased by €182.2 million to €1,046.5 million. Payments were also recoverable from the tax authorities in respect of taxes totaling €115.8 million (previous year: €43.2 million), resulting primarily in connection with the loss, recognized as an expense for tax purposes, from the buyback of the convertible bond issued in 2016 at fair value.

Cash and cash equivalents rose from €99.0 million in the previous year to €139.5 million. This item accounted for 1.8% (previous year: 1.4%) of total assets at the reporting date.

Equity

[T26] Changes in equity

in € million	2019	2018
As of Jan. 1	2,144.2	1,841.3
Other comprehensive income		
Financial instruments designated as cash flow hedges	-12.0	-83.2
Changes in the fair value of equity investments	-1.8	2.5
Actuarial gains/losses on pension obligations and plan assets	-66.1	-4.0
Translation differences arising from the financial statements of foreign entities	13.9	-4.6
Net income	488.4	453.3
Dividend payment to shareholders of MTU Aero Engines AG	-147.1	-118.4
Impact of application of new financial reporting standards	0.5	7.2
Convertible bonds	-22.6	
Issue of treasury shares under the Restricted Stock Plan	5.0	4.5
Sale of treasury shares in connection with the employee stock option program (MAP)	18.8	16.3
Investment by non-controlling interests		29.3
Total change in group equity	277.0	302.9
As of Dec. 31	2,421.2	2,144.2

Positive changes in equity

Equity in 2019 grew principally on account of €488.4 million attributable to net income (previous year: €453.3 million).

Negative changes in equity

Negative changes in equity in the reporting period mainly include an amount of €147.1 million for the dividend payment to shareholders of MTU Aero Engines AG for the fiscal year 2018 (previous year: dividend payment of €118.4 million for the fiscal year 2017) and an amount of €66.1 million resulting from actuarial losses (previous year: €4.0 million). Furthermore an onerous net effect resulted from the partial repayment of the convertible bond issued in 2016, which outweighed the positive effects from the exercise of conversion options of this bond or from the issue of a new convertible bond in the reporting period.

Liabilities

Among the items of non-current debt, non-current pension provisions increased by €101.1 million due to a lower actuarial interest rate, from €853.2 million in the previous year to €954.3 million.

Non-current liabilities comprised non-current gross financial debt amounting to €1,011.2 million (previous year: €879.8 million), contract liabilities of €26.9 million (previous year: €27.0 million), and deferred tax liabilities amounting to €0.2 million as of December 31, 2019 (previous year: €8.4 million). Non-current liabilities represented 14.5% of total liabilities as of December 31, 2019, which is a slightly lower proportion than that in the previous year.

The combined total of equity and non-current debt increased in the fiscal year 2019 by €504.9 million to €4,551.4 million (previous year: €4,046.5 million). This means that 109.5% (previous year: 108.9%) of the group's non-current assets are financed through available non-current funds.

The provisions recognized under current debt include pension provisions amounting to €21.9 million (previous year: €25.8 million), which is slightly below the previous year's level, income tax liabilities, which declined from €9.9 million to €5.2 million, and other provisions of €168.3 million, which were €9.0 million lower than in the previous year. Current liabilities also include refund liabilities to customers amounting to €1,682.3 million (previous year: €1,506.2 million), trade payables of €313.1 million (previous year: €230.6 million), contract liabilities totaling €680.4 million (previous year: €549.0 million), gross financial debt of €253.0 million (previous year: €228.5 million), and a large number of other individual obligations.

The debt to equity ratio remained almost unchanged compared with the previous year at 31.2% (previous year: 31.3%).

Financial performance indicators

At MTU's Capital Market Day in November 2018, the group provided an initial outlook on its expected business development in the reporting year. These expectations were confirmed as part of the reporting on the annual results 2018 on February 20, 2019, which held out the prospect of annual revenue totaling around €4,700 million and for adjusted EBIT a revenue margin of around 15.5%. Adjusted net income is expected to grow in line with adjusted EBIT. MTU's forecast for free cash flow was that the cash conversion rate, defined as free cash flow divided by adjusted net income, would range between 50% and 60%.

[T27] Forecast and actual results

in € million	Actual 2019	Forecast for 2019 as of Oct. 25, 2019	Forecast for 2019 as of July 25, 2019	Forecast for 2019 as of Feb. 20, 2019	Actual 2018
Revenue	4,628.4	approx. 4,700	approx. 4,700	approx. 4,700	4,567.1
Adjusted EBIT margin (in %)	16.4	approx. 16	approx. 16	approx. 15.5	14.7
Adjusted net income	537.6	Growth in line with adjusted EBIT	Growth in line with adjusted EBIT	Growth in line with adjusted EBIT	479.1
Cash conversion rate (in %)	67	between 65 and 70	between 65 and 70	between 50 and 60	42

Revenue forecast

On February 20, 2019, the Executive Board forecast that revenue in 2019 would increase to around €4,700 million (previous year's revenue: €4,567.1 million). This revenue forecast was confirmed on presentation of the half-year financial report on July 25, 2019, and on the release of

the figures for the third quarter on October 25, 2019. At year end, revenue amounted to €4,628.4 million, which is slightly below the forecast figure of €4,700 million. This was essentially attributable to delayed invoicing on account of longer cycle times for shop visits in the MRO segment.

Earnings forecast

For the ratio of adjusted earnings before income taxes to sales (adjusted EBIT margin) MTU initially forecast an increase of 15.5%. This forecast was raised to 16% on July 25, 2019, in light of a further improvement in business prospects. This forecast was confirmed in the third quarter. At the end of the year, the adjusted EBIT margin stood at 16.4%, thus exceeding the forecast.

The Executive Board initially forecast that adjusted net income in 2019 would grow in line with adjusted EBIT. The forecast was reaffirmed on July 25, 2019, and on October 25, 2019. Growth of adjusted EBIT in the reporting period was 12.7%. By contrast, adjusted net income in 2019 increased by 12.2% to €537.6 million, compared to €479.1 million in the previous year, and was thus in line with expectations.

Free cash flow

In 2019, in a similar fashion to the previous year, MTU expected that increases in its operating income would compensate for the strain resulting from higher capital expenditure and a rise in funds tied up. In the light of these conditions, the Executive Board on February 20, 2019, forecast a ratio of free cash flow to adjusted net income ranging between 50% and 60%. A revised, higher forecast of between 65% and 70% was issued on July 25, 2019, when the half-year report was published. In the context of the release of the figures for the third quarter this forecast was reaffirmed on October 25, 2019. This target was met as of December 31, 2019, with a free cash flow of €358.3 million. The ratio between free cash flow and adjusted EBIT came to 67%, thus improving year on year as expected (previous year: 42%).

Overall assessment of business performance in 2019

2019 was yet another record-breaking year for MTU. Revenue increased to €4,628.4 million, which is 1.3% higher year on year (previous year: €4,567.1 million). In particular, prior to consolidation between the segments, the OEM segment contributed to higher revenue with growth of 9.2% while sales in the MRO segment declined by 3.2%, essentially due to invoicing reasons.

In 2019, MTU continued its capital expenditure and growth phase. Development activities for engines in all commercial thrust classes and the expansion of production capacity at locations in and outside Germany together with the increase in the volume of funds tied up as part of operating business growth characterized the reporting period.

Operating earnings of MTU in 2019 were increased to record levels in both the OEM and MRO segments: Adjusted EBIT came to €756.9 million (previous year: €671.4 million). The operating margin was 16.4% (previous year: 14.7%).

In line with this, free cash flow was increased: Despite the high capital expenditure on development assets, the expansion of capacity at locations in and outside Germany and the amount of capital tied up due to operating business growth, free cash flow was increased to €358.3 million (previous year: €202.9 million).

The forecasts published at the start of the year, which were adjusted upwards in the course of the reporting year, were thus essentially reaffirmed or even exceeded.

MTU AG (disclosures in accordance with the German Commercial Code [HGB])

The management report of MTU AG and the group management report for the fiscal year 2019 have been combined in accordance with Section 315 (5) in conjunction with Section 298 (2) of the German Commercial Code (HGB). The annual financial statements of MTU AG were prepared in accordance with the provisions of the German Commercial Code (HGB) and are published together with the combined management report in the electronic version of the Federal Gazette (Bundesanzeiger).

The business environment of MTU AG corresponds for the most part with that of the group as described above under "[Business environment.](#)"

Business activities

MTU AG develops and manufactures commercial and military aircraft engines and aero-derivative industrial gas turbines. The company also carries out maintenance of military engines.

MTU has technological expertise in low-pressure turbines, high-pressure compressors and turbine center frames, and in repair techniques and manufacturing processes. It is involved in important national and international technology programs and cooperates with the top names in the industry (GE Aviation, Pratt & Whitney and Rolls-Royce).

Disclosures relating to results of operations

[T28] Income statement of MTU Aero Engines AG

in € million	2019	2018	Change against previous year	
			in € million	in %
Revenue	4,087.2	3,639.7	447.5	12.3
Cost of goods sold	-3,811.2	-3,417.7	-393.5	-11.5
Gross profit	276.0	222.0	54.0	24.3
Selling expenses	-74.8	-90.5	15.7	17.3
General administrative expenses	-44.9	-45.8	0.9	2.0
Net other operating income/expenses	42.6	81.3	-38.7	-47.6
Net financial income/expense	-79.3	209.9	-289.2	<-100
Earnings from ordinary operating activities	119.6	376.9	-257.3	-68.3
Tax expense	-39.4	-115.4	76.0	65.9
Net profit for the year	80.2	261.5	-181.3	-69.3
Withdrawal from other retained earnings	99.5		99.5	-99.5
Allocation to other retained earnings		-114.0	114.0	100.0
Net profit available for distribution	179.7	147.5	32.2	21.8

Revenue

Revenue in the fiscal year 2019 increased by €447.5 million (12.3%) to €4,087.2 million. The commercial engine business provided much of the impetus for this growth, especially the new GTF™ programs. The revenue growth benefited from the development of the exchange rate, which went from an average of 1.1810 U.S. \$/€ in 2018 to 1.1195 U.S. \$/€ in 2019.

Cost of goods sold and gross profit

At 11.5%, the cost of goods sold increased at a slightly lower rate than revenue compared with the previous year. This is mainly attributable to economies of scale and to the more moderate impact of exchange rate developments compared with revenue. Gross profit increased accordingly by €54.0 million to €276.0 million in the reporting period. This was coupled with an increase in the gross margin to 6.8%.

Balance of other operating income and expenses

In the reporting period, this item mainly comprised a net expense of €49.3 million (previous year: net income of €27.1 million) from foreign currency translation, measurement of currency holdings and hedging transactions, and an offsetting effect of €93.2 million (previous year: €63.7 million) in income from adjustments to prepaid expenses.

Net financial income/expense

The financial result deteriorated by €289.2 million to a negative balance of €79.3 million in 2019. This trend is largely attributable to the partial repurchase on September 10, 2019, of a nominal value of €275.0 million of the convertible bond issued in 2016. The repurchase cost was €550.6 million and resulted in a tax-deductible impact of €275.6 million on the financial result. This effect is partly offset by the investment income realized in the reporting period in the amount of €207.8 million (previous year: €219.7 million) which includes profit transfers from MTU Maintenance Hannover GmbH, Langenhagen, Germany, MTU Maintenance Berlin-Brandenburg GmbH, Ludwigsfelde, Germany, and MTU Versicherungsvermittlungs- und Wirtschaftsdienst GmbH, Munich, Germany, amounting to a total of €178.6 million (previous year: €196.2 million).

Earnings from ordinary operating activities

The significant year-on-year improvement in gross profit and the lower selling expenses, caused in particular by updated adjustments of customer accounts receivable, were more than offset by the negative impact in the financial result of buying back the convertible bond as well as the decrease in net other operating income and expenses. Consequently, earnings from ordinary operating activities decreased by €257.3 million compared to the previous year to €119.6 million.

Taxes

Income tax expense amounted to €38.2 million in 2019 (previous year: €114.4 million). The current tax expense included in this figure amounted to €50.3 million (previous year: €122.1 million); €24.5 million relates to previous years (previous year: €16.7 million).

This current tax expense should be seen alongside deferred tax income of €12.1 million (previous year: €7.7 million), composed of €18.9 million (previous year: €17.7 million) in income from previous years and expense of €6.8 million (previous year: €10.0 million) from the reporting period. Current and deferred taxes from previous years are mainly attributable to changes in the tax bases of assets and liabilities in 2018 in conjunction with the preparation of the tax returns for 2018.

Net profit available for distribution

Net profit for the year amounts to €80.2 million in the reporting period (previous year: €261.5 million). In order to safeguard a sustainable dividend policy, also in light of the extraordinary charge resulting from the partial redemption of the 2016 convertible bond in the reporting period, a withdrawal from other retained earnings of €99.5 million is taken into consideration in determining net profit available for distribution (previous year: allocation to retained earnings of €114.0 million). The net profit available for distribution to the shareholders of MTU Aero Engines AG for the reporting period thus amounted to €179.7 million (previous year: €147.5 million).

In regard to determining the net profit available for distribution, amounts that were excluded from distribution included €204.7 million (previous year: €166.1 million) arising from the capitalization of internally generated intangible assets (Section 248 (2) of the German Commercial Code [HGB]) and €39.9 million (previous year: €45.6 million) from the measurement of pension obligations (Section 253 (2) of the German Commercial Code [HGB]), as well as the deferred taxes corresponding to each of these amounts. Even in consideration of the withdrawal from other retained earnings, these were matched in full

by free reserves pursuant to Section 268 (8) of the German Commercial Code (HGB) and Section 253 (6) of the German Commercial Code (HGB) as of the reporting date.

The Executive Board is recommending to the Supervisory Board that in view of the latest developments of the global coronavirus pandemic, the proposal should be made

to the Annual General Meeting to bring forward the net profit for the fiscal year 2019 to new account. Based on the developments in the coming weeks and the expected consequences for MTU's business development, the Executive Board can present the Supervisory Board as appropriate with an updated recommendation regarding profit distribution.

Disclosures relating to net assets and financial position

[T29] Balance sheet of MTU Aero Engines AG

in € million	Dec. 31, 2019		Dec. 31, 2018		Change against previous year	
	in € million	in %	in € million	in %	in € million	in %
Assets						
Tangible and intangible assets	1,814.9	29.7	1,710.0	30.8	104.9	6.1
Financial assets	832.0	13.6	848.1	15.2	-16.1	-1.9
Non-current assets	2,646.9	43.3	2,558.1	46.0	88.8	3.5
Inventories	686.7	11.2	664.1	11.9	22.6	3.4
Receivables and other assets	2,559.1	41.9	2,193.4	39.4	365.7	16.7
Cash and cash equivalents	51.9	0.9	5.2	0.1	46.7	>100
Current assets	3,297.7	54.0	2,862.7	51.4	435.0	15.2
Prepaid expenses	12.6	0.2	6.0	0.1	6.6	>100
Deferred tax assets	154.3	2.5	136.5	2.5	17.8	13.0
Total assets	6,111.5	100.0	5,563.3	100.0	548.2	9.9
Capital						
Subscribed capital	52.8	0.9	51.6	0.9	1.2	2.3
Capital reserves	595.0	9.7	423.5	7.6	171.5	40.5
Retained earnings	1,023.3	16.7	1,117.1	20.1	-93.8	-8.4
Net profit available for distribution	179.7	2.9	147.5	2.7	32.2	21.8
Equity	1,850.8	30.2	1,739.7	31.3	111.1	6.4
Pension provisions	685.5	11.2	643.6	11.6	41.9	6.5
Other provisions	2,014.8	33.0	1,757.4	31.6	257.4	14.6
Provisions	2,700.3	44.2	2,401.0	43.2	299.3	12.5
Liabilities						
Bonds	692.2	11.3	602.4	10.8	89.8	14.9
Liabilities to banks	40.1	0.7	54.4	1.0	-14.3	-26.3
Advance payments received	340.1	5.6	277.4	5.0	62.7	22.6
Trade payables and other liabilities	291.7	4.8	297.7	5.3	-6.0	-2.0
Liabilities	1,364.1	22.4	1,231.9	22.1	132.2	10.7
Deferred tax liabilities	196.3	3.2	190.7	3.4	5.6	2.9
Total equity and liabilities	6,111.5	100.0	5,563.3	100.0	548.2	9.9

Total assets increased by €548.2 million (9.9%) year on year to €6,111.5 million.

Tangible and intangible fixed assets increased by a total of €104.9 million to €1,814.9 million. In the fiscal year 2019, intangible assets in the amount of €80.7 million were capitalized (previous year: €113.4 million). Of this sum, €2.0 million (previous year: €36.6 million) related to shares in the GE9X, PW1900G and PW800 programs, €8.2 million (previous year: €14.3 million) related to externally acquired development work, and €65.8 million (previous year: €58.2 million) to internally generated development assets for the Pratt & Whitney GTF™ engine family, the GE9X and the PW800. Altogether, MTU's total expenditure on development projects amounted to €154.2 million (previous year: €150.7 million). Tangible fixed assets increased in particular as a result of new and replacement purchases of machinery, tools/fixtures and IT equipment.

In the reporting period, inventories increased by €22.6 million or 3.4% to €686.7 million (previous year: €664.1 million). Of this increase, inventories of raw materials and supplies rose by €15.9 million to €98.2 million (previous year: €82.3 million), and inventories of finished goods and merchandise rose by €22.3 million to €184.4 million (previous year: €162.1 million). In contrast, inventories of work in progress decreased by €14.1 million to 391.4 million (previous year: €405.5 million), and advance payments fell by €1.5 million to €12.7 million (previous year: €14.2 million). The increase in inventories corresponds with the trend in receivables and with revenue growth in the reporting period.

Receivables and other assets increased by €365.7 million year on year to €2,559.1 million. This increase was driven by accounts receivable from third parties, which increased year on year by €132.7 million to €770.9 million, and receivables from affiliated companies, which increased from €741.0 million to €898.5 million. The increase in receivables is attributable in particular to the trend in U.S.-dollar spot rates and growth in the series and the spare parts/aftermarket business. Compared with the previous year, other assets increased by €79.8 million to €164.8 million. The increase is primarily attributable to tax receivables from income taxes and input taxes.

Cash and cash equivalents increased by €46.7 million to €51.9 million. Their percentage of total assets increased to 0.8% (previous year: increase of 0.1%).

Equity comprises the capital stock less the nominal amount of treasury shares, capital and revenue reserves, and the net profit available for distribution. The debt to equity ratio remained close to the previous year's level, at 30.2% (previous year: 31.3%).

Provisions increased by €299.3 million to €2,700.3 million. This figure includes pension provisions of €685.5 million (previous year: €643.6 million). Other provisions increased year on year by €257.4 million. The main drivers of this increase are accrued warranty expenses and provisions for non-payment risks, which grew by €168.3 million and €70.5 million, corresponding in particular with the trends in U.S.-dollar spot rates and revenue from the GTF™ programs in the reporting period.

Total liabilities rose in relation to the previous year by €132.2 million to €1,364.1 million. Within this amount, bonds increased by €89.8 million to €692.2 million in the reporting period. This was attributable to a new convertible bonds issued at a nominal value of €500 million. In contrast, the convertible bond issued in 2016 was reduced by buying back part of the issue at a nominal value of €275 million and exercising 1.1 million options to convert. Likewise, advance payments received increased by €62.7 million to €340.1 million, trade payables increased by €20.8 million to €98.8 million, and liabilities to affiliated companies increased by €2.8 million to €12.6 million. This stood in contrast to a year-on-year decrease in other liabilities by €30.9 million to €179.0 million and in liabilities to banks by €14.3 million to €40.1 million. Other liabilities mainly comprise obligations to employees of €59.8 million (previous year: €46.6 million), liabilities in connection with acquired development assets in the amount of €32.1 million (previous year: €44.6 million), and liabilities arising from investments in engine programs amounting to €29.7 million (previous year: €48.4 million).

Other disclosures

The opportunities, risks and future development of MTU AG essentially correspond to the opportunities, risks and future development of the MTU Group as described below under [Forecast](#) and [Risk and opportunity report](#).

As the group's parent company, MTU AG is integrated in the group-wide risk management system that is described in detail in the [Risk and opportunity report](#). The description of the internal control system of MTU AG required under Section 289 (4) of the German Commercial Code (HGB) can be found under ["Internal control and risk management system for the group accounting process."](#)

For further information on the use of financial instruments, please refer to the Notes to the consolidated financial statements and to the ["Use of financial instruments" section of the Risk and opportunity report](#).

Due to its dominant role within the OEM operating segment (commercial and military engine business), and in view of the profit and loss transfer agreements that exist between the parent company and its German maintenance subsidiaries in the MRO operating segment, the outlook for MTU AG is closely aligned with the expected future development of the group as described under ["Future performance of MTU."](#)

Looking ahead to the annual financial statements for MTU AG in 2020, which are prepared in accordance with the provisions of the German Commercial Code (HGB), the Executive Board expects revenues in the commercial OEM segment to increase in U.S.-dollar terms compared with 2019 in a low double-digit percentage range. Revenue in the military engine business is expected to grow slightly in 2020. Assuming a stable exchange rate between the U.S. dollar and the euro and considering the reduction in earnings from the repurchase of the convertible bond in the fiscal year 2019, MTU AG is forecasting significant growth for 2020 in earnings from ordinary operating activities.

MTU AG is observing the potential impact of the coronavirus issue and will, if necessary, adjust its forecast in the course of the year.

Forecast

Macroeconomic conditions

The global economy is likely to be impacted above all by the spread of the coronavirus as well as by the trade conflict between the world's two largest economies, the USA and China. Although "Phase 1" of a broader trade deal between the USA and China served to ease tensions at the beginning of the year, the rapid spread of the coronavirus 2019-nCoV in China since January 2020 has fueled uncertainty.

Due to the spread of the coronavirus and based on the assumption that the virus will be contained within the first quarter of the year, The Economist Intelligence Unit issued a report on February 10, 2020, lowering its forecast for China's economic output from 6.1% in 2019 to 5.4% in 2020. With regard to the world's economy in 2020, forecasts call for slower but nonetheless stable growth of 2.2%. However, it is still too early to make a reliable estimate of the impact the coronavirus will have on the global economy in 2020.

Microeconomic conditions in the aviation industry

In December 2019, on the back of a slight decline in economic growth coupled with higher costs, the International Air Transport Association (IATA) anticipated moderate growth in global passenger traffic (4.1%) in 2020 compared with 2019 (4.2%). The forecast called for a slightly higher industry-wide net income of U.S. \$29 billion. The spread of the coronavirus is likely to affect global passenger traffic and therefore net income. Whether that impact will be minimal or dramatic depends on the duration of the virus's spread and limitations to air traffic within and to China. In its press release of February 20, 2020, the IATA lowered its forecast for passenger traffic in 2020 from 4.1% to -0.6%. This estimate is based on the assumption of a course for the coronavirus similar to the outbreak of SARS in 2003, in which passenger traffic sank for six months and then returned to the level it held before the outbreak.

A decline like this would mean a lower number of flight hours for the engine fleet, especially in China and Asia during the first half of the year.

Airbus and Boeing are beginning the year with a high backlog of 13,600 aircraft orders. Airbus plans to produce 60 aircraft of the A320 family per month. Due, among other things, to the trade dispute between the USA and China, production of the Boeing 787 is to be reduced from 14 to 12 aircraft per month, and deliveries of the PW1100G-JM for the A320neo family of aircraft and the GEnx for the Dreamliner are likely to be affected accordingly.

At Boeing, the primary issue in 2020 is the recertification of the 737Max, but MTU is not involved with its engine.

Future performance of MTU

The statements below are based on the knowledge available at the beginning of 2020. Owing to the large number of new programs, there might be delays in development or in the ramp-up of volume production that affect the performance indicators.

Expenditure on new products and services

The ramp-up of the new Geared Turbofan™ programs, which are enjoying considerable market success, has for the past several years called for substantial capital expenditure on development and production resources.

To limit the resulting increase in inventory levels, a project to reduce inventories was launched at the end of 2018. In the OEM segment, the emphasis will be on further optimization of the supply chain as well as on reducing lead times and warehouse inventories. In the MRO segment, the focus will be on lead times and receivables management.

Due to the ramp-up of engine programs, MTU has invested heavily in building up highly productive manufacturing and logistics capacities at its main site in Munich. At the same time, MTU has continued to build up additional capacity at its other German locations and, in particular, in Poland, Canada and China. In addition, the first steps have been taken to establish a repair site in Serbia.

Outlook for 2020

Targets

MTU's targets for the fiscal year 2020 are as follows:

[T30] Outlook for 2020		
in € million	Forecast for 2020	Actual 2019
	Growth in the low 10-percent range	
Revenue		4,628.4
	Growth in the high single-digit percentage range	
Adjusted EBIT		756.9
	Growth in line with adjusted EBIT	
Adjusted net income		537.6
Cash conversion rate	approx. 70%	67%

The company thus expects its revenue, earnings and free cash flow to continue rising in 2020.

Revenue by operating segment

For the commercial OEM business, MTU is forecasting growth in both the series and spare parts business.

Growth in the commercial OEM business will be mainly driven by a further rise in deliveries of the new Geared Turbofan™ programs, and is likely to be in the high single-digit percentage range.

Revenue in the military engine business is expected to grow slightly in 2020.

The rate of growth in the spare parts business is likely to be in the mid to high single-digit percentage range, driven mainly by the V2500 program.

MTU forecasts growth in the low 20-percent range for its commercial maintenance business (MRO segment) in 2020. Here, high revenue is expected from shares in the retrofit program for the PW1100G-JM.

Against this backdrop, the growth in total revenue at the MTU Group in euros is expected to be in the low 10-percent range.

This estimate is based on an average exchange rate of the U.S. dollar to the euro of 1.15.

Operating profit

Compared to 2019, MTU expects its operating profit (adjusted EBIT) in 2020 to grow at a rate in the high single-digit percentage range. Major factors driving the improvement in earnings in 2020 will be growth in commercial spare parts business, growth in the military business and growth in the commercial maintenance business (MRO segment).

Adjusted net income in 2020 is expected to grow in line with adjusted EBIT.

Free cash flow

2020 will be another year of sustained high investment spending. However, MTU plans to compensate for these effects with its operating activities and achieve a further improvement in the cash conversion rate (ratio of free cash flow to adjusted net income) to approx. 70%.

Future dividend

It is MTU's policy to pay an attractive dividend. Despite all current and future challenges and based on the overall forecast of future business developments of MTU in 2020, the company aims to increase the dividend payout ratio.

Employees

Due to strong business growth in both operating segments, MTU expects the size of its workforce to increase in 2020. This increase mainly pertains to the MTU locations in Poland, Hannover and Munich. Looking at the group as a whole, the global workforce is expected to increase only moderately, at a lower rate than revenue growth.

Research and development

In 2020, MTU will continue to focus its research and development activities on increasing engine efficiency by improving the performance of the key components in which MTU possesses specialized expertise, namely the low-pressure turbine, high-pressure compressor and turbine center frame, with a view to reducing fuel consumption and emissions and reducing the frequency of repairs. Detailed information on research and development activities, including the targeted medium- and long-term reductions in fuel consumption and emissions, is provided under "[Research and development.](#)"

Overall forecast of future business performance in 2020

The MTU Executive Board remains optimistic that it will be able to profitably expand the company's business in 2020, leading to a further increase in revenue, earnings and free cash flow. The sustained high level of R&D activities and the continuing ramp-up of production for the new Geared Turbofan™ programs in 2020 will provide a sound basis for the sustained long-term growth of MTU's business.

MTU is observing the potential impact of the coronavirus issue and will, if necessary, adjust its forecast in the course of the year.

Risk and opportunity report

Risk report

Risks are an inherent part of any entrepreneurial activity. In order to take best advantage of market opportunities and to identify and manage the risks involved, MTU has an integrated opportunity and risk management system, which is linked to the group's value-oriented performance indicators and its organizational structure. The system is based on the internationally recognized COSO II Enterprise Risk Management Framework. To assist in implementing risk management in the MTU Group, the central risk management function provides the risk owners with a variety of information and tools. These include the MTU risk guidelines and risk manual and extensive checklists, which provide guidance and operational support in the risk management process.

The systematic consideration of significant risk factors serves as a fundamental basis for value-oriented management of the MTU Group and ensures lasting business success. MTU identifies risks early on, analyzes their possible consequences and devises appropriate risk mitigation measures. The key areas of risk exposure are:

- / macroeconomic and strategic risks,
- / market and program risks,
- / development and production risks,
- / other risks arising from business operations.

Strategy and risk management system

Control environment

MTU regards a suitable control environment as being essential for a functioning risk management system. The main elements of this are:

- / management style and philosophy,
- / integrity and ethical values,
- / no-blame culture,
- / staff training and development.

The MTU Principles require a constructive approach to mistakes, and the company's leadership values include a commitment to actively driving change, creating an atmosphere of trust, and ensuring continuous improvement. This is supported by lean management in all areas of the company, which also aims to create a culture that ensures a functioning risk management system.

Risk management objectives and risk strategy

The objectives of MTU's risk management system are to create transparency with regard to all risks and opportunities, to ward off risks to MTU's status as a going concern and to safeguard the company's future business success.

The company does not limit itself to ensuring compliance with statutory requirements. Rather, it seeks to integrate

its opportunity and risk management system into all processes in the company, from financial planning, control and reporting processes right through to monthly reporting to the Executive Board and the Supervisory Board. Risk management also takes place in other areas of the company; for instance it is a key component of project management.

Identification, analysis and management of risks

MTU regards risk management as a continuous process that ensures responsible behavior when dealing with specific risks to organizational units and general risks affecting several units or the entire group.

The group's risk inventory, which encompasses all organizational units and all risk factors to which MTU is exposed, forms the basis for identifying risks. In accordance with the COSO II Framework, it is divided into governance and compliance, strategy and planning, operations and infrastructure, and reporting. In the interests of a more detailed assessment of risks, MTU has divided this framework into 15 risk categories covering all organizational units. MTU also examines risks inherent in its business activities that may affect third parties.

Operational risk management takes place at the level of the individual, organizationally separate units and in the subsidiaries. These are responsible for identifying, assessing, controlling and monitoring the risks in their specific areas, and documenting them in a central risk management tool. To this end, they use a general risk checklist derived from the risk inventory. Mandatory reports are submitted to the central risk management function for risks exceeding €5 million over the three-year assessment period in the form of risk maps, at dates aligned to the quarterly financial results. The risk maps are also used to document risks below the €5 million threshold. Risks occurring during the year that could threaten the company's status as a going concern are reported immediately to the central risk management function. Risks are assessed using uniform definitions of the probability of loss/damage and as possible deviations in the group performance indicators "adjusted EBIT" and "free cash flow" compared with current operational planning figures. In addition to these financial risks, risk management also explicitly includes non-financial risks.

The central risk management function aggregates and consolidates the reported risks. It also provides assistance with the risk management process, prescribes uniform methods and tools, and evaluates the group's overall risk position. Furthermore, it supports the work of the cross-organizational Risk Management Board, which performs central control and monitoring functions

for the group. At its quarterly meetings, the Risk Management Board discusses the interactions between individual risks, ensures that all risks have been reported in full, and assesses the risk exposure of the group as a whole.

Risk reporting and risk communication

MTU's Executive Board is informed quarterly of the group's current risk situation. The report is agreed with the Risk Management Board and is structured on the basis of the segments. This report presents the company's Top Risk Map, which covers all risks and opportunities exceeding €20 million over a three-year period. A risk assessment is then performed in this context, taking account of the amount of damage, the probability of occurrence and the identification of compensatory countermeasures.

The Supervisory Board's Audit Committee is also given an update of the MTU group's risk position on a quarterly basis. The most important issues from the previous risk review are also presented in monthly reports to the Executive Board and the Supervisory Board.

Monitoring the risk management process

Monitoring the risk management process is crucial to ensure its proper functioning and ongoing development.

The system used for the early recognition of risks is audited by the auditor. In addition to this, the risk management system is monitored and verified by other functions and group bodies:

- / peer-group comparisons and benchmarking,
- / process reviews by the Risk Management Board in the form of a self-assessment,
- / regular process and effectiveness audits by Internal Audit,
- / monitoring by the Audit Committee and/or Supervisory Board.

Strategy risks

Macroeconomic risks

In general, the MTU Group's business development is subject to a number of different risks, especially the U.S. dollar exchange rate, the commodity price situation, the development of air traffic and general economic risks. Taking the latest market forecasts into account, MTU considers that negative impacts for the company could result from lower global economic growth, increased protectionist measures in some economies and the high sovereign debt in certain countries, together with resulting monetary policy of the central banks. MTU analyzes the possible effects of changes in the political environment (EU and U.S. interest rate policy and

changes in international tax and customs regulations) in order to identify potential risks. Political crises in some regions and restrictions on air travel imposed as a result of natural disasters, epidemics or terrorist attacks are regularly discussed during the risk management process. The spread of the coronavirus 2019-nCoV in China since December 2019 is being monitored very closely at the moment. An ongoing epidemic and the associated restrictions on air travel could have a negative impact on the demand for spare parts and maintenance. If the economic situation should deteriorate, this could impact the volume of passenger or freight traffic, reduce the need for maintenance services and prompt a more cautious approach to orders for new transportation capacity. In addition, further national budget cuts could negatively impact the military engine business. The current view, however, is that defense budgets are more likely to increase. The other macroeconomic risks include a change in usage patterns or in regulations for aviation customers as a result of the climate debate, fluctuations in energy costs, and disruption or delays to delivery. Moreover, the long lead time of engine programs can be the source of volume and price risks that are difficult to calculate.

Risks arising from corporate strategy

The main forms of strategy risk are misjudgments when taking decisions about investment in engine programs, the establishment of new sites and possible M&A activities. During the decision-making phase of a program, highly qualified specialists perform cost-benefit analyses based on set procedures that include the obligation to carry out a risk analysis on the basis of different scenarios. MTU's business model is based on long-term processes, particularly in the OEM segment. Many years of development, preproduction and volume production may lie between the decision to invest in a new commercial engine and the breakeven point. The risk is that the original economic and technological parameters might change over time, hence the need for frequent reassessments that take into account the most recent economic and technological developments. Decisive factors in this regard are, in particular, the success of the aircraft platforms on which the engines are deployed and any changes made to those platforms. MTU counters such strategy risks through a broad portfolio. This means that the company limits the impact of an individual program or aircraft platform by holding an interest in a wide range of products across all thrust classes.

In the longer term, a further identifiable risk, in addition to that arising from MTU's strategic decisions, is the arrival on the market of new competitors, e.g. from Russia or China. But given the high barriers to market entry, this risk is currently not regarded as critical.

Substitution risks arising from disruptive technologies

Electric propulsion systems for aircraft are in principle a substitution risk for conventional engine technologies, but they do not yet come anywhere near the performance required to power a large passenger or freight aircraft. Together with its research partners, MTU is conducting studies to examine all the conceivable concepts in order to factually assess the opportunities arising from alternative engine concepts and make use of them as appropriate. Among the key results from these studies are:

- / Propulsion systems based on electric batteries are suitable today for applications requiring low performance and short duration of use, such as general aviation and urban mobility. With improvement in the storage capacity of batteries (5% per year), they could be used in several years on commuter aircraft and in about 30 years on regional aircraft. At the moment, there are no known battery concepts with sufficient capacity for short and medium-haul aircraft, let alone for long-haul aircraft, which represent an important market for MTU.
- / Hybrid propulsion systems combine electric motors, generators, gas turbines and batteries. These open up new possibilities for aircraft and engine design and engine integration and still rely on kerosene, an energy source with high energy density. MTU is involved in a number of studies that are examining the potential of these propulsion concepts. However, as yet they have not shown any major benefits compared with conventional propulsion systems.
- / Considerable progress has been made in the development of fuel cells in recent years. However, their present performance potential is not sufficient for commercial aviation. In the long term, however, in conjunction with liquid hydrogen fuel, they have far greater potential for use in aviation than batteries. MTU has therefore begun to examine the potential and feasibility of fuel cells for propulsion systems.

From today's perspective, the fields in which MTU currently operates will not be affected by actual substitution risks in the foreseeable future. Nevertheless, MTU will continue to keep a close eye on the progress of developments in the field of electric motors, batteries and, especially, fuel cells, and compile further studies so it can react and participate in a timely fashion. In parallel, MTU is permanently working to improve the efficiency of conventional engines, thus continuously raising the ecological and economical access barriers for any substitute products.

Market and program risks

The success of existing and established engine programs across their entire lifecycle depends to a large extent on aftermarket sales. Some airlines are still experiencing financial difficulties, especially as a result of competitive pressure in the aviation market. A further massive impact on the already strained situation could come from changes in fuel prices, exchange rate fluctuations or state intervention in the aviation industry. Given this, airlines are striving to minimize their operating costs, including aircraft and engine maintenance costs, in order to improve and lock in their profit margins. In addition, they may delay shop visits for as long as possible or, when they take place, replace defective parts or entire engines with used ones instead of new ones.

The market for new engine programs has also changed and engine manufacturers now mainly sell their engines with maintenance packages. Therefore, success no longer depends solely on spare-part sales, but also on accurate forecasting of the volume of maintenance services, including the supply of spare parts. As with serial production of engines, a key element in sales drives is offering discounts on the maintenance services sold. Moreover, as part of their sales drives, manufacturers frequently offer financing arrangements to end customers. They are provided in two basic forms: predelivery payments (PDPs) and backstop commitments. Within the scope of its partnerships in engine programs, MTU is a party to aircraft financing loans offered by consortium leaders (OEMs) to end customers. The agreements fundamentally limit MTU's participation in the financing of the consortium leader's (OEM's) commitment to MTU's own share in the engine program. The funds are always made available to the airlines via the lead partners in the consortia (OEMs). The risk of suffering a loss because an airline becomes insolvent is currently considered to be very low, due to the collateral rights pertaining to retained goods. What is more, the airlines currently only avail themselves of these arrangements to a limited extent because loans are often available on the market on better terms than these financing arrangements ([see the "Financial situation" section](#)).

MTU's customers in the military engine business are national and international agencies. Therefore, political changes have an almost immediate effect on MTU. Given the tight national budgets that can be observed at present, especially in Europe, there is always the risk that countries may postpone or cancel orders. Due to the budget situation, it may be necessary to renegotiate the scope of contractually agreed deliveries. In the military engine business, MTU is firmly embedded in

international cooperative ventures. This tends to limit risks because the partners work together to protect their common interests. Furthermore, the terms of existing contracts in the military sector are generally defined to cover a prolonged period of time, thus largely ruling out price risks.

The client base in the MRO segment is characterized by a broad customer portfolio with only a few large individual customers. When committing to new large-scale contracts, there is a risk that on the long-term perspective not all future economic developments can be foreseen. Some engine programs in the MRO phase are already at an advanced stage of their lifecycle. This harbors the risk of MTU's MRO portfolio becoming too focused on aging products. MTU strives to maintain a balanced portfolio that is constantly being expanded to include maintenance services for new engine programs. However, new programs also harbor a ramp-up risk. Bespoke maintenance services are available for older engine programs.

Dependence on cooperation

The commercial engine market is dominated by a small number of major manufacturers. MTU sells most of its products under risk- and revenue-sharing arrangements with market leaders. The major engine manufacturers, who are the lead partners in the consortia (OEMs), determine the prices, conditions and concessions. They also define the engine development processes prior to the market launch phase of new engines, e.g., the scope of development work and the payments to be made by the individual partners in the consortia toward the costs. As a partner in the consortium, MTU has rights of objection and control, and can improve its own position through negotiations. By virtue of these partnerships, MTU is able to participate in the industry-leading engine programs of the major engine manufacturers. In the commercial engine and maintenance sector, the customers of the consortium leaders (OEMs) are airlines and aircraft leasing companies. The marketing of commercial engines and the maintenance services they entail always involves making concessions to the end customers. MTU is obliged to absorb these concessions to the extent of its program share in risk- and revenue-sharing arrangements. The fact that the cooperation partners share a common interest helps to prevent excessive concessions during contract negotiations with the end customers.

In the commercial maintenance business, MTU's interests in the Asian market include a 50:50 joint venture, MTU Maintenance Zhuhai Co. Ltd., Zhuhai, China. MTU is involved in further joint ventures in the fields of engine leasing, maintenance and development. In this way it can respond to the new structures in the after-

market and offer customers a full range of services. In jointly controlled entities, where decisions have to be made collectively, there is always a risk of differences of opinion. Similarly, participation in international joint ventures often reveals cultural and political differences (for instance payment morale).

From today's standpoint, MTU believes its collaborative business model stands it in good stead to effectively manage market and program risks; in particular in respect of the challenges associated with the development, production and market introduction of new engine programs and architectures. MTU therefore does not expect these market and program risks or its dependency on cooperative agreements to have any significant impact on the group's continued existence as a going concern.

Development and manufacturing risks

Development risks

In the commercial and military engine business, MTU undertakes development work, during which delays and additional costs may arise. The company ensures strict adherence to time schedules and budgets by permanently monitoring project management across all organizational units involved and taking appropriate corrective action where necessary. Furthermore, through its involvement in collaborative ventures, it works in partnerships that extend beyond corporate boundaries, thus spreading the risk. However, in isolated cases MTU can suffer significant economic impacts as a result of development and production risks materializing with cooperation partners. As the market launch of the innovative Pratt & Whitney GTF™ engine family demonstrates, the complexity of the products means that technical risks cannot be ruled out completely – even when all possible risk minimization measures are implemented. Such risks are not, however, unusual in the context of rolling out completely new product architectures.

MTU products are subject to extremely stringent safety and quality requirements. The company requires numerous official certifications, particularly from the FAA and EASA, in order to carry out its activities. These are only valid for limited periods and can be renewed only after further tests have been carried out. The well-documented development process ensures compliance with all regulations.

Manufacturing risks/shop floor risks

Highly sophisticated components and new materials are needed to meet the requirements of the airlines and OEMs with respect to engine weight, fuel consumption and noise emissions. In order to efficiently produce and process such components, MTU develops – and gains official approval for – innovative new manufacturing tech-

niques. This can lead to delays in the start of production, a temporary increase in unit costs or a temporary reduction in delivery volumes compared to the agreed level. A further risk is that customers might impose penalties in the event that deliveries are delayed. It could also happen that the new manufacturing processes are not yet sufficiently mature to fully meet requirements when volume production is due to start. MTU counters this risk in technology projects by providing systematic support for the development and implementation process.

Procurement and purchasing risks

MTU is dependent on suppliers and third-party vendors for some raw materials, individual parts and components, and for the provision of specific services. Risks can arise in the form of the unavailability of suppliers, problems with quality and price increases. MTU strives to reduce its reliance on individual suppliers by securing the services of several equally qualified vendors for materials, parts and services. All ramp-up programs have a second – and in individual cases a third – supplier for the majority of components. In the case of single-source suppliers, MTU enters into long-term agreements as a hedge against unforeseen shortages and to reduce the risk of sudden price hikes. The risks involved are manageable thanks to the broadly diversified supply chain.

Occasional delays may arise when ramping up production of new, high-volume programs involving production capacities, new production processes or new workflow systems, thus affecting the agreed delivery deadlines. MTU supports the ramp-up of new components through strict project management and the deployment of IIMs (Interim Improvement Managers). By deploying specialists on site with the supplier, MTU can ensure timely tracking of process progress and provide active support.

Liability risks

In the aviation industry, as elsewhere, accidents can still occur despite the highest possible quality standards in manufacturing and maintenance. In the military engine business (excluding exports), MTU is largely exempt from product risk liability. The remaining product liability, especially in the commercial engine business, is covered by contractual clauses and by high-coverage insurance policies, including aircraft liability insurance. Other risks that could threaten the company's status as a going concern, such as fire or the interruption of business operations, are also insured.

The risks are rendered transparent and manageable by MTU's collaborative business model and by additionally limiting liability risks and taking out insurance cover.

In this respect, MTU believes it is well prepared to effectively manage the development and production risks

and has not identified any risks related to these activities at the present time that might endanger its status as a going concern.

Use of financial instruments

Meanwhile, more than 80% of MTU's revenue is generated in U.S. dollars. A large proportion of expenses is likewise invoiced in U.S. dollars, thus providing a natural hedge. Most other expenses are incurred in euros and, to a lesser extent, in Polish zloty, Chinese renminbi and Canadian dollars. In line with the corporate policy of generating profit solely on the basis of operating activities and not through currency speculation, MTU makes use of hedging instruments exclusively for the purpose of controlling and minimizing the effect of U.S. dollar exchange rate volatility on EBIT.

The forward foreign exchange contracts concluded by MTU cover a large part of its net exposure to currency risk. The hedging horizon is up to four years and uses a phased model where the authorized hedging ratios decline the further in the future the net currency exposure is. Thus, only a small portion of the net U.S. dollar exposure in the present and following year is exposed to currency risks. The unhedged portion of future cash flows is translated into euros at the exchange rate prevailing on the date of settlement.

MTU has a long-term hedge portfolio comprising forward foreign exchange contracts with terms to maturity stretching over several years. As of December 31, 2019, the value of the portfolio of hedging instruments with terms until 2023 amounted to U.S. \$2,750.0 million (€2,447.9 million at the exchange rate prevailing on the reporting date).

Detailed information on the financial instruments used to hedge future cash flows is provided in [Section IV. of the Notes to the consolidated financial statements \(Note 36\)](#).

In view of this long-term hedging strategy, MTU considers its currency risks to be manageable.

For a detailed description of MTU's financial management system, please refer to the ["Principles and objectives of financial management" section under "Financial situation."](#)

Other risks pertaining to business operations

Compliance risks

Compliance risks arise when managers or employees of the company fail to comply with laws and regulations or fail to observe internal guidelines. These risks can arise in all areas of the company.

MTU has implemented a number of measures with regard to its organizational structures and processes to minimize these risks and to safeguard compliance. In particular,

central offices with managerial authority have been set up to monitor and enforce compliance with laws and regulations in the individual divisions (for instance, the Quality division is responsible for compliance with aviation authority regulations, while the Environmental Protection/Occupational Health and Safety division ensures that environmental protection regulations are adhered to).

Above and beyond that, measures have been put in place at the company level to minimize the risks associated with compliance issues:

- / Binding rules of conduct valid throughout the group
- / Establishment of a central contact for reports of misconduct
- / Designation of a Compliance Officer
- / Continuous security checks on employees
- / Regular training

Criminal intent can never completely be ruled out. All in all, MTU considers the compliance risks to be manageable, especially in light of the measures taken to control them.

Non-payment risk

Airlines, in particular, are direct and indirect customers of MTU. These companies may find themselves facing financial difficulties that affect the receivables of MTU and its partners. The consortium leaders in the commercial OEM business have intensive receivables management systems in place. No significant risks have been identified with respect to MTU's long-standing partnerships with OEMs. In the MRO business, the responsible account managers monitor and manage credit risks in short cycles and proactively. A risk assessment is carried out before any relevant contract is signed, and systematic compensatory precautions are taken as needed, such as commercial credit insurance or export credit guarantees (Hermes coverage). All in all, MTU considers the risks of non-payment to be manageable, especially in light of the measures taken to control them.

Environmental risks

MTU is subject to a wide range of laws and provisions on the environment and occupational safety. As a result of the processing of materials such as nickel and cobalt alloys, the use of chemical substances in manufacturing processes, as well as emissions, for example from test stations and production facilities, more stringent environmental and occupational safety requirements can result in additional investment costs. Moreover, it could be necessary to substitute the substances used (REACH compliance). Further information on occupational safety can be found in the ["Non-financial statement" section](#). MTU needs special permits to operate certain production

facilities. The regulations must be strictly observed and full documentation ensured. An environmental management system certified as conforming to EMAS minimizes the risks in this area. All in all, MTU considers the environmental risks to be manageable, especially in light of the measures taken to control them.

IT risks

The main IT risks are the theft of confidential data through industrial espionage and data loss due to system failures. Through its experience in dealing with military customers, MTU is particularly aware of the need to safeguard confidential data. The company operates a highly advanced data security system that is always state-of-the-art. It has also taken out specific cyber risk insurance to cover business interruption caused by cyber attacks. When new IT systems are introduced, there is a possibility of workflows being disrupted. MTU minimizes these risks by employing qualified experts and using professional project management. All in all, MTU considers the IT risks to be manageable, especially in light of the measures taken to control them.

Personnel risks

The shortage of skilled workers, which is intensified by demographic change, can pose risks to the company. For instance, there may not be enough top performers available to fill vacancies, competent and experienced employees could leave the company and knowledge may be lost. In light of this, MTU seeks access to qualified young talent and experienced specialists through company training programs and dual-study programs (which combine practical and academic work), competitive working conditions and up-to-date personnel marketing. All in all, MTU considers the personnel risks to be manageable, especially in light of the measures taken to control them.

Risks arising from general, customs and tax legislation

To compensate for relevant legal risks, processes that reinforce control are monitored and developed further by central departments with technical and managerial authority. Identifiable risks arising from pending tax audits or ongoing customs audits and legal proceedings are managed by the central departments with the support of independent external consultants. The focus lies in particular on targeting process weaknesses and compensating for them. All in all, MTU considers the risks arising from general, customs and tax legislation to be manageable, especially in light of the measures taken to control them.

Overall assessment of MTU's risk exposure

Risks in each key area of exposure as described above are assessed for the coming fiscal year according to their probability of occurrence and quantified as a deviation in EBIT from the currently applicable operational planning figures. In MTU's risk management process, risks are assigned to one of four probability levels. Based on the top individual risks evaluated in the MTU Group's risk management process, for fiscal 2020, the risk exposure affecting earnings is €59 million. The OEM segment accounts for €53 million of this and the MRO segment for €6 million. This risk exposure affects only market and program risks.

Apart from a quantitative assessment of the top individual risks and overall risk position, MTU monitors and reports qualitatively on risks associated with development, production, maintenance and procurement that are not yet assessable – especially in connection with its involvement in the GTF family of engines.

In addition to the risks outlined above, the risk management process is used to monitor unplanned events with an impact on liquidity. In addition to the impact of identified earnings risks, this assessment revealed risk factors that could affect liquidity in 2020 totaling approximately €93 million, which would, however, be covered by the company's existing lines of credit. Other, non-measurable risks have been identified above and beyond those mentioned above.

Looking beyond 2020, there is the possibility that the company may be exposed to other identifiable, in some cases significant, risk factors (potentially impacting earnings and liquidity), which MTU is continuously monitoring and has integrated into its short- to medium-term planning and risk management processes. MTU considers it extremely improbable that all these risks might arise concurrently. Therefore, aggregated figures must be viewed merely as a rough indication of the MTU Group's overall risk exposure.

As of December 31, 2019, there were no substantial changes in MTU's risk exposure compared with the end of the previous year. MTU continues to believe it is well prepared to effectively manage its business risks, particularly those relating to the development, production and market introduction of new engine programs. The level of risk exposure is manageable. From the present vantage point, the MTU Group's continuing existence as a going concern is not endangered. MTU does not anticipate any fundamental changes in its risk exposure at the present time. The company has taken every possible organizational measure to ensure early awareness of potential risk situations.

Opportunity report

Market and program opportunities

Basic research and ongoing development of engine technologies, followed by their deployment in end products, have made MTU one of the world's leading manufacturers of engine components. MTU's new products lead the field in terms of efficiency because they save fuel and reduce emissions, noise and costs. MTU has achieved market success with the Pratt & Whitney GTF™ engine family, which it develops in partnership with Pratt & Whitney. The A320neo, Airbus A220 and Embraer E190-E2 with GTF engines are already being used in scheduled service. Further GTF applications will be used on scheduled services in the coming years, in particular in the regional jet segment. Since 2018, the PW800 engine family, developed in cooperation with Pratt & Whitney Canada, which is based on the same core engine as the GTF, has powered premium manufacturer Gulfstream's new generation of business jets. In order to balance out its engine portfolio in the long-haul segment, MTU has participated in the development of the GE9X, which will be the sole engine for the Boeing 777X. Thanks to this balanced portfolio, MTU will benefit in the decades ahead from the predicted growth in all market segments – the regional jet, narrowbody and widebody segments. What is more, MTU has an opportunity to raise its share of the medium-haul market because, in addition to its stake in the PW1100G-JM for the A320neo family, it also holds a stake in the V2500 for the classic A320 family. The latter program is now entering the aftermarket phase, offering future potential in the spare parts business.

Among its customers in the military sector, MTU has established a reputation as a highly qualified partner with comprehensive system know-how in product development, manufacturing and maintenance. In particular by driving forward its military-engine maintenance services with the German air force, MTU sees chances to strengthen its ties with Germany's armed forces.

What is more, ongoing export drives – especially for the Eurofighter EJ200 engine and the TP400-D6 for the A400M military transporter – present opportunities to acquire new customers in the military business. In addition, the Eurofighter partner countries are discussing the procurement of substitute aircraft for aging delivery tranches of the Eurofighter.

Driven in particular by the T408 engine, the military-program partnership with GE Aviation is doing well and could generate further opportunities to participate in transatlantic programs in the future.

The changed maintenance-related business practices in the aviation industry, in which MRO services are increasingly being offered together with engine sales contracts, open up opportunities for MTU, from the perspective of its position as a consortium partner, to develop customer loyalty in the commercial maintenance segment that will soften the impact of risks associated with the spare parts market. This integrated approach to MRO enables program partners to become members of an MRO network, giving them access to the entire volume of MRO work associated with an engine series, in accordance with their share in the program. Here there is a variety of models for participating. For instance, partners in the MRO network might only perform repairs on their own components, or be allocated a quota of complete shop visits corresponding to their program share. Membership in an MRO network offers more moderate margins than operating as an independent MRO provider.

The independent MRO market for engines such as the GE90 and V2500 continues to offer long-term prospects for MRO providers to participate in this steadily growing market. In particular, the increase in the number of aircraft no longer tied to the OEMs offers independent MRO providers like MTU the opportunity to gain new customers and to assume responsibility for managing the maintenance of large fleets.

Continued investment in automation and building up maintenance capacity, for instance through the establishment of MTU Maintenance Serbia d.o.o. and EME Aero Sp. Z.o.o., will enable MTU to meet the high demand in both the OEM and MRO segments in the long term.

Through MTU Maintenance Lease Services B.V., Amsterdam, Netherlands, and SMBC Aero Engine Lease B.V., Amsterdam, Netherlands, which operate in the field of engine leasing, and the establishment of MS Engine Leasing LLC., Rocky Hill, USA, for engine leasing with the partner companies in the PW1100G-JM MRO network, MTU aims to extend its activities in the lucrative leasing business and increase the scope of services provided in the aftermarket. The positive experience with joint venture partner Sumitomo Corporation could also generate good opportunities to establish further strategic partnerships.

Opportunities associated with product development and manufacturing

The risk report describes the risks associated with development and manufacturing, but MTU's ongoing technology and development activities also open up new business opportunities. For example, ongoing product development could open up the opportunity for MTU to acquire new partnership roles in future engine programs

thanks to its new technologies, enabling the company to maintain a balanced product portfolio covering engines at all different stages of their lifecycle.

The risk report also refers to the challenges involved in ramping up new programs; here again these challenges can be transformed into opportunities. Production processes and systems can be optimized, for example through the use of predictive simulation and process data management, and new, cutting-edge manufacturing technologies and processes can be introduced. The risk analyses undertaken to secure the ramp-up of production result in timely identification of potential problems and the related lasting process improvements. The effects of these improvements are not only felt in new programs; they can also be transposed to existing ones. That leads, for example, to further cost reductions and enhanced delivery reliability. The spread of additive manufacturing techniques (3D printing of components) opens up new possibilities for application-optimized component design and cost benefits in their production.

Through continuous improvements towards operational excellence, methods, processes and leadership behavior are constantly being developed as part of Lean Management@MTU. This results in increased transparency, a focus on value creation, support in achieving ambitious targets, and faster and more sustainable problem-solving and approaches to improvement. Improved preventive approaches, a faster response to deviations from plan and sustainable and structured solutions to problems enable the company to put in place stable processes and optimize resource deployment.

Other opportunities

As a large part of the company's revenue comes from contracts invoiced in U.S. dollars – especially in the commercial engine business and commercial MRO –, a strengthening of the U.S. dollar against the euro would improve MTU's earnings. If energy prices were to stabilize or retreat to a lower level, and if commodity prices were to fall, this would have a positive effect on MTU's cost structure and hence on its business results.

Other opportunities are listed in the SWOT analysis presented below. See the risk report for information on how the opportunities identified can be exploited and the associated risks avoided.

Overall assessment of opportunities

As of December 31, 2019, the opportunities identified by MTU had not changed substantially compared with the end of the previous year. MTU has taken all the organizational measures necessary to recognize potential opportunities in good time and respond to them adequately. MTU applies the same methods in its assessment of specific opportunities as it does when evaluating risks. As a conservative approach is taken to the identification of risks and opportunities, the opportunities are necessarily very low compared with the risks.

In the process of identifying opportunities, a number of smaller opportunities (<€20 million) were identified, which do not form part of the internal top risk and opportunity reporting used to prepare this report. Opportunities to extend MTU's range of products and services initially lead to a financial burden. In view of the long cycles involved in the business model, this will only generate positive earnings in subsequent fiscal

years. MTU does not currently foresee any fundamental changes in its opportunities.

SWOT analysis

The results of an analysis of the main strengths, weaknesses, opportunities and threats (SWOT) identified in the course of MTU's planning and risk management processes are as follows:

[T31] SWOT analysis of the MTU Group

Company-specific	Market-based
<p>Strengths</p> <p>Technological leadership</p> <ul style="list-style-type: none"> - OEM: low-pressure turbine and high-pressure compressor (2-module strategy) - MRO: expertise in high-tech repairs <p>Balanced engine and service portfolio across all market segments and lifecycle phases</p> <p>Long-term contracts in the OEM and MRO business, involvement in consortia and cooperative ventures</p> <p>Participation in aftermarket networks for new programs as well as coverage of all aftermarket services (e.g., leasing)</p> <p>Quality and reliability of supply form the basis for reliable partnerships</p> <p>Use of new manufacturing processes and systems, e.g., simulation tools and data management</p> <p>Continuous improvement through use of lean management methods, shop-floor and office management</p>	<p>Opportunities</p> <p>Growing market in both operating segments</p> <p>Very good positioning in the regional jet, narrowbody and widebody segments</p> <p>Additional opportunities to sell engines for military aircraft</p> <p>Growth potential in the MRO and OEM-IGT market (including fracking and new applications for energy generation)</p> <p>Greater exploitation of synergies in the commercial business (integration of MRO into volume business)</p> <p>Positive changes in U.S. dollar exchange rate</p>
<p>Weaknesses</p> <p>High dependence on U.S. dollar</p> <p>Dependence on decisions of consortium partners</p> <p>Partnerships focused on only two OEM engine manufacturers in the commercial market</p> <p>Higher wage levels at the traditional sites</p>	<p>Threats</p> <p>Change in aftermarket business model</p> <ul style="list-style-type: none"> - Price competition in maintenance - Market entry barriers for OEM business (licenses) - Changes to prices and demand in the spare parts business <p>Entry of new participants in engine market</p> <p>Fundamental changes in aircraft engine technologies, including greater complexity</p> <p>Additional development costs and contractual penalties due to technical difficulties with new engine types</p> <p>Dependence on national and international political decisions</p> <p>Negative changes in U.S. dollar exchange rate</p>

Management compensation report

The compensation report describes the principles applied in determining the compensation for the Executive Board and Supervisory Board of MTU Aero Engines AG, and states the amount and composition of that compensation. The compensation report follows the provisions of Section 314 (1) no. 6 of the German Commercial Code (HGB), German Accounting Standard (GAS) 17 "Reporting on the remuneration of members of governing bodies," the recommendations of the German Corporate Governance Code (GCGC), and the International Financial Reporting Standards (IFRSs).

Principles of the compensation system for members of the Executive Board

At the proposal of the Personnel Committee, which is independent within the meaning of the GCGC, the Supervisory Board decides on a system of compensation for the members of the Executive Board, including the material components of their contracts such as the amount and breakdown into non-performance-related and performance-related components. The Personnel Committee reviews the appropriateness and alignment with the market of the Executive Board compensation at regular intervals. To this end, regular benchmarking is conducted with selected peers – currently 14 mechanical engineering companies listed in the DAX and MDAX indices – with the support of an independent compensation expert. The above-mentioned benchmarking prompted the Personnel Committee and the Supervisory Board to raise the compensation of the Chief Executive Officer to within average range for CEOs in the peer group. Similarly, the compensation of Executive Board members Peter Kameritsch and Lars Wagner was adjusted to the average ranges for similar functions in the peer group and now corresponds to the amount of compensation of Executive Board member Michael Schreyögg.

Developed with the support of independent external compensation experts, the present compensation system for the Executive Board is primarily oriented toward the group's positive and sustainable development. The compensation awarded to members of the Executive Board is therefore composed of non-performance-related and performance-related components, particularly in the form of long-term incentives. This ensures that corporate governance is optimally aligned with the long-term interests of the group and its investors. This means that the compensation system is aligned with market conditions; it was introduced in its current form with effect from the fiscal year 2016.

Structure of total compensation

[T32] Structure of the compensation system (total target direct compensation)

Non-performance-related components	~ 40%	Fixed annual payment	Fixed compensation Fringe benefits
			Approx. 40% of variable compensation
		Short-term incentive (STI)	Key characteristics: Distribution based on attainment of adjusted EBIT and free cash flow targets Capped at 0-180% (exceptional performance bonus/penalty of up to 20% in accordance with the German Corporate Governance Code)
Performance-related components	~ 60%	Restricted Stock Plan (RSP) long-term incentive (LTI)	Approx. 60% of variable compensation
			Key characteristics: Distribution based on achievement of 3-year targets for adjusted EBIT and free cash flow in previous years Capped at 0-180% Granted as MTU shares (vesting period of 4 years)

Non-performance-related components

Non-performance-related compensation (basic salary), which makes up around 40% of total compensation, is paid on a monthly basis and consists of fixed compensation and fringe benefits. Fringe benefits comprise taxable reimbursements of expenses and the cash equivalent of payments in kind, such as the use of a company car for business and private purposes and insurance premiums, including any taxes on such benefits that have been reimbursed.

Performance-related components

Performance-related compensation makes up around 60% of total compensation; it consists of a short-term incentive (STI) and the Restricted Stock Plan (RSP).

Short-term incentive (STI)

Performance-related compensation is paid in the form of short-term incentive (STI) compensation. This amounts to around 40% of the performance-related Executive Board compensation.

The actual amount depends on the degree of target achievement for two equally weighted key performance indicators at group level – adjusted EBIT and free cash flow.

The targets to be achieved in the respective fiscal year to ensure payment of 100% of the STI are set annually in advance by the Supervisory Board, taking the operational business plan into account. In addition, an entry threshold is set at 70% of the target level which, if achieved, corresponds to an STI payment of 50%. There

is no STI entitlement below this entry threshold. Similarly, the maximum payment is limited to 180%, which is payable if the maximum degree of target achievement of 115% is reached. Between the entry threshold, the 100% level and maximum target achievement, the payment percentage is interpolated on a straight line. The effective STI payment percentage is calculated by taking the arithmetic mean of the degree of achievement of the two performance targets.

The targets set by the Supervisory Board for the reporting period on the basis of the operational business planning figures do not include the effects of the initial application of the financial reporting standard IFRS 16 (Leases). In particular, the application of IFRS 16 requires the allocation of material amounts of procurement lease payments to cash flow from financing activities (rather than cash flow from operating activities as before) and this led to a material improvement in free cash flow in the reporting period. To ensure that target achievement is measured consistently, the free cash flow realized in the reporting period is adjusted for the effects of the initial application of IFRS 16 for the calculation of the degree of target achievement (more information can be found in the [Notes to the consolidated financial statements in Section I. "Accounting policies and principles" under "IFRS 16 Leases"](#)).

In accordance with the GCGC, the Supervisory Board has the right to take each Executive Board member's individual performance into account by adjusting the STI for the respective fiscal year by up to 20% (bonus/penalty),

based on the individual performance determined by the Supervisory Board. In this context, the Supervisory Board resolved in March 2011 generally not to grant any bonus or apply any penalty. Accordingly, the STI was not adjusted by a bonus or penalty in the reporting period or in the previous year.

Restricted Stock Plan (RSP)/long-term incentive (LTI)

Performance-related long-term incentive compensation is awarded under the Restricted Stock Plan (RSP). This compensation component is share-based and represents around 60% of variable compensation. Technically, the RSP is awarded in the form of a cash settlement; its net amount (less income tax) must be reinvested immediately in restricted MTU shares by the respective member of the Executive Board. The shares awarded in this way must be held for a holding period of four years (shareholding requirements).

To strengthen the long-term incentive effect of this compensation component, the grant value of these RSP shares is weighted with a long-term performance factor, which is calculated by taking the arithmetic mean of the STI payment percentages for the three fiscal years preceding the granting of the RSP shares. A maximum of 180% is applied. If a new Executive Board member joins the group, their multi-year performance level for the years prior to their joining the group is determined by assuming an STI payment percentage of 100%.

Value of performance-related components

Short-term incentive (STI)

For the reporting period, the Supervisory Board had set the following performance targets: for the short-term incentive (STI), adjusted EBIT of €700.0 million (actual: €756.9 million) and free cash flow (FCF) of €250.0 million (actual: €358.3 million, adjusted for the effects of the initial application of IFRS 16: €317.2 million). As mentioned above, the FCF figure used in the reporting period is adjusted for the effects of the initial application of IFRS 16 (Leases; more information can be found in the [Notes to the consolidated financial statements in Section I. "Accounting policies and principles" under "IFRS 16 Leases"](#)). Accordingly, the FCF realized in the reporting period was adjusted for the effect of IFRS 16 to ensure that target achievement is measured consistently. On this basis, the maximum target achievement for the STI was reached in the reporting period, leading to a payment percentage of 180.0% (previous year: 160.80%).

**Restricted Stock Plan (RSP)/
long-term incentive (LTI)**

The grant value of Restricted Stock Plan (RSP) shares was derived in the reporting period from the amount allocated as the percentage of total compensation and the multi-year performance target reached. The latter was calculated for each Executive Board member in the reporting period by taking the arithmetic mean of the short-term incentive (STI) payment percentages for the fiscal years 2016, 2017 and 2018.

The following numbers of MTU shares (each with a holding period of four years) were acquired by Executive Board members under the RSP:

[T33] Purchased RSP shares

Members of the Executive Board	Year	Number of shares	Purchase price per share in €	Vesting period until
Reiner Winkler	2019	3,512	209.20	April 30, 2023
	2018	4,460	143.30	April 30, 2022
Peter Kameritsch	2019	1,999	209.20	April 30, 2023
	2018	1,941	143.30	April 30, 2022
Michael Schreyögg	2019	1,999	209.20	April 30, 2023
	2018	2,976	143.30	April 30, 2022
Lars Wagner	2019	1,999	209.20	April 30, 2023
	2018	1,941	143.30	April 30, 2022

The following table shows the basis for determining the multi-year performance target achievement level under the Restricted Stock Plan (RSP):

[T34] Entitlements granted in respect of variable compensation (in %)

	2019	2018	2017	2016	2015
STI	180.00	160.80	180.00	153.81	170.61
RSP/LTI	164.87	168.14	157.86	138.51	

Compensation of individual members of the Executive Board

Benefits granted (target figures) for the reporting period (GCGC)

In accordance with the recommendations of the GCGC (model table), the following table shows benefits granted for the fiscal years 2019 and 2018 based on 100% target achievement as well as the minimum and maximum amounts achievable for the fiscal year 2019.

For the reporting period, the service cost reported and the level of provisions recognized for post-employment benefits arising from the pension commitments to all members of the Executive Board were determined on the basis of the present value, which is calculated pro rata with a diminishing balance; in the previous year, the pension commitments made to Lars Wagner were recognized at the present value of the benefits accumulated, given his shorter period of service.

[T35] Benefits granted

Reiner Winkler
Chief Executive Officer

Individual data in €	2019	2019 (min.)	2019 (max.)	2018
Fixed compensation	924,000	924,000	924,000	787,500
Fringe benefits ¹⁾	25,848	25,848	25,848	25,400
Total	949,848	949,848	949,848	812,900
STI	665,000		1,436,400	567,000
RSP/LTI	911,000		1,639,800	777,000
Total fixed and variable compensation	2,525,848	949,848	4,026,048	2,156,900
Service cost in accordance with IAS 19	76,928	76,928	76,928	668,202 ²⁾
Total compensation (German Corporate Governance Code)	2,602,776	1,026,776	4,102,976	2,825,102

Peter Kameritsch
Chief Financial Officer and Chief Information Officer

Individual data in €	2019	2019 (min.)	2019 (max.)	2018
Fixed compensation	525,000	525,000	525,000	360,000
Fringe benefits ¹⁾	19,666	19,666	19,666	19,195
Total	544,666	544,666	544,666	379,195
STI	325,500		703,080	225,000
RSP/LTI	483,000		869,400	315,000
Total fixed and variable compensation	1,353,166	544,666	2,117,146	919,195
Service cost in accordance with IAS 19	127,851	127,851	127,851	1,918,064 ³⁾
Total compensation (German Corporate Governance Code)	1,481,017	672,517	2,244,997	2,837,259

Michael Schreyögg
Chief Program Officer

Individual data in €	2019	2019 (min.)	2019 (max.)	2018
Fixed compensation	525,000	525,000	525,000	525,000
Fringe benefits ¹⁾	33,500	33,500	33,500	34,395
Total	558,500	558,500	558,500	559,395
STI	325,500		703,080	325,500
RSP/LTI	483,000		869,400	483,000
Total fixed and variable compensation	1,367,000	558,500	2,130,980	1,367,895
Service cost in accordance with IAS 19	116,682	116,682	116,682	116,468
Total compensation (German Corporate Governance Code)	1,483,682	675,182	2,247,662	1,484,363

Lars Wagner
Chief Operating Officer

Individual data in €	2019	2019 (min.)	2019 (max.)	2018
Fixed compensation	525,000	525,000	525,000	360,000
Fringe benefits ¹⁾	12,097	12,097	12,097	15,110
Total	537,097	537,097	537,097	375,110
STI	325,500		703,080	225,000
RSP/LTI	483,000		869,400	315,000
Total fixed and variable compensation	1,345,597	537,097	2,109,577	915,110
Service cost in accordance with IAS 19 ⁴⁾	465,979	465,979	465,979	383,060 ³⁾
Total compensation (German Corporate Governance Code)	1,811,576	1,003,076	2,575,556	1,298,170

¹⁾ Fringe benefits comprise the cash equivalent of additions to compensation covering the personal use of company vehicles amounting to €84,273 (previous year: €88,166) and premiums for insurance policies taken out on behalf of members of the Executive Board amounting to €6,838 (previous year: €5,934).

²⁾ One-year variable compensation.

³⁾ Multi-year variable compensation.

⁴⁾ Including past service cost reflecting an improved commitment from Jan. 1, 2019.

⁵⁾ Including past service cost reflecting a new commitment and an improved commitment from Jan. 1, 2019.

⁶⁾ In the previous year, the pension commitments made to Lars Wagner were recognized at the present value of the benefits accumulated, given his shorter period of service; since the provision is measured on the basis of present value calculated pro rata with a diminishing balance, this will lead to an increase in pension plan expense in subsequent periods.

[T36] Prerequisites for achieving the maximum amounts of variable compensation granted in 2019

One-year variable compensation

STI	Target achievement for adjusted EBIT Target achievement for free cash flow
	Arithmetic mean of both figures 115% (payment percentage of 180%) and exceptional performance bonus/penalty of up to 20% in accordance with the German Corporate Governance Code

Multi-year variable compensation

RSP/LTI	STI entitlement 180% for each of the 3 years prior to grant date
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Compensation for the reporting period (Section 314 (1) no. 6a of the German Commercial Code [HGB]) and benefits granted in the reporting period (GCGC)

The members of the Executive Board received total compensation within the meaning of Section 314 of the German Commercial Code (HGB) amounting to €9.4 million (previous year: €7.5 million) for the fiscal year 2019. Of this amount, €2.6 million (previous year: €2.1 million) was non-performance-related and €6.8 million (previous year: €5.4 million) was performance-related.

The table below discloses the total compensation for individual Executive Board members pursuant to Section 314 (1) no. 6a of the German Commercial Code (HGB) as well as the actual fixed and variable compensation granted and the service cost in accordance with the GCGC's recommendations (model table) for the fiscal years 2019 and 2018:

[T37] Total compensation (German Commercial Code)/allocation (German Corporate Governance Code)

Members of the Executive Board	Reiner Winkler Chief Executive Officer		Peter Kameritsch Chief Financial Officer and Chief Information Officer		Michael Schreyögg Chief Program Officer		Lars Wagner Chief Operating Officer	
	2019	2018	2019	2018	2019	2018	2019	2018
in €								
Fixed compensation	924,000	787,500	525,000	360,000	525,000	525,000	525,000	360,000
Fringe benefits ¹⁾	25,848	25,400	19,666	19,195	33,500	34,395	12,097	15,110
Total	949,848	812,900	544,666	379,195	558,500	559,395	537,097	375,110
STI ²⁾	1,197,000	911,736	585,900	361,800	585,900	523,404	585,900	361,800
RSP/LTI	1,501,966	1,306,448	796,322	529,641	796,322	812,116	796,322	529,641
Total fixed and variable compensation (total compensation in accordance with Section 314 (1) no. 6a of the German Commercial Code)	3,648,814	3,031,084	1,926,888	1,270,636	1,940,722	1,894,915	1,919,319	1,266,551
Service cost in accordance with IAS 19 ³⁾	76,928	668,202 ⁴⁾	127,851	1,918,064 ⁵⁾	116,682	116,468	465,979 ³⁾	383,060 ⁵⁾
Total compensation (German Corporate Governance Code)	3,725,742	3,699,286	2,054,739	3,188,700	2,057,404	2,011,383	2,385,298	1,649,611

¹⁾ Fringe benefits include charges to taxable income covering personal use of company vehicles amounting to €84,273 (previous year: €88,166) and premiums for insurance policies taken out on behalf of members of the Executive Board amounting to €6,838 (previous year: €5,934).

²⁾ The amount reported for the one-year variable compensation corresponds to the amount promised for 2019, to be paid out in 2020 after adoption of the annual financial statements.

³⁾ Multi-year variable compensation.

⁴⁾ In the previous year, the pension commitments made to Lars Wagner

were recognized at the present value of the benefits accumulated, given his shorter period of service; since the provision is measured on the basis of present value calculated pro rata with a diminishing balance, this will lead to an increase in pension plan expense in subsequent periods.

⁵⁾ Including past service cost reflecting an improved commitment from Jan. 1, 2019.

⁶⁾ Including past service cost reflecting a new commitment and an improved commitment from Jan. 1, 2019.

Members of the Executive Board did not receive any compensation for board appointments in group-owned companies. The group did not grant any loans to members of the Executive Board in the reporting period or the previous year.

Rules when terminating the contracts of members of the Executive Board

The members of the Executive Board are given defined benefit commitments whose structure corresponds to that of pension commitments for members of governing bodies of peer-group companies.

Retirement and survivors' pensions

The members of the Executive Board earn company pension entitlements in accordance with the "MTU Pension Capital" plan, which governs the post-employment benefits for members of the Executive Board of MTU Aero Engines AG. The benefit target is to provide a pension amounting to 60% of the basic salary after 15 years of service on the Executive Board. When the previous plan was replaced, the benefits earned up until December 31, 2009, were transferred to the new plan as the initial transfer amount. This entitlement represents the benefits payable under the old plan at the age of 60, adjusted by the ratio of actual years of service with the group to the number of years from joining the group until the age of 60. The initial transfer amount corresponds to the pension equivalent converted into a one-time capital amount.

Once the initial transfer amount has been determined, a pension account is opened for each member of the Executive Board, to which further capital units are credited annually. The annual capital units are determined on the

basis of the individual Executive Board member's contribution and an age-related factor. The age-related factor represents an interest rate of 6% p.a. until the age of 60. The contribution period is normally limited to 15 years of service on the Executive Board and ends at the age of 60. From the age of 61, the pension account earns interest at 4% p.a. until the pension is drawn (= bonus amount). The total of accrued capital units, plus the initial transfer amount and any bonus amounts credited, make up the pension capital available to finance post-employment benefits. If a member of the Executive Board dies before reaching the age of 60, 50% of the benefits earnable up to the fixed age limit are added to the accrued balance on the pension account, taking into account the promised contribution period.

When an insured event occurs, the pension capital is generally granted as a one-time payment. However, at the request of the Executive Board member and subject to the group's approval, the balance accumulated on the pension account may either be drawn as capital in ten installments (with a 4% increase in the balance accumulated) or as a life annuity with annual increments of 1%. When an insured event occurs, the pension account is topped up to the level of benefit commitment under the previous plan (guaranteed capital). Pension benefits do not become payable until an insured event occurs (i.e., on reaching pensionable age, or in the event of disability or death), even if the insured party leaves the Executive Board. The pension entitlement is vested from inception.

Basic details of the above-mentioned commitments and benefits are shown in the following table:

[T38] Existing post-employment benefit entitlements

Members of the Executive Board in €	Initial transfer amount ¹⁾	Guaranteed capital ²⁾	Annual contribution	End of contribution period	One-time payment
Reiner Winkler	1,625,140 ³⁾	2,510,788	400,000	Aug. 1, 2021 ⁴⁾	8,537,538 ⁵⁾
Peter Kameritsch	461,573	461,573	226,027	April 1, 2029	4,324,204
Michael Schreyögg	365,627	365,627	215,478	Aug. 1, 2026	4,801,945
Lars Wagner	207,344	207,344	211,965	Jan. 1, 2033	6,791,104

¹⁾ Credit for past service up to date of changeover to new system. Reiner Winkler: Dec. 31, 2009; Michael Schreyögg: July 1, 2013; Peter Kameritsch and Lars Wagner: Jan. 1, 2018.

²⁾ Level of benefits to which the insured party would have been entitled under the previous pension plan.

³⁾ Reiner Winkler had already been promised under the previous pension plan that his years of service with former group companies would count toward his pension. In connection with the transfer of his pension entitlements to the new plan, he was promised a special transfer amount of €575,065 in 2010.

⁴⁾ As part of the contract extension in 2018, the contribution period was extended to the age of 60.

⁵⁾ With interest cost of 4% p.a., the one-time payment at the end of the settlement period on September 30, 2024, will amount to €9,511,228.

The differences in the annual contributions to the pension accounts result from the remaining periods of service until the end of the respective contribution period, the respective age-related factors, and the individual amounts of pensionable compensation.

The following table shows the service cost for the fiscal years 2019 and 2018, and the corresponding levels of provisions, recognized in accordance with IFRSs and the German Commercial Code (HGB) for members of the Executive Board:

[T39] Allocations to pension provisions and total amounts recognized

	Year	Service cost (IFRSs)	Service cost (German Commercial Code)	Carrying amount of pension provisions as of Dec. 31 (IFRSs)	Carrying amount of pension provisions as of Dec. 31 (German Commercial Code)
Members of the Executive Board					
in €					
Reiner Winkler	2019	76,928	71,010	8,142,654	7,349,686
	2018	668,202 ²⁾	246,519	7,620,475	6,890,376
Peter Kameritsch ¹⁾	2019	127,851	110,627	3,738,115	3,086,058
	2018	1,918,064 ³⁾	1,647,618	3,274,661	2,746,169
Michael Schreyögg	2019	116,682	103,850	3,859,434	3,363,355
	2018	116,468	98,026	3,477,192	3,051,934
Lars Wagner ¹⁾	2019	465,979	356,922	1,518,331	1,107,808
	2018	383,060 ³⁾	293,705	687,282	522,105
Total	2019	787,440	642,409	17,258,534	14,906,907
Total	2018	3,085,794	2,285,868	15,059,610	13,210,584

¹⁾ Member of the Executive Board since Jan. 1, 2018.

²⁾ Including past service cost reflecting an improved commitment from Jan. 1, 2019.

³⁾ Including past service cost reflecting a new commitment and an improved commitment from Jan. 1, 2019.

The defined benefit obligations for former members of the Executive Board, measured in accordance with International Financial Reporting Standards (IFRSs), amount to €18,372,009 (previous year: €16,262,628).

Disability

Under the rules of January 1, 2010, if a member of the Executive Board becomes disabled before reaching the age of 60, 50% of the benefits earnable up to the maximum age limit are added to the balance on the pension account from the time of disablement. The amount credited is based on the contribution paid at the time of exit.

Severance payments on premature termination of contracts of service with members of the Executive Board

Members of the Executive Board whose contract of service is terminated prematurely by MTU are entitled to receive a severance payment equivalent to the total of the prorated basic salary, prorated short-term incentive (STI) and prorated compensation under the Restricted Stock Plan (RSP) for the original remaining term of their contract. The severance payment is capped at twice the departing Executive Board member's total annual compensation. If the contract of service is terminated by MTU for cause, no severance package is paid. In such cases, MTU also has the right to demand the repayment of the RSP tranche granted in the fiscal year in which the contract was terminated (clawback). No other clawback regulations are applied because the German Stock Corporation Act (Section 93 of the AktG) already provides for damage claims against members of the Executive Board who breach their duties.

Severance payments on premature termination of contracts of service with members of the Executive Board in the event of a change of control or changes of shareholders of MTU Aero Engines AG

Under the contracts of service for members of the Executive Board in effect since January 1, 2016, a change of control is deemed to have occurred if a shareholder, alone or on the basis of the voting rights attributable to him or her pursuant to Section 22 of the German Securities Trading Act (WpHG), acquires the majority of the voting rights and this results in significant disadvantages for the Executive Board. Material disadvantages are, in particular, if the Executive Board member is removed, if his/her responsibilities and duties are significantly altered, or if the Executive Board member is asked to accept a reduction in employment benefits or to agree to premature termination of his/her contract of service. In such case, each member of the Executive Board shall have a special right of termination, which is to be exercised within a period of six months, with a period of notice of three months to the end of a month. If a member of the Executive Board makes use of his/her special right of termination, or if the Executive Board member's contract of service is terminated by mutual consent within nine months of the change of control, the Executive Board member receives a severance payment corresponding to the benefits still to be awarded up to the end of the contract term originally agreed. For the calculation of the severance payment, 100% target fulfillment is agreed for the variable compensation components. The maximum amount of the severance payment is capped at three times the total annual compensation.

Compensation of the Supervisory Board

The rules governing Supervisory Board compensation are laid down in the articles of association of MTU Aero Engines AG. The compensation is relative to the size of the group and the duties and responsibilities of the Supervisory Board members.

Pursuant to Article 12 of the articles of association of MTU Aero Engines AG, members of the Supervisory Board receive fixed annual compensation of €50,000, payable at the end of the fiscal year. The chair of the Supervisory Board receives three times and the deputy one-and-a-half times the amount of fixed compensation. In addition to this compensation, members serving on one of the Supervisory Board's committees receive an additional €10,000 and a further €20,000 if they chair a committee. Furthermore, members of the Supervisory Board receive an attendance fee of €3,000 per meeting of the Supervisory Board and its committees, limited to €3,000 per day. The attendance fee is halved for meetings convened by the chair or deputy chair if they are conducted by means of telecommunication (telephone or video conference). Expenses incurred in connection with the exercise of their office are reimbursed, as is the value-added tax payable on compensation.

The members of the Supervisory Board do not receive any share-based compensation.

The following compensation was awarded to members of the Supervisory Board of MTU Aero Engines AG for the fiscal years 2019 and 2018:

[T40] Compensation of the Supervisory Board

Supervisory Board members	2019 ¹⁾				2018 ¹⁾			
	Fixed annual payment	Compensation for membership in committee	Attendance fees	Total compensation	Fixed annual payment	Compensation for membership in committee	Attendance fees	Total compensation
Klaus Eberhardt (Chairman of the Supervisory Board, Personnel Committee and Nomination Committee) ³⁾	150,000.00	50,000.00	28,500.00	228,500.00	150,000.00	50,000.00	27,000.00	227,000.00
Josef Mailer (Deputy Chairman of the Supervisory Board) ^{2) 3) 5)}	75,000.00	20,000.00	25,500.00	120,500.00	75,000.00	20,000.00	27,000.00	122,000.00
Dr. Joachim Rauhut (Audit Committee Chairman)	50,000.00	30,000.00	25,500.00	105,500.00	50,000.00	30,000.00	24,000.00	104,000.00
Roberto Armellini (since June 13, 2019) ^{2) 5)}	27,500.00	5,500.00	9,000.00	42,000.00				
Thomas Bauer (until April 11, 2018)					14,027.78		6,000.00	20,027.78
Michael Behé (until April 11, 2018) ⁵⁾					14,027.78		6,000.00	20,027.78
Dr. Wilhelm Bender (until April 11, 2018)					14,027.78		6,000.00	20,027.78
Dr. Christine Bortenlänger (since April 11, 2018)	50,000.00		15,000.00	65,000.00	36,111.11		12,000.00	48,111.11
Thomas Dautl	50,000.00		15,000.00	65,000.00	50,000.00		15,000.00	65,000.00
Dr.-Ing. Jürgen M. Geißinger ^{2) 4)}	50,000.00	20,000.00	15,000.00	85,000.00	50,000.00	20,000.00	18,000.00	88,000.00
Angelo Gross (since April 11, 2018) ⁵⁾	50,000.00		15,000.00	65,000.00	36,111.11		12,000.00	48,111.11
Anita Heimerl (since July 17, 2018) ⁵⁾	50,000.00		15,000.00	65,000.00	22,777.78		9,000.00	31,777.78
Dr. Martin Kimmich (until May 31, 2019) ^{2) 5)}	20,833.33	4,166.67	6,000.00	31,000.00	50,000.00	10,000.00	18,000.00	78,000.00
Heike Madan ^{3) 5)}	50,000.00	10,000.00	25,500.00	85,500.00	50,000.00	10,000.00	24,000.00	84,000.00
Prof. Dr.-Ing. Klaus Steffens	50,000.00		15,000.00	65,000.00	50,000.00		15,000.00	65,000.00
Prof. Dr. Marion A. Weissenberger-Eibl	50,000.00		15,000.00	65,000.00	50,000.00		15,000.00	65,000.00
Total	723,333.33	139,666.67	225,000.00	1,088,000.00	712,083.34	140,000.00	234,000.00	1,086,083.34

¹⁾ Amounts do not include VAT.

²⁾ Member of the Personnel Committee.

⁵⁾ These employee representatives have declared that they will donate their Supervisory Board compensation to the Hans-Böckler-Stiftung, in accordance with the guidelines of the Confederation of German Trade Unions.

³⁾ Member of the Audit Committee.

⁴⁾ Member of the Nomination Committee.

Internal control and risk management system for the group accounting process

The current recommendations of German Accounting Standard (GAS) 20 have been applied in this section of the combined management report concerning the main features of the accounting-related internal control and risk management system.

Objectives and components

MTU's Executive Board, Supervisory Board and Audit Committee attach the greatest importance to ensuring the regularity, accuracy and reliability of MTU's financial reporting. The accounting-related internal control and risk management system applicable for the MTU Group's financial statements helps ensure systematic compliance with these internal and external accounting requirements. The Executive Board of MTU bears overall responsibility for establishing and refining the required control and monitoring systems. The systems are tailored to the MTU Group's business model and company-specific requirements, and are an important part of the comprehensive approach to corporate governance that defines the basic framework for creating sustainable value for shareholders, customers, employees and the public.

- / The accounting-related risk management system (RMS) is an integral part of the group's company-wide risk management system. It forms the basis for the uniform and appropriate handling of risks and for communicating them within the group. The risks inherent in the group's financial reporting are among the corporate risks to be monitored as a whole. The design of the accounting-related internal control system (ICS) at MTU meets the requirements of the German Accounting Law Modernization Act (BilMoG), the definition provided by the Institute of Public Auditors in Germany (Institut der Wirtschaftsprüfer e.V. - IDW), the internationally recognized and established framework of the Committee of Sponsoring Organizations of the Treadway Commission (COSO I), and the features specific to MTU. MTU understands an ICS to be the principles, procedures and measures introduced at the company by its management that are aimed at the organizational implementation of management decisions:
 - to safeguard the effectiveness and economic efficiency of business operations – which includes protecting the company's assets,
 - to ensure the regularity and reliability of internal and external accounting, and
 - to comply with statutory regulations relevant to the company.
- / The internal auditing system, which is process-independent, plays an important role in checking the effectiveness of, and improving, the accounting-related

- ICS and RMS. The internal audit function at MTU assesses, and helps to enhance, the controlling and monitoring systems. It is also considered to have an advisory function, contributing to improving business processes and, ultimately, the effectiveness of the internal control system. The rules of procedure of the internal audit function comply with national and international requirements as laid down by the Deutsches Institut für Interne Revision and the Institute of Internal Auditors. The internal audit function is also bound by the code of professional ethics. The administrative standards of the internal audit function are accessible to all employees on MTU's intranet.
- / The Audit Committee of the Supervisory Board discusses risk management and the audits by the internal audit function. In accordance with Section 107 (3) of the German Stock Corporation Act (AktG), as amended by the German Accounting Law Modernization Act (BilMoG), the Audit Committee is also responsible for monitoring the effectiveness of the risk management system, the internal control systems, the internal auditing systems, the financial reporting process and the audit of the financial statements.

Main features

- / MTU has a clearly defined management and corporate structure. Key functions spanning more than one organizational unit are managed centrally. The subsidiaries nevertheless enjoy an adequate level of autonomy.
- / The integrity and responsibility of all employees, also in terms of finance and financial reporting, are ensured by their undertaking to observe the group-wide Code of Conduct.
- / An adequate system of guidelines has been drawn up and is updated as required.
- / The departments and other organizational units involved in the accounting process are suitably equipped and regularly trained both in quantitative and qualitative terms.
- / The IT systems are protected against unauthorized access by appropriate installations in the IT area. As far as possible, standard software is used in the finance systems. As part of the comprehensive IT strategy and architecture, the IT system's application controls are subject to regular internal and external reviews based on a high level of automatic (plausibility) checks. The general IT controls are checked during internal and external IT audits.
- / Controls are in place for accounting-relevant processes, including dual control comprising detailed analytical checks and programmed plausibility checks on the accounting and consolidation process.
- / The consolidated financial statements and all significant financial data submitted for inclusion by the group companies are audited by an external auditor once a year. The same auditor also reviews the condensed consolidated financial statements and interim group management report in the half-year financial report.
- / In addition, accounting-relevant processes are checked by the process-independent internal audit function.
- / The subsidiaries submit their annual and monthly financial statements directly to the group accounting department. This information is used to prepare the consolidated financial statements in accordance with IFRSs, which are compiled in consultation with the business administration departments at the group companies.
- / The financial data communicated by the group companies for inclusion in the consolidated financial statements are processed and validated on a decentralized basis by the respective business administration departments on the basis of the group-wide reporting guidelines. As a supplementary control measure, (plausibility) checks on the reported data are carried out by the group accounting department during the compilation of its monthly reports and during the consolidation process for the consolidated financial statements.
- / The group accounting department is also the central point of contact for financial reporting issues at group level or within individual subsidiaries and joint ventures. If necessary, external consultants are called on for support.
- / All subsidiaries and joint ventures are required to report their business figures to the group in a standardized reporting format on a monthly basis, and the reported data are compared with the planning figures to ensure timely identification of discrepancies between the planned and actual figures. This allows timely identification of undesirable developments and risks so countermeasures can be taken if necessary.

Disclosures under takeover law

The following disclosures are made pursuant to Section 315a of the German Commercial Code (HGB) (takeover directive implementation). Items included in Section 315a of the German Commercial Code (HGB) that are not met at MTU Aero Engines AG are not mentioned here.

Composition of subscribed capital

The company's subscribed capital (capital stock) amounts to €53,093,867 and is divided into 53,093,867 registered non-par-value shares. The shares are registered shares. All shares have equal rights and each share entitles the holder to one vote at the Annual General Meeting.

Restrictions on voting rights and the transfer of share ownership

As of December 31, 2019, MTU held 243,070 treasury shares (previous year: 365,773). No voting rights are exercised in respect of treasury shares. The articles of association of MTU Aero Engines AG do not contain any restrictions on voting rights or the transfer of share ownership. The Executive Board has no knowledge of any agreement between shareholders that could give rise to any such restrictions.

Rules governing the appointment and dismissal of members of the Executive Board and amendments to the company's articles of association

The rules for the appointment and dismissal of members of the Executive Board are based on Sections 84 and 85 of the German Stock Corporation Act (AktG) and Section 31 of the German Codetermination Act (MitbestG) in conjunction with Article 5 of the company's articles of association.

All amendments to the articles of association require a resolution by the Annual General Meeting with a majority of at least three quarters of the voting stock attending, pursuant to Section 179 of the German Stock Corporation Act (AktG). The right to add amendments of a purely formal nature, for instance changes to the share capital as the result of utilization of the authorized capital, is devolved to the Supervisory Board under the terms of Article 13 of the articles of association.

Authorizations conferred on the Executive Board, especially concerning the issue and purchase of shares

Authorized capital

In accordance with Article 4 (5) of the articles of association, the Executive Board is authorized until April 10, 2024, to increase the company's capital stock by up to €15.6 million, with the prior approval of the Supervisory Board, by issuing, either in a single step or in several steps, new registered non-par-value shares in return for cash contributions (Authorized Capital 2019).

Conditional capital

In accordance with Article 4 (6) of the articles of association, the company's capital stock may be conditionally increased by up to €5.2 million through the issue of up to 5,200,000 new registered non-par-value shares. The purpose of this conditional capital increase is to issue shares to owners or creditors of convertible bonds and/or bonds with warrants in accordance with the authorization granted to the company under a resolution passed by the Annual General Meeting on April 15, 2015. Shares are issued at a conversion price or warrant exercise price determined on the basis of this authorization.

The Executive Board is authorized until April 14, 2020, to issue, in a single step or in several steps and with the prior approval of the Supervisory Board, bearer and/or registered convertible bonds and/or bonds with warrants (collectively referred to as "bonds"), with or without maturity date, with a total nominal value of up to €500 million, and to grant the owners of convertible bonds and/or bonds with warrants the right, obligation or option to convert them into registered non-par-value shares of the company representing a stake in the capital stock of up to €5.2 million under the conditions established for the issue of convertible bonds or bonds with warrants. The bonds may be issued in return for cash contributions only. They may be issued in euros or – to an equivalent value – in any other legal currency, for instance that of an OECD country. They may also be issued by an affiliated company where MTU exercises control. In such cases, and subject to the prior approval of the Supervisory Board, the Executive Board is authorized to act as guarantor for the bonds, and to grant the owners of the bonds the right, obligation or option to convert them into new registered non-par-value shares in MTU. In 2016, MTU made use of this authorization to increase the company's capital stock by issuing a convertible bond with a nominal value of €500 million.

Further, in accordance with Article 4 (7) of the articles of association, the company's capital stock may be conditionally increased by up to €2.6 million through the issue of up to 2,600,000 new registered non-par-value shares (Conditional Capital 2019). The purpose of this conditional capital increase is to issue shares to owners or creditors of convertible bonds and/or bonds with warrants in accordance with the authorization granted to the company under a resolution passed by the Annual General Meeting on April 11, 2019. Shares are issued at a conversion price or warrant exercise price determined on the basis of this authorization.

The Executive Board is authorized until April 10, 2024, to issue, in a single step or in several steps and with the prior approval of the Supervisory Board, bearer and/or registered convertible bonds and/or bonds with warrants (collectively referred to as "bonds"), with or without maturity date, with a total nominal value of up to €600 million, and to grant the owners of convertible bonds and/or bonds with warrants the right, obligation or option to convert them into registered non-par-value shares of the company representing a stake in the capital stock of up to €2.6 million under the conditions established for the issue of convertible bonds or bonds with warrants. The bonds may be issued in return for cash contributions only. They may be issued in euros or – to an equivalent value – in any other legal currency, for instance that of an OECD country. They may also be issued by an affiliated company where MTU exercises control. In such cases, and subject to the prior approval of the Supervisory Board, the Executive Board is authorized to act as guarantor for the bonds, and to grant the owners of the bonds the right, obligation or option to convert them into new registered non-par-value shares in MTU.

In 2019, MTU made use of this authorization to increase the company's capital stock by issuing a convertible bond with a nominal value of €500 million.

For more information about this bond issue, please refer to the section of the Combined management report dealing with the financial position, and to [Note 28 to the Consolidated financial statements "Financial liabilities."](#)

Resolution concerning the authorization to purchase and use treasury shares pursuant to Section 71 (1) no. 8 of the German Stock Corporation Act (AktG) and to exclude subscription rights

Under the resolution adopted at the Annual General Meeting on April 11, 2019, the company received the following authorizations:

a) The company was authorized to purchase treasury shares accounting for a proportion of up to 10% of the company's capital stock, as applicable on the date of the resolution, during the period from April 11, 2019, through April 10, 2024, pursuant to Section 71 (1) no. 8 of the German Stock Corporation Act (AktG). At no point in time may the value of the acquired shares, together with other treasury shares in the company's possession or which are attributed to it pursuant to Section 71a et seq. of the German Stock Corporation Act (AktG), exceed 10% of the company's capital stock. At the discretion of the Executive Board, the shares may be purchased through the stock exchange or by means of a public offer to buy addressed to all shareholders (or – where permitted by law – through a public call to submit a sell offer).

The shares must be sold in return for proceeds that are not more than 10% above or below the quoted share price, net of any supplementary transaction charges. In the case of a sale through the stock exchange, the reference for the quoted share price as defined above is the average value of share prices in the closing auction of Xetra trading (or a comparable successor system) on the last three trading days prior to the purchase of the shares. In the case of shares purchased by means of a public offer to buy addressed to all shareholders (or a public call to submit a sell offer), the reference for the quoted share price is the average value of share prices in the closing auction of Xetra trading (or a comparable successor system) on the last three trading days prior to publication of the offer. In the event of substantial fluctuations in the share price, the Executive Board is authorized to publish a new public offer to buy or a public call to submit a sell offer based on a recalculated average value of share prices computed as outlined in the previous sentence.

The volume of the offer can be limited in the case of shares purchased by means of a public offer to buy addressed to all shareholders (or a public call to submit a sell offer). If the whole take-up of the offer (or the total number of offers) exceeds this volume, the purchase must be transacted in proportion to the number of shares offered. Preferential treatment may be given to small packages (up to 100 shares) offered for sale. Further conditions may be imposed in the offer or call to submit offers.

b) The Executive Board was authorized to sell the purchased treasury shares in a manner other than through the stock exchange or by means of a public offer addressed to all shareholders on the condition that the shares are sold in return for cash payment at a price that is not significantly below the stock market price of similarly entitled shares of the company at the time of sale. However, this authorization shall apply only on the condition that the shares sold excluding subscription rights pursuant to Section 186 (3) sentence 4 of the German Stock Corporation Act (AktG) do not exceed a total amount of 5% of the company's capital stock when this authorization becomes effective or – if such value is lower – when this authorization is exercised. This limit of 5% of the capital stock shall also include option rights and/or conversion rights on shares of the company which are issued during this authorization, i.e. since April 11, 2019, excluding subscription rights in mutatis mutandis application of Section 186 (3) sentence 4 of the German Stock Corporation Act (AktG), as well as the issue or sale of treasury shares without subscription rights pursuant to Section 186 (3) sentence 4 of the German Stock Corporation Act (AktG).

c) The Executive Board was authorized to use the purchased treasury shares in a manner other than through the stock exchange or by means of an offer addressed to all shareholders if the treasury shares are issued to program participants in conjunction with the company's stock option programs and those participants are, or were, employees or service providers of the company or one of its affiliated companies. If shares are to be used by issuing them to active or former members of the MTU Executive Board under the terms of the company's stock option programs, the Supervisory Board is authorized to transact this issue.

d) Furthermore, the Executive Board was authorized to use the purchased treasury shares as partial or complete payment in conjunction with business combinations or the acquisition, whether direct or indirect, of companies, parts of companies or holdings in companies.

e) The Executive Board was also authorized, with the consent of the Supervisory Board, to use the purchased treasury shares to exercise conversion rights or discharge conversion obligations relating to convertible bonds, bonds with warrants, profit participation certificates or income bonds (or combinations of such instruments) issued by the company or by a dependent affiliated company.

- f) The Executive Board was moreover authorized, with the consent of the Supervisory Board and without any requirement for a further resolution to be passed by the Annual General Meeting, to redeem purchased treasury shares in whole or in part. They may be redeemed in a simplified procedure without any capital reduction and by adapting the arithmetic value of the outstanding portion of non-par-value shares to that of the company's stock capital. The redemption may be limited to a defined fraction of the purchased shares. The authorization to redeem shares may be used on one or more occasions. If the simplified procedure is employed, the Executive Board is authorized to amend the number of non-par-value shares stated in the articles of association.
- g) The above-stated authorizations may be exercised on one or more occasions, in whole or in part, individually or in combination. They may also be exercised by group companies as defined in Section 17 of the German Stock Corporation Act (AktG).
- h) The subscription rights of existing shareholders in respect of these treasury shares are excluded insofar as the shares are utilized in the manner stated above in subsections b) to e).
- i) The authorization to purchase treasury shares granted to the company on April 15, 2015, is revoked as of the effective date of this new authorization. The authorization to use the treasury shares purchased under the terms of the above-mentioned earlier resolution dated April 15, 2015, remains in force.

Material agreements relating to change of control subsequent to a takeover bid

MTU Aero Engines AG issued a registered bond in June 2013 and a note purchase agreement in March 2014. These grant the creditor a right of early repayment in the event that a third party assumes control of over 50% of the company's share capital with voting rights and this has a negative impact on the company's credit rating.

The convertible bond issued by MTU Aero Engines AG in May 2016 contains the provisions summarized below with regard to a change of control: In the event of a change of control, the bond terms grant bondholders the right to exercise their conversion right within a specific period of time at an adjusted conversion rate. In the event of a change of control, bondholders can redeem their bonds prematurely at the terms described in more detail in the bond conditions. A "change of control" shall be deemed to be when control is acquired or a mandatory takeover offer is published pursuant to Section 35 (2) sentence 1, Section 14 (2) sentence 1 of the German Securities Acquisition and Takeover Act (WpÜG) or, in the case of a voluntary takeover offer, if more than 30% of MTU Aero Engines AG's voting rights are legally or beneficially owned by the bidder or attributed to it pursuant to the bond conditions. If one or more persons within the meaning of Section 22 (2) of the German Securities Trading Act (WpHG) (old version) acquire(s) 50% of the voting rights of MTU Aero Engines AG, this shall represent an "acquisition of control."

The convertible bond issued by MTU Aero Engines AG in September 2019 contains the provisions summarized below with regard to a change of control: In the event of a change of control, the bond terms grant bondholders the right to exercise their conversion right within a specific period of time at an adjusted conversion rate. In the event of a change of control, bondholders can redeem their bonds prematurely at the terms described in more detail in the bond conditions. A "change of control" comprises the acquisition of control or a mandatory offer under Section 35 (2) sentence 1 and Section 14 (2) sentence 1 of the German Securities Trading Act (WpHG). If one or more persons within the meaning of Section 29 (2) and Section 30 of the Securities Acquisition and Takeover Act (WpÜG) acquire(s) 50% of the voting rights of MTU Aero Engines AG, this shall represent an "acquisition of control."

In October 2013, MTU Aero Engines AG agreed a revolving credit facility with a banking syndicate (extended in September 2018), which provides for a right of termination for the lenders in the event that one or more persons assume(s) control of MTU Aero Engines AG or acquire(s) more than 50% of the company's issued capital.

MTU Aero Engines AG has risk and revenue sharing agreements with an engine manufacturer containing clauses that allow the risk and revenue sharing agreement to be converted into a long-term supplier contract in the event that a material competitor of the contracting party acquires control of 25% or more of the company's voting rights or assets.

In addition, MTU Aero Engines AG has a cooperation agreement with another engine manufacturer. Under this agreement, that manufacturer is entitled to terminate the contract for cause in the event that one of its competitors acquires more than 50% of the company's voting rights. MTU Aero Engines AG has further cooperation agreements with the same engine manufacturer. Under these agreements, that manufacturer is entitled to terminate the contract for cause in the event that one of its competitors acquires more than 30% of the company's voting rights.

MTU Aero Engines AG also has equity investments in various joint ventures with other engine manufacturers, the purpose of which is to cooperate in the development and production of aircraft engines. According to the provisions of the corresponding agreements, MTU Aero Engines AG's share in the joint venture may be withdrawn and its participation in the accompanying cooperation agreements terminated if MTU Aero Engines AG is taken over by a competitor of the partners in these consortia.

It is standard market practice to confer contractual rights of this kind. Should an event meeting any of the above definitions of change of control take place, the exercise of rights ensuing from these agreements could have a substantial impact on MTU's net assets, financial position or results of operations.

Other agreements

Agreements on compensation in the event of a takeover bid

Pursuant to the Executive Board contracts in effect since January 1, 2016, a change of control is deemed to have occurred when a shareholder acquires a majority interest in the company and this entails material disadvantages for members of the Executive Board. Material disadvantages are, in particular, if the Executive Board member is dismissed, if his/her responsibilities and duties are significantly altered, or if the Executive Board member is asked to accept a reduction in employment benefits or to agree to premature termination of his/her contract. In such case, each member of the Executive Board shall have a special right of termination, which is to be exercised within a period of six months, with a period of notice of three months to the end of a month. If a member of the Executive Board makes use of this right, or if the executive employment contract is terminated by mutual consent within nine months after the change of control, the Executive Board member shall receive a severance payment corresponding to the benefits that would otherwise have been awarded up to the date on which the contract would normally have expired. For the calculation of the severance payment, 100% target fulfillment is agreed for the variable compensation components. The maximum amount of the severance payment is limited to three times the target annual direct compensation.

No comparable agreements have been made with regard to other employees.

Other disclosures

Non-financial statement

This non-financial statement of MTU Aero Engines in accordance with the German CSR Directive Implementation Act (CSR-RUG) provides information on material non-financial topics relating to the fiscal year 2019. This is a condensed non-financial statement in accordance with Sections 289b et seq. and Sections 315b et seq. of the German Commercial Code (HGB). It contains disclosures relating to MTU Aero Engines AG as the parent company, as well as information relating to the MTU Group. The structure of the group is described in the [Combined management report under "The MTU Group."](#)

In addition, in early summer, the company publishes a separate sustainability report for the previous fiscal year in accordance with the international reporting standards of the Global Reporting Initiative (GRI).

Since the definition of materiality used by CSR-RUG differs from the definition used by the GRI, MTU has not used any standard as the framework for its non-financial statement.

Business model

The MTU Group and its business model are described in the [Combined management report under "The MTU Group."](#)

Framework

The key topics for the non-financial statement were identified by the corporate responsibility (CR) coordinators in the relevant organizational units, in consultation with the CR Board, which is the central CR decision-making body at MTU, and the Executive Board. The basis for this was the topics featured in the sustainability report that MTU deems to be material for the company and its stakeholders. These topics were assessed on the basis of the social and environmental impacts of MTU's business activities using criteria such as legal regulations and the requirements of stakeholder groups. The topics were also evaluated in terms of their relevance for MTU's business, for instance their impact on the group's reputation and on its profit and loss situation.

As a result, eight topics were identified as relevant for inclusion in the non-financial statement prepared in accordance with the CSR Directive Implementation Act (CSR-RUG). This legislation requires the provision of relevant non-financial information on the business performance, operating results and position of the group. Information is also required on the impact of its business activities on the following aspects: environmental matters, employee matters, social issues, human rights, combating corruption and possible additional aspects. As one such additional aspect, the non-financial statement contains information on product quality and flight safety.

Information relating to the environmental aspect can be found in the section on eco-efficient engines. Responsible international trade, protecting employees' human rights and, as a new topic, respect for human rights in the supply chain are allocated to the human rights aspect. The materiality evaluation of the topics was discussed by the Supervisory Board's Audit Committee.

[T41] Contents of the non-financial statement

Aspect in accordance with the German CSR Directive Implementation Act (CSR-RUG)	Topics of relevance for MTU
Additional aspect	Product quality and flight safety
Environmental matters	Eco-efficient engines
Combating corruption and bribery	Prevention of corruption and bribery
Employee matters	Occupational safety
	Employee development
Respecting human rights	Protecting employees' human rights
	Respect for human rights in the supply chain
	Responsible international trade

For the reporting period, no topics of relevance for the CSR-RUG aspect of social issues have been classified as relevant for inclusion in the report. The topic of diversity and equal opportunity, which was included in the non-financial statement in the previous year, is reported in the sustainability report on materiality grounds. The non-financial statement has therefore been streamlined. The sustainability report also contains information on other sustainability topics, especially MTU's management approaches to CO₂ emissions in production and to corporate citizenship.

Risk identification and evaluation for the topics covered by the non-financial statement are based on MTU's established opportunity and risk management. The potential risks to the environment, society and employees resulting from MTU's business activities are compiled and evaluated quarterly by the CR coordinators and the CR Board analogously to the established opportunity and risk process, taking into account, in each case, the probability of occurrence and impact of the risk. To supplement the risk management process, MTU has established a compliance system with a separate reporting line. It is organized and managed by the Compliance Officer.

The risk analysis did not reveal any reportable risks with a high probability of having a severe negative impact on the identified non-financial topics.

Product quality and flight safety

Quality and safety are of paramount importance in aviation and the corresponding framework conditions are strictly regulated. Legal requirements for the safe operation of flights are closely monitored by the aviation authorities. This is reflected in the high importance MTU places on product quality and flight safety. The company has to comply with the legal requirements imposed upon it as a development, manufacturing and maintenance organization in the aviation industry. MTU continuously evaluates the regulatory requirements for its business activities in order to obtain or keep the required licenses, approvals and certifications from the aviation authorities.

MTU-wide quality management

A group-wide integrated management system (IMS) ensures compliance with regulatory requirements and internal regulations as well as clear assignment of responsibilities within the company. One principle of the IMS policy is that “Safety takes priority in what we do.” The basic framework is enshrined in a management manual that is binding for all employees and managers across the group. Corporate Quality is a separate organizational unit directly subordinate to the Chief Operating Officer (COO). It reports quarterly to the Executive Board on quality aspects and flight-related incidents. In accordance with the International Civil Aviation Organization (ICAO) standard, the IMS includes a specific safety management process, which defines how to handle safety-related incidents at MTU’s locations and in air traffic. Appropriate organizational structures and responsibilities, such as a Flight Safety Board and a Flight Safety Manager, have also been established. High quality standards, together with product safety and reliability, are important corporate objectives that are enshrined in the MTU Principles.

The strict regulatory quality and safety requirements must be complied with throughout the entire product lifecycle of an engine. MTU has therefore implemented processes designed to meet these requirements. For example, the aviation sector has strict rules governing documentation in order to verify the airworthiness of engines and their components. There must be no gaps in documentation over the entire product lifecycle. To ensure compliance with quality and safety requirements, MTU has implemented comprehensive testing and monitoring processes throughout the entire value chain. Components classified as critical undergo thorough tests and are monitored in the production process.

Annual internal audits and quality audits by customers and authorities provide evidence that MTU meets uniformly high standards and is in conformance with regulatory requirements. MTU uses supplier audits to monitor suppliers’ compliance with sector-specific requirements. These audits are managed on a site-specific basis. The implementation of MTU’s IMS at the individual sites is validated and certified by independent and accredited external auditors.

Focus on quality and customer satisfaction

MTU continuously monitors quality and, where necessary, initiates appropriate measures to achieve effective improvements. Providing customers and partners with safe and high-quality products and services helps to keep MTU’s business competitive. High customer satisfaction was a focus of MTU’s corporate objectives for 2019: one of the sub-targets was high quality standards. Therefore, the operational target for each site was to reduce customer complaints, or at least hold them stable. The targets are implemented through initiatives with a long-term focus, which are realized on a continuous basis.

A defined process is in place to ensure that all customer complaints about sub-standard quality of MTU products are followed up and analyzed, and that appropriate measures are defined and implemented to permanently eliminate the root cause. The success of these measures is closely monitored. Customer complaints are evaluated at site level. There was a year-on-year rise in the number of customer complaints at the majority of sites in 2019. This was principally due to an increase in production volume, including the portfolio mix. In production, the main emphasis is on the ramp-up of the new Geared Turbofan™ family of engines as well as on commercial maintenance (MRO), with its significantly increased volume of component repairs.

Steadily improving

MTU is continuously developing its quality management system and regularly takes up suggestions arising, for example, from its collaboration in the international Aerospace Engine Supplier Quality (AESQ) Strategy Group and regular communication between its quality managers and sites. For instance, in the reporting period the company continued to refine internal quality reporting and the rules and regulations for quality management. In addition, regular site-specific training on quality aspects is organized for managers and employees. The cross-site quality initiative for MRO was successfully completed at the end of 2019. This initiative used best practice principles from all areas of MRO for further development of planning and production processes.

Eco-efficient engines

MTU is working on solutions to make flying more environmentally friendly, with a focus on reducing fuel consumption, CO₂ emissions and noise emissions of engines. These are factors it can influence directly thanks to its expertise in developing and manufacturing high-pressure compressors and low-pressure turbines. The MTU Principles reflect this commitment to sustainable product development with reduced fuel consumption and lower noise emissions. There is a direct correlation between fuel consumption and CO₂ emissions. These are a material factor affecting the climate impact of aviation. Making engines more fuel-efficient therefore has high priority because it saves resources and also reduces the impact on global warming. The MTU Code of Conduct also contains guidelines on product development based on ecological criteria. MTU also contributes to the European aviation industry and research sector's Strategic Research and Innovation Agenda (SRIA) and supports its climate protection and noise reduction targets.

However, the goal of limiting the temperature increase to less than 2°C (2015 Paris Agreement) requires extending and accelerating all activities. In the reporting period, MTU summarized its long-term goal of emission-free flying in its Technology Roadmap Towards Emission-Free Flying. This sets out the principal new propulsion technologies required, including, in particular, sustainable fuels and hydrogen-driven fuel cells as a long-term concept for propulsion systems as the latter has the potential to facilitate emission-free flying.

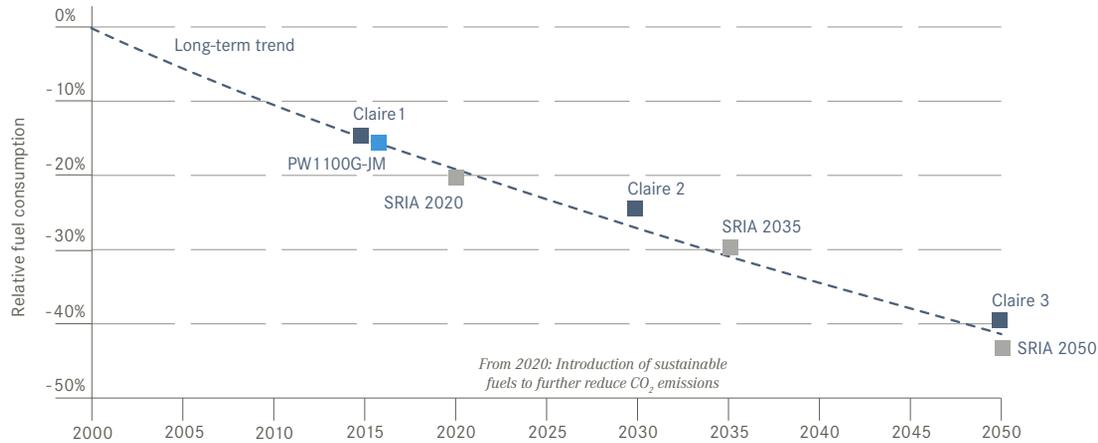
An Innovation Board regularly discusses all topics related to technology and innovation and initiates technology projects and studies. The Technology steering committee, which includes the Chief Operating Officer and Chief Program Officer, approves MTU's technology roadmap and is regularly updated on progress. MTU manages its product development in a multi-level technology and innovation process. In the short term, product development focuses on concrete customer specifications based on present technologies. In the mid term (up to 15 years), advanced product designs will be generated in order to derive technology requirements. In the long term (by 2050), pilot concepts will be drafted with the aid of technology radar and development of the enabling technologies will be initiated.

MTU is committed to the principle of integrated environmental protection, which takes a precautionary approach to how the company's products impact the environment, and integrates insights from this into entrepreneurial decisions. MTU's technology and innovation process incorporates the environmental and societal driving forces of aviation and derives its own targets for product development from them. The company also uses dialogue with stakeholders to identify their expectations and the impact of aviation on the environment and society. In 2019, MTU also took part in discussion forums such as the National Aviation Conference in Leipzig and the German Aeroday in Potsdam to draw the attention of politicians, the general public, research and industry to ways of making flying more environmentally friendly, including emission-free flying.

The aviation industry is characterized by long product cycles, with aircraft engines generally spending 30 years in service before they are decommissioned. Goals for the production of more eco-efficient engines therefore have a long-term perspective and are set out in memoranda of understanding with stakeholders (airlines, aviation industry, research, and aviation authorities). In Europe, goals aimed at cutting fuel consumption, CO₂ emissions and noise emissions are defined in the SRIA, which forms the basis for all national and European technology programs as well as for MTU's Clean Air Engine (Claire) agenda. In this internal roadmap for the development of engine programs, MTU has defined its own eco-efficiency targets through to 2050. These are derived from the SRIA goals.

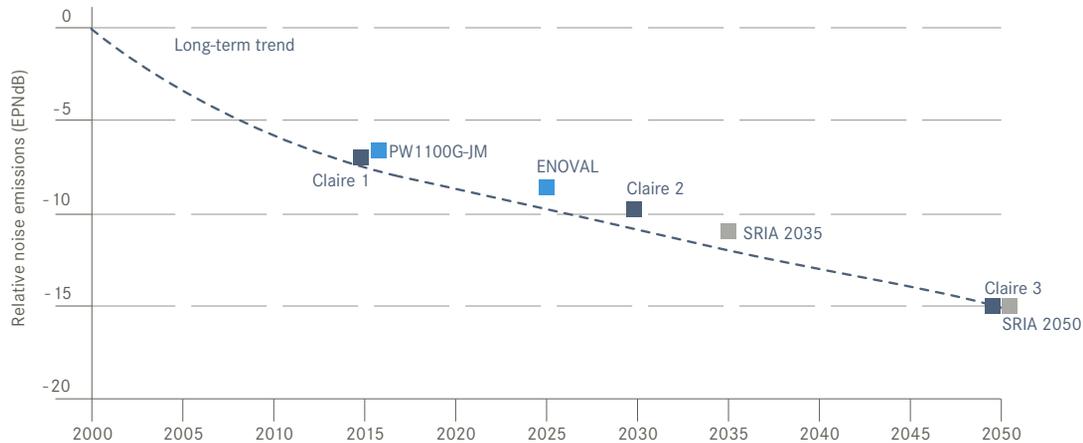
Development and approval cycles for aircraft engines and their ongoing development are very time-consuming. Therefore, MTU's long-term approach to improving the aviation industry's environmental performance, centering on continuous research and development, currently includes annual qualitative targets, but no quantitative targets that would support annual reporting of KPIs.

[T42] Targets set by the SRIA and Claire agendas to reduce energy consumption



The targets set out in MTU's Claire program are based on the SRIA targets. All targets relate to relative fuel consumption per passenger-kilometer. For kerosene, that corresponds to CO₂ emissions. In the case of sustainable fuels, CO₂ emissions are further reduced by the CO₂ avoidance potential of the fuel. Improvements in performance are measured relative to an engine corresponding to the state of the art in 2000. The PW1100G-JM engine (data provided by the OEM Pratt & Whitney) was chosen to illustrate the performance of the PW1000G family of engines in respect of these targets because this engine is expected to generate the most sales within the family (based on the number of orders received up to the end of 2019). Kerosene is the only fuel approved for use in aircraft.

[T43] Targets set by the SRIA and Claire agendas to reduce noise emissions



All targets refer to the noise emissions of the aircraft as a whole, with improvements measured by comparison with an aircraft corresponding to the state of the art in 2000. For the PW1000G family of engines, achievement of these targets is demonstrated by the PW1100G-JM engine (in combination with the Airbus A320). Noise levels are expressed in EPNdB (effective perceived noise in decibels) relative to the ICAO (International Civil Aviation Organization) Stage 4 noise limits, taking the average of the separate measurements at the three certification points: approach, sideline and flyover. A reduction in noise emissions of 10 EPNdB corresponds to a halving of the subjective noise perception.

Climate protection in three stages: Claire Level 1

The PW1100G-JM member of the Pratt & Whitney GTF™ engine family reduces fuel consumption and CO₂ emissions by 16% (according to data and calculations provided by the OEM Pratt & Whitney), thus exceeding the target set for the first Claire level of a 15% reduction by 2015 (reference base 2000). However the goal of reducing noise by 7.4 EPNdB (compared with the ICAO Stage 4 noise emission class) was not quite achieved; the average reduction is 6.7 EPNdB. MTU developed the Geared Turbofan™ in cooperation with Pratt & Whitney and takes charge of some of the series production. The Geared Turbofan™ will be used for five aircraft platforms. All applications are scheduled to be transferred stepwise to series production by 2020.

Milestones in the implementation of Claire 1 in 2019:

- / Certification of the new Embraer E195-E2 jet, powered by the PW1900G Geared Turbofan™ engine family, by the aviation authorities in Brazil, the USA and Europe. According to the manufacturer, Embraer, the E195-E2 will reduce fuel consumption by 25.4% (per passenger, compared with its predecessor, the E195).
- / First flight by an Airbus A319neo with a PW1100G-JM engine; this means that the last model in the A320neo family is ramping up for scheduled passenger flights.

25% less fuel consumption by 2030: Claire Level 2

MTU's target as part of its cooperations up to 2030 is to reduce fuel consumption by 25% (per passenger-kilometer, compared with a state-of-the art engine from 2000). An even greater reduction in CO₂ emissions could be achieved by using sustainable fuels. The target for noise emissions from the aircraft and engine is a reduction of 50% or 10 EPNdB compared with the state of the art in the year 2000. Claire Level 2 will be implemented using the Geared Turbofan™ engine as well, which, in the next generation, will be refined into an ultra-high-bypass engine with the potential to significantly reduce CO₂ and noise emissions. MTU is already working on the preliminary design of this engine. MTU is developing the technologies required for this generation as part of the German aviation research program LuFo and European technology programs. Further development of the technologies until they are mature enough to be used in product development is taking place as part of the Clean Sky research program.

The European technology programs LEMCOTEC, E-Break and ENOVAL have resulted in new engine technologies, although these are still at an early stage of development. Depending on application (short-, medium- or long-haul), they are expected to cut fuel consumption by 25-32% (per passenger-kilometer) compared with the state of the

art in 2000. These results show that the SRIA 2020 and Claire 2 targets of 20% and 25% respectively are achievable. However, these technologies need further development before they can be transferred to serial production. The technologies developed to date are not sufficiently advanced to fully attain the SRIA and Claire targets for flight noise reduction by 2020 and 2030.

Milestones in the implementation of Claire 2 in 2019:

- / Successful testing by MTU of an improved high-pressure compressor for a more efficient PW1100G-JM engine
- / Extensive testing of a two-shaft compressor rig with partners at DLR in Cologne
- / Extensive testing with GE Aviation of a rig at TU Graz for a more efficient future turbine center frame
- / Opening of a new center of competence for component testing at MTU

New engine architectures from 2050: Claire Level 3

Furthermore, MTU is already collaborating with universities on the next level of the Clean Air Engine agenda for 2050 (Claire 3). This includes plans to implement new engine architectures to move toward emission-free flying. Here, MTU is pursuing two different concepts:

- / Heat engines featuring innovative cyclic processes beyond conventional gas turbines, which promise a significant improvement in thermal efficiency
- / Electric propulsion systems, ranging from electric batteries to hybrid systems (gas turbine and battery) and fuel cells.

Milestones in the implementation of Claire 3 in 2019:

- / Memorandum of understanding on participation in the development and construction of a hybrid electric propulsion system for the planned Silent Air Taxi, a four-seater aircraft developed by e.SAT GmbH
- / Definition of a technology project with partners for proof of concept of innovative cyclic processes, including a ground demonstrator
- / Cooperation with DLR on a flight demonstrator based on a modified Dornier Do228 propeller plane to test electric propulsion systems. There are also plans for an extensive technology program for an electric propulsion system with fuel cells and hydrogen.
- / Memorandum of understanding on Horizon Europe, the EU's follow-on program to Clean Sky 2

As well as supporting the development of eco-efficient propulsion systems, in 2019 MTU continued to support the introduction of sustainable fuels with a low carbon content, for example, through aireg e.V. (Aviation Initiative for Renewable Energy in Germany). MTU established

this initiative jointly with airlines, manufacturers and research institutes in order to consolidate activities and expertise in this area in Germany. MTU acts as an advisor to this initiative.

Prevention of corruption and bribery

MTU condemns corruption of any kind and all other forms of white-collar crime. Long-term business success is based on compliance with the applicable laws and regulations and the company's own internal guidelines. A group-wide Code of Conduct requires employees and management to act with responsibility and integrity and to comply with the law and in-house regulations. The MTU Principles help MTU to act in a consistent and reliable manner and make compliance with the Code of Conduct and ethical principles mandatory. MTU guidelines also provide clear rules for day-to-day dealings with officials and on gifts. Further internal regulations concerning the prevention of corruption relate to hospitality, customer events, donations and sponsoring and the approval process for sales consultants.

As the highest decision-making authority, the CEO is responsible for the company's business ethics and anti-corruption policy. The central functions responsible for ensuring compliance are a group-wide Compliance Officer and the Compliance Board. The Compliance Officer is responsible, in particular, for ongoing development of MTU's established compliance system to prevent corruption. He works in close consultation with the Compliance Board. The Compliance Board holds both regular and ad hoc meetings at the invitation of the Compliance Officer. The Compliance Officer submits quarterly reports to the Executive Board and the Supervisory Board's Audit Committee, which in turn reports to the plenary meetings of the Supervisory Board. The Supervisory Board's Audit Committee oversees the Executive Board's compliance activities.

The company has established a global whistleblower system that allows employees and external stakeholders to report suspected cases of misconduct confidentially to the Compliance Officer. Reports can also be made anonymously via a web-based electronic reporting system. The Compliance Officer initiates appropriate action if such suspicions are confirmed.

MTU's goal is to prevent corruption and bribery throughout the group (principle of zero tolerance). As in the past, no cases of corruption were identified in the reporting period.

Memberships

MTU's compliance management system is based on the requirements of assurance standard IDW AsS 980 published by the Institute of Public Auditors in Germany (IDW) and the Good Practice Guidance on Internal Controls, Ethics, and Compliance issued by the Organisation for Economic Co-operation and Development (OECD). The group is also a member of the following initiatives whose activities include the prevention of corruption and bribery:

- / Aerospace and Defence Industries Association of Europe,
- / UN Global Compact,
- / TRACE International.

To minimize compliance risks, the Compliance Officer screens, among other areas, all sales-related consultancy contracts for possible corruption risks before they are concluded or renewed. The Compliance Officer also uses external service providers for this. The corporate audit function conducts regular compliance audits to check that business processes are in conformance with legal requirements and internal guidelines. Raising awareness of corruption risk management is done first and foremost by organizing mandatory anti-corruption training for managers and for employees in specific functions, for example in sales. Staff training on the Code of Conduct with a focus on preventing corruption took place in 2019 via the e-learning platform.

Continuous development

MTU strives to continuously develop its compliance system. As part of this, in 2019 the Compliance Officer took over the ombudsman's role as the direct line of contact for complaints and reports of suspected non-compliance. In addition, a new IT-based whistleblower system called "iTrust" was introduced in 2019. Employees and external stakeholders can use this system to submit reports anonymously to the Compliance Officer. An internal communications campaign was used to inform staff about the new iTrust system in 2019. The company plans to introduce a new group-wide compliance reporting system in 2020, with standardized reporting procedures for all sites. In addition, the Code of Conduct and the associated e-learning program are to be revised.

Occupational safety

MTU places a great deal of importance on the safety of its employees. Employee health and safety are included in MTU's Code of Conduct as key principles of corporate social responsibility. Compliance with national laws on occupational safety is embedded in the Code of Conduct as a mandatory minimum standard for all MTU subsidiaries. In addition, MTU has an internal standard that contains generally valid parameters, rules and definitions of performance indicators. Quarterly reporting to the Executive Board is established throughout the group. Occupational safety is organized on a decentralized basis at MTU and the sites are responsible for implementing the relevant requirements. At the company's production sites, occupational safety is the responsibility of the site managers and occupational safety officers are appointed at management level. The responsible local departments implement site-specific occupational safety requirements and report regularly to the site management. The company's production sites in Germany, Poland and Canada have local occupational safety committees, which include representatives of the works council.

Occupational safety is part of MTU's integrated management system and is regularly reviewed and driven forward. At the European production sites, workplace regulations that are mandatory for all employees contain important safety rules pertaining to accident prevention, fire protection and what to do in the event of workplace or commuting accidents.

MTU strives to minimize health and safety risks to its employees and third parties as far as possible, whilst also seeking to make continuous improvements. Workplaces are regularly assessed for any risks and hazards they present for employees so that appropriate measures can be implemented where necessary. To prevent accidents and achieve a lasting reduction in the number of accidents, the local occupational safety specialists record all accidents using uniform criteria and analyze them with the employees involved and their managers. Where the analysis reveals significant accident hotspots, the causes are investigated and appropriate steps taken to prevent a recurrence. In addition, near-misses are recorded and evaluated at all production sites. Regular safety training is required for all employees throughout the group and trained first responders have been appointed. In addition, the responsible local departments undertake continuous prevention work through training sessions and information on occupational safety issues.

The occupational safety management systems at the German sites are validated externally as conforming to the internationally valid standard OHSAS 18001 (Occupational Health and Safety Assessment Series) or have already been certified as conforming to the new standard ISO 45001, which combines occupational safety and industrial health management and will replace OHSAS.

High standards of occupational safety throughout the group are one of MTU's annual corporate objectives, and 2019 was no exception. In addition, at each MTU site, annual tolerance thresholds are set for category 4 reportable workplace accidents (accidents that entail more than three days of absence). Depending on the site, these were between zero and ten in 2019. The threshold was met at three sites. For the group as a whole, the total number of reportable accidents in 2019 resulting in more than three days of absence was 47 (MTU AG: 22), which is higher than the 2018 figure of 42 (MTU AG: 20). At all production sites, except in Poland, the number of accidents increased in 2019. In this context, it should be pointed out there was a group-wide increase in headcount. As in the previous year, the group-wide accident rate was low at 4.4 (previous year: 4.3) reportable accidents per 1,000 employees, while for MTU AG it was 4.0 (previous year: 3.9). MTU therefore has a high level of occupational safety compared with the average for the German metal-working industry, which recorded 34 accidents per 1,000 employees (Wood and Metal Trade Association – BG Holz- und Metall; 2018 data). As in previous years, there were no fatal accidents at MTU in 2019. The accident statistics relate to the total workforce, including employees in vocational training, interns, students and temporary employees (excluding temporary agency workers and employees from external companies).

Focus on prevention

Occupational safety is implemented on a site-specific basis. The local occupational safety officers derive proactive measures from regularly updated risk assessments, routine inspections of workplaces and audits of production and administration. All accidents are reported and evaluated. The analyses show that MTU's plant and machinery generally have a very high level of technical and organizational safety, so the cause of many accidents tends to be attributable to behavior rather than to the operation of plant and equipment. In the reporting period, occupational safety again focused on promoting risk-aware behavior with the aim of continuously enhancing the safety culture. This included regular campaigns to raise awareness at MTU sites, focusing, for example, on fork-lift traffic at the site in Munich and the use of protective equipment at the site in Hannover.

Moreover, in 2019 greater attention was paid to ergonomics in the workplace and measures to improve ergonomic aspects were implemented.

Employee development

Innovative capability and competitiveness are key success factors in the aviation industry. MTU is convinced that continuous and intensive employee development is essential for this and therefore invests in vocational and further training and in the development of talented employees. Moreover, in many of the areas in which MTU operates, training requirements are defined by the aviation authorities. One example is mandatory training on human factors (human error). In addition to industry-specific vocational training, for example, of aircraft maintenance engineers, and dual courses of study aimed at building up knowledge over the long term, MTU encourages further training of its employees. This is a key principle of corporate social responsibility defined in the company's Code of Conduct. Promoting further training and individual development perspectives for employees and managers is also enshrined in the MTU Principles and group-wide HR strategy. The head of human resources is responsible for training and development of employees group-wide. The Executive Board is updated on training indicators once a year through the education and training report, and discusses specific training initiatives.

The enormous importance of vocational and further training is reflected in the extensive range of training and development offers and MTU's spending on staff training. That is based on a group-wide works agreement in Germany, which guarantees all staff access to training and requires managers to discuss development options with their employees (training interview). At MTU's three sites in Germany, the works council is also involved in employee training in accordance with the German Works Constitution Act (*Betriebsverfassungsgesetz*) and has a say in the annual training and development program. The international locations also have their own regulations. At MTU Aero Engines North America, for example, each employee receives an annual development plan.

Employee development and lifelong learning help employees hone and develop their skills. Employees' training requirements are systematically reviewed each year. To this end, the training requirements of the workforce are established in a standard process either in a training interview or in divisional/company-level interviews. After completion, training courses are evaluated in a personal meeting between the employee

and their supervisor, or in some cases via a feedback form. Completed training and development courses are documented in a training history. Training officers can be consulted at any time for advice on needs-focused training.

An online learning portal offers employees the opportunity to organize training for themselves, in consultation with their supervisor. Since 2019, staff at sites in Germany have also had access to training content in English. Employees in Poland have also had access to an e-learning platform since 2019, and can take web-based training courses in English or Polish.

Wide-ranging management training

One focus of employee development is ensuring that managers have future-oriented leadership competencies. The aim is to empower managers to shape the future of MTU successfully in collaboration with their staff. To foster future-oriented leadership, common leadership values apply throughout the group. These are: "We transform," "We empower" and "We create trust." The values were introduced in 2018 as part of a leadership value process in Germany, which led to more detailed inspiration events and departmental workshops in 2019. In parallel with this, launch events and supporting workshops were held in Poland, the Netherlands and North America in the spring to roll out the leadership values. Therefore, the leadership values are now established at all management levels throughout the group.

In addition, MTU offers development opportunities and programs at all levels to identify and support talented employees, and to support the professional development of those already appointed to management positions. These include a newly designed leadership exploration program for recently appointed managers. The first round of this started in 2019. There is also a Development Center, which uses exercises and interviews to help individuals with potential in the MTU Group draw up an individual development plan to prepare for leadership functions. The aim of the defined process at the Development Center is to undertake an objective assessment of talented employees and raise their visibility in the company. Around 80% (MTU AG: 83%) of the managers newly appointed to leadership functions in 2019 had previously attended the Development Center. There is also an International Leadership Program (ILP), which is designed to promote a common understanding of leadership in the global corporate context. In the first half of 2019, employees from German and foreign locations once again took part in the ILP.

Furthermore, fostering talented women and equality in management are important to MTU. In the light of this, the group has a wide range of measures to support the professional development of women.

New local training offers

A sound vocational training is important to MTU, not least in the light of the expansion of many of its sites and the related hiring of new staff. In Hannover and Ludwigsfelde, people with qualifications in other metal-working occupations can undertake supplementary training to acquire skills for engine maintenance. In connection with the establishment of a new site in Eastern Europe – MTU Maintenance Serbia d.o.o –, the company has signed a cooperation agreement with the Republic of Serbia to establish local training of aviation specialists based on the German system of combined practical and classroom training.

One important yardstick for successful teamwork and leadership is the regular employee survey, which is conducted at MTU's German locations every three years. The next survey is scheduled for 2021. Employees at the site in Rzeszów in Poland are also regularly asked for feedback.

In 2019, MTU invested a considerable amount in staff training. Group-wide, MTU invested a total of €5.4 million (MTU AG: €3.4 million) in staff training in 2019 (costs for internal and external training, excluding vocational training).

Protecting employees' human rights

MTU respects the internationally proclaimed human rights set out in the United Nations' Universal Declaration of Human Rights and enforces and protects these rights within the company. Human rights are integrated into the corporate culture with the aid of various tools. In particular, MTU strives to prevent employees being exposed to any violation of their human rights (zero-tolerance principle).

MTU is committed to respecting the individuality and dignity of every individual, maintaining equality of opportunity in the workplace and preventing discrimination. The protection of human rights, the right to appropriate remuneration as well as recognition of regulations governing employee and union representation under labor and works constitution law are implemented group-wide through the Code of Conduct. As an employer, MTU aims to create fair working conditions based on legally binding employment contracts and appropriate remuneration. This includes freedom of association and the right

to adopt collective agreements. Compliance with the Code of Conduct and ethical principles is also enshrined in the MTU Principles. The commitment to respecting human rights is reinforced by MTU's status as a signatory to the UN Global Compact and by national legislation that upholds human rights. In Germany, for example, MTU is bound by the General Act on Equal Treatment (AGG), which prohibits discrimination against employees and job applicants. In addition, there are internal guidelines on fair and cooperative conduct, which are designed to prevent bullying, sexual harassment and discrimination. These guidelines were adopted in consultation with the representatives of the workforce and include a systematic process for dealing with complaints.

Established reporting procedures are in place to ensure structured and effective follow-up of all complaints and reports of human rights infringements. Reports can be made confidentially within the group to the Compliance Officer or via the new web-based reporting system iTrust. In addition, site-specific reporting structures have been set up. In line with the provisions of, for example, the General Act on Equal Treatment (AGG), every site in Germany has a designated contact who is appropriately trained and to whom employees can address any complaints of discrimination. There is also a female contact person that women can turn to in case of sexual harassment. MTU Maintenance Canada has set up an Employment Equity Committee in accordance with Canadian law to handle complaints or information relating to equal opportunities in the workplace and has appointed an Employment Equity Officer to whom employees can address their concerns confidentially. At MTU Aero Engines Polska this function is carried out by an elected employee representative. Employees can also report complaints to managers, the works council or the head of human resources. The Executive Board is informed about infringements depending on the severity of their impacts.

When they join the company, new employees are informed about the principles set out in the Code of Conduct and – in Germany – the General Act on Equal Treatment (AGG), and they undertake to comply with these requirements. In addition, MTU provides regular training on the Code of Conduct at all the company's sites and all hierarchical levels.

In 2019, there were no substantiated complaints under applicable anti-discrimination laws at any sites in the MTU Group.

Respect for human rights in the supply chain

As a member of the UN Global Compact, MTU respects the internationally recognized human rights enshrined in the UN Declaration of Human Rights. It extends this to its supply chain as well. The aim is to ensure the observance of human rights and fair working conditions.

A code of conduct for suppliers is in place to cover the upstream value chain. MTU's suppliers are required to give an undertaking that they will comply with this Code of Conduct for MTU Suppliers, which is based on the ten principles of the UN Global Compact and the core labor standards of the International Labour Organization (ILO). The Code of Conduct requires suppliers to respect and apply human rights, and to make sure that they are not complicit in human rights violations. In particular, it requires observance of labor standards relating to freedom of association, the right to collective bargaining, the ban on forced and child labor, equal pay regardless of gender and the equal treatment of employees. MTU also expects its suppliers to obtain a corresponding undertaking from sub-suppliers and reserves the right to terminate any contract with a supplier without notice if the supplier uses child labor in the production process for its deliveries. In addition, these principles of behavior are contained in the general business conditions and the contractual documents for suppliers.

An annual risk analysis concept is already applied to suppliers to MTU's sites in Germany, Poland and Canada and to the subsidiary MTU Aero Engines North America. Further development of this concept is planned, with a focus on differentiated evaluation of the product risk. In addition, at MTU Maintenance, a structured supplier evaluation is performed twice a year for suppliers to the German sites. In the future, there are plans to extend this to include additional sustainability aspects.

A variety of measures are used to achieve the goal of ensuring that human rights are respected in the supply chain. These apply, above all, to the procurement of certain raw materials known as conflict minerals, for example, tantalum, tin, gold and tungsten, which are used in some MTU components. Procurement of these minerals can be problematic because some of them come from Central African mines where the profits may be used specifically to fund armed conflicts that violate human rights. MTU strives to ensure a sustainable and transparent value chain without conflict minerals. The

company does not procure minerals directly but they enter production and pre-production via the global, multi-step supply chain. The general conditions of business and the templates for contracts with MTU suppliers require information on the origin of minerals. This information is compiled using the EICC/GeSI Conflict Minerals Reporting Template. In accordance with the provisions of the Dodd-Frank Act, MTU makes it compulsory for relevant suppliers to provide information once a year on the origin of minerals and specifies that minerals may only be procured from certified mines and smelters (compliant smelter list) in order to ensure that the value chain does not contain conflict minerals. Based on its survey in 2019, MTU has no indication that components from its suppliers contain conflict minerals.

Moreover, in the reporting period there were no reported indications that suppliers had violated the human rights provisions of the Code of Conduct for MTU Suppliers. Furthermore, MTU did not terminate its relationship with any suppliers as a result of sustainability shortcomings relating to human rights.

Responsible international trade

Trade compliance plays a vital role for MTU. One important goal here is to avoid violations of human rights. The provisions of international trade legislation apply to all business units and group companies, including their employees. Customs and export control laws govern which products, services and technical data MTU is permitted to sell or pass on to whom, for what purpose and where. Compliance with customs legislation and international trade regulations is explicitly stipulated in MTU's Code of Conduct.

Export control law prohibits doing business with specific countries or individuals, and the supply of sensitive goods, transfer of advanced technologies, and provision of military services without explicit authorization by the respective official bodies. This is intended, in particular, to prevent the proliferation of nuclear, biological and chemical weapons, to prevent the supply of military goods or goods that can be used for military purposes to crisis regions, to prevent support for blacklisted individuals and activities that violate human rights, and to protect sovereign security interests. Under customs regulations, MTU is required to provide a precise description, detailed itemization and accurate declaration of the value of all goods intended for import or export. What is more,

anti-boycott laws may prohibit individuals and entities from participating in other countries' economic boycotts and restrict the dissemination of information relating to business activities or individuals.

To ensure international trade regulations are implemented throughout the group, MTU has set up a central international trade department (functional responsibility and supervisory authority for export control, coordination of customs regulations), which draws on the support of external consultants where necessary. To ensure compliance with international trade regulations, harmonized process standards have been introduced group-wide. These verify conformity with export control regulations and required authorizations prior to the dispatch of documents and components. The head of the international trade department reports disciplinarily to the head of purchasing and has a direct duty to report to the Executive Board member responsible for export (Chief Operating Officer [COO]).

In view of the rising significance of international trade, MTU integrated the issue into its corporate objectives in 2019 and continuously drove forward the development of the process landscape. In this context, an international workshop on trade compliance with participation from all MTU sites took place to achieve greater harmonization of group standards and guidelines to foster best practice.

Corporate governance statement

Declaration of conformity

The executive and supervisory boards of listed companies issue an annual declaration stating that the recommendations of the Government Commission on the German Corporate Governance Code have been and are being complied with, where necessary citing those recommendations that have not been or are not being applied. The declaration of conformity of MTU Aero Engines is included in the [“Corporate “governance” section](#) of this Annual Report.

There is also a section devoted to corporate governance [in the Investor Relations section of MTU’s website \(www.mtu.de\)](#).

Management practices extending beyond statutory requirements

A full description of management practices that extend beyond statutory requirements is provided in the [Corporate governance report](#) in the 2019 Annual Report.

Working procedures of the Executive Board and the Supervisory Board

A description of the working procedures of the Executive Board and Supervisory Board is provided in the [Corporate governance report](#).

German law on equal participation of women and men in leadership positions

In the context of the German law on equal participation of women and men in leadership positions, MTU Aero Engines has set itself the following goals:

In accordance with the statutory provisions, MTU planned to increase the proportion of women holding seats on the Supervisory Board of MTU Aero Engines AG to at least 30% at the upcoming elections. This quota applies separately to the number of shareholder representatives and the number of employee representatives. The Annual General Meeting in 2019 did not result in any change in the gender distribution on the Supervisory Board. Currently, the percentage of women on the Supervisory Board is unchanged at 33.3%

It is also planned that the overall percentage of women in leadership positions at the company’s three locations in Germany should be increased to 13% by the end of 2022. As of December 31, 2019, the percentage was 10.3%. MTU’s talent management program specifically supports the development of women at all levels of the corporate hierarchy. Increasing the proportion of female employees and thus increasing the pool of female candidates for management positions is a long-term process. As a result of high recruitment of blue-collar workers, mainly men

with technical qualifications, the ratio of female to male employees has shifted and the absolute proportion of women in the company has decreased.

With regard to the composition of the Executive Board of MTU Aero Engines AG, the company plans to increase the proportion of women to 25% by 2022. For further information on MTU’s diversity concept, please see the [Corporate governance report](#).

Directors’ dealings

Pursuant to Section 15a of the German Securities Trading Act (WpHG), members of the Executive Board and the Supervisory Board have a legal obligation to disclose transactions involving the purchase or sale of shares in MTU Aero Engines AG, Munich, or of related financial instruments, if the total amount of the transactions undertaken by a board member or related persons reaches or exceeds €5,000 within a single calendar year. These transactions are posted on [MTU’s website \(www.mtu.de\)](#) and published in the register of companies.

The total number of shares in MTU Aero Engines AG, Munich, held by members of the company’s Executive Board and Supervisory Board as of December 31, 2019, amounted to less than 1% of the company’s capital stock (December 31, 2018: less than 1%).

Responsibility statement

We hereby affirm that, to the best of our knowledge, the consolidated financial statements of the MTU Group and the separate annual financial statements of MTU Aero Engines AG present a true and fair view of their respective net assets, financial position and results of operations in accordance with the applicable financial reporting standards, and that the combined management report provides a faithful and accurate review of the business performance of the MTU Group and of MTU Aero Engines AG, including business performance and position, and outlines the significant opportunities and risks of the MTU Group's and MTU Aero Engines AG's likely future development.

Munich, March 17, 2020



Reiner Winkler
Chief Executive Officer



Peter Kameritsch
Chief Financial Officer
and Chief Information
Officer



Michael Schreyögg
Chief Program Officer



Lars Wagner
Chief Operating
Officer

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Consolidated income statement

[T44] Consolidated income statement

in € million	(Note)	2019	2018
Revenue	(1.)	4,628.4	4,567.1
Cost of goods sold	(2.)	-3,697.1	-3,715.8
Gross profit		931.3	851.3
Research and development expenses	(3.)	-65.8	-60.7
Selling expenses	(4.)	-118.5	-115.1
General administrative expenses	(5.)	-84.8	-83.6
Other operating income	(6.)	12.0	9.0
Other operating expenses	(6.)	-51.3	-26.2
Profit/loss of companies accounted for using the equity method	(7.)	80.0	43.8
Profit/loss of equity investments	(7.)	2.7	1.7
Earnings before interest and taxes (EBIT)		705.6	620.2
Net interest income/expense	(8.)	-17.2	-0.7
Other financial income/expense	(9.)	-21.8	-12.2
Net financial income/expense		-39.0	-12.9
Earnings before income taxes		666.6	607.3
Income taxes	(10.)	-178.2	-154.0
Net income		488.4	453.3
thereof:			
Owners of MTU Aero Engines AG		478.1	447.0
Non-controlling interests		10.3	6.3
Earnings per share (in €)			
Basic (EPS)	(11.)	9.23	8.67
Diluted (DEPS)	(11.)	8.46	8.10

Consolidated statement of comprehensive income

[T45] Consolidated statement of comprehensive income

in € million	(Note)	2019	2018
Net income		488.4	453.3
Translation differences arising from the financial statements of foreign entities		13.9	-4.6
Financial instruments designated as cash flow hedges		-12.0	-83.2
Items that may subsequently be recycled to profit or loss		1.9	-87.8
Actuarial gains/losses on pension obligations and plan assets		-66.1	-4.0
Changes in the fair value of equity investments		-1.8	2.5
Items that will not be recycled to profit or loss		-67.9	-1.5
Other comprehensive income after taxes	(24.)	-66.0	-89.3
Total comprehensive income		422.4	364.0
thereof:			
Owners of MTU Aero Engines AG		410.8	355.6
Non-controlling interests		11.6	8.4

Consolidated balance sheet – assets

[T46] Assets

in € million	(Note)	Dec. 31, 2019	Dec. 31, 2018
Non-current assets			
Intangible assets	(14.)	1,162.5	1,072.7
Property, plant and equipment	(15.)	1,100.8	799.3
Financial assets accounted for using the equity method	(16.)	538.2	426.9
Other financial assets	(16.)	77.1	104.4
Acquired program assets, development work and other assets	(17.)	1,220.6	1,252.1
Deferred taxes	(18.)	55.8	60.5
Total non-current assets		4,155.0	3,715.9
Current assets			
Inventories	(19.)	1,278.6	995.8
Trade receivables	(20.)	922.8	1,051.2
Contract assets	(21.)	1,046.5	864.3
Income tax receivables	(22.)	115.8	43.2
Other financial assets	(16.)	61.9	40.6
Other assets	(17.)	45.2	40.8
Cash and cash equivalents	(23.)	139.5	99.0
Total current assets		3,610.3	3,134.9
Total assets		7,765.3	6,850.8

Consolidated balance sheet – equity and liabilities

[T47] Equity and liabilities

in € million	(Note)	Dec. 31, 2019	Dec. 31, 2018
Equity	(24.)		
Subscribed capital		53.1	52.0
Capital reserves		460.4	465.8
Retained earnings		2,160.4	1,829.0
Treasury shares		-11.4	-16.9
Accumulated other comprehensive income		-327.0	-259.7
Owners of MTU Aero Engines AG		2,335.5	2,070.2
Non-controlling interests		85.7	74.0
Total equity		2,421.2	2,144.2
Non-current liabilities			
Pension provisions	(25.)	954.3	853.2
Other provisions	(27.)	47.8	47.7
Refund liabilities	(31.)	20.7	30.3
Financial liabilities	(28.)	1,079.9	935.0
Contract liabilities	(30.)	26.9	27.0
Other liabilities	(31.)	0.4	0.7
Deferred taxes	(33.)	0.2	8.4
Total non-current liabilities		2,130.2	1,902.3
Current liabilities			
Pension provisions	(25.)	21.9	25.8
Income tax liabilities	(26.)	5.2	9.9
Other provisions	(27.)	168.3	177.3
Refund liabilities	(31.)	1,682.3	1,506.2
Financial liabilities	(28.)	253.0	228.5
Trade payables	(29.)	313.1	230.6
Contract liabilities	(30.)	680.4	549.0
Other liabilities	(31.)	89.7	77.0
Total current liabilities		3,213.9	2,804.3
Total equity and liabilities		7,765.3	6,850.8

Consolidated statement of changes in equity

[T48] Consolidated statement of changes in equity

	Sub- scribed capital	Capital reserves	Retained earnings	Treasury shares	Accumulated other comprehensive income				Owners of MTU Aero Engines AG	Non-con- trolling interests	Total equity
					Transla- tion differ- ences arising from the financial state- ments of foreign entities	Changes in the fair value of equity invest- ments	Actuarial gains/ losses ¹⁾	Financial instru- ments designat- ed as cash flow hedges			
in € million											
Carrying amount as of Jan. 1, 2018	52.0	451.2	1,500.4	-23.1	16.1	9.8	-245.9	51.7	1,812.2	36.3	1,848.5
Net income			447.0						447.0	6.3	453.3
Other comprehensive income					-6.7	2.5	-4.0	-83.2	-91.4	2.1	-89.3
Total comprehensive income			447.0		-6.7	2.5	-4.0	-83.2	355.6	8.4	364.0
Dividend payment			-118.4						-118.4		-118.4
Investment by non-controlling interests										29.3	29.3
Restricted Stock Plan		2.9		1.6					4.5		4.5
Employee stock option program (MAP)		11.7		4.6					16.3		16.3
Carrying amount as of Dec. 31, 2018, as reported	52.0	465.8	1,829.0	-16.9	9.4	12.3	-249.9	-31.5	2,070.2	74.0	2,144.2
Impact of initial application of IFRS 16			0.4						0.4	0.1	0.5
Carrying amount as of Jan. 1, 2019	52.0	465.8	1,829.4	-16.9	9.4	12.3	-249.9	-31.5	2,070.6	74.1	2,144.7
Net income			478.1						478.1	10.3	488.4
Other comprehensive income					12.6	-1.8	-66.1	-12.0	-67.3	1.3	-66.0
Total comprehensive income			478.1		12.6	-1.8	-66.1	-12.0	410.8	11.6	422.4
Dividend payment			-147.1						-147.1		-147.1
Convertible bond 2016	1.1	-55.3							-54.2		-54.2
Convertible bond 2019		31.6							31.6		31.6
Restricted Stock Plan		3.9		1.1					5.0		5.0
Employee stock option program (MAP)		14.4		4.4					18.8		18.8
Carrying amount as of Dec. 31, 2019	53.1	460.4	2,160.4	-11.4	22.0	10.5	-316.0	-43.5	2,335.5	85.7	2,421.2

¹⁾ Refers to pension obligations and plan assets.

Consolidated cash flow statement

[T49] Consolidated cash flow statement

in € million	(Note)	2019	2018
Operating activities			
Net income		488.4	453.3
Non-cash amortization of acquired program assets and development work		52.9	49.0
Amortization, depreciation, write-ups and impairment of other non-current assets		206.6	151.5
Profit/loss of companies accounted for using the equity method		-80.0	-43.8
Profit/loss of equity investments		-2.7	-1.7
Gains/losses on the disposal of assets		0.5	-0.1
Change in pension provisions	(25.)		2.3
Change in other provisions	(27.)	-8.9	11.8
Change in refund liabilities (not included in working capital)		185.0	170.4
Change in working capital		-141.9	-320.4
Other non-cash items		49.4	67.0
Net interest income/expense	(8.)	17.2	0.7
Interest paid		-13.5	-7.3
Interest received		6.3	10.5
Dividends received		30.5	34.2
Income taxes	(10.)	178.2	154.0
Income taxes paid		-136.3	-136.7
Cash flow from operating activities		831.7	594.7
Investing activities			
Capital expenditure on:			
Intangible assets	(14.)	-127.7	-72.1
Property, plant and equipment	(15.)	-301.7	-199.3
Financial assets	(16.)	-55.6	-113.7
Acquired program assets and development work		-21.9	-48.4
Proceeds from disposal of:			
Intangible assets/property, plant and equipment	(14.) / (15.)	3.0	14.9
Financial assets	(16.)	32.3	82.5
Cash flow from investing activities		-471.6	-336.1
Financing activities			
Proceeds from convertible bond 2019 ¹⁾	(28.)	511.2	
Repayment of convertible bond 2016	(28.)	-550.7	
Settlement of lease liabilities	(28.)	-42.4	-1.5
Settlement of purchase price liabilities for stakes in programs		-63.2	-77.6
Repayment of financial liabilities	(28.)	-50.2	-81.5
Dividend payment		-147.1	-118.4
Sale of treasury shares in connection with the employee stock option program (MAP)	(28.)	18.8	16.3
Cash flow from financing activities		-323.6	-262.7
Net change in cash and cash equivalents during the reporting period		36.5	-4.1
Effect of translation differences on cash and cash equivalents		4.0	-3.0
Cash and cash equivalents at beginning of period (Jan. 1)		99.0	106.1
Cash and cash equivalents as of Dec. 31		139.5	99.0

¹⁾ After transaction costs.

Consolidated segment report

[T50] Consolidated segment report

	Commercial and military engine business (OEM)	
in € million	2019	2018
External revenue ¹⁾	1,953.4	1,788.7
Revenue from intersegment sales ¹⁾	42.2	38.0
Total revenue¹⁾	1,995.6	1,826.7
Gross profit	615.3	549.1
Amortization	36.7	31.0
Non-cash amortization of capitalized program assets and acquired development work	52.9	49.0
Depreciation	92.9	82.0
Impairment losses		
Amortization/value adjustments/depreciation/impairment losses	182.5	162.0
Earnings before interest and taxes (EBIT)	446.7	382.6
Special items from purchase price allocation	18.5	18.6
Special items from increase in the stake in IAE-V2500	30.4	30.2
Adjusted earnings before interest and taxes (adjusted EBIT)	495.6	431.4
Profit/loss of companies accounted for using the equity method	30.3	11.4
Carrying amount of companies accounted for using the equity method	325.2	250.6
Assets	6,686.9	6,034.5
Liabilities	4,550.0	4,118.2
Material non-cash items	34.1	41.4
Capital expenditure:		
Intangible assets	78.1	71.8
Property, plant and equipment	209.2	127.5
Acquired program assets and acquired development work	15.8	59.5
Total capital expenditure	303.1	258.8
Key segment data:		
EBIT (in % of revenue) ¹⁾	22.4	20.9
Adjusted EBIT (in % of revenue) ¹⁾	24.8	23.6

¹⁾ Prior-year amounts adjusted.

The key indicator used by management to measure the operating performance of each segment is adjusted earnings before interest and taxes (adjusted EBIT). The contribution of companies accounted for using the equity method to adjusted EBIT amounted to €80.0 million in fiscal year 2019 (previous year: €43.8 million).

Intersegment sales are transacted at arm's length at standard market terms and invoiced in the same way as transactions with external third parties. The material non-

cash items in the reporting period included gains and losses arising from foreign currency translation, which have no impact on cash flows. In the previous year, financing agreements were additionally recognized. In the reporting period, two major customers each accounted for more than 10% of total group revenue. Business with the largest customer generated revenue of €1,090.5 million (previous year: €1,418.0 million) and with the second-largest customer €692.3 million (previous year: €639.3 million).

Commercial maintenance business (MRO)		Total reportable segments		Consolidation/reconciliation		MTU Group	
2019	2018	2019	2018	2019	2018	2019	2018
2,675.0	2,778.4	4,628.4	4,567.1			4,628.4	4,567.1
36.4	21.4	78.6	59.4	-78.6	-59.4		
2,711.4	2,799.8	4,707.0	4,626.5	-78.6	-59.4	4,628.4	4,567.1
315.0	301.3	930.3	850.4	1.0	0.9	931.3	851.3
6.8	6.7	43.5	37.7			43.5	37.7
		52.9	49.0			52.9	49.0
65.5	25.9	158.4	107.9			158.4	107.9
4.7	5.9	4.7	5.9			4.7	5.9
77.0	38.5	259.5	200.5			259.5	200.5
258.5	237.3	705.2	619.9	0.4	0.3	705.6	620.2
2.4	2.4	20.9	21.0			20.9	21.0
		30.4	30.2			30.4	30.2
260.9	239.7	756.5	671.1	0.4	0.3	756.9	671.4
49.7	32.4	80.0	43.8			80.0	43.8
213.0	176.3	538.2	426.9			538.2	426.9
2,360.8	1,845.9	9,047.7	7,880.4	-1,282.4	-1,029.6	7,765.3	6,850.8
1,736.1	1,277.2	6,286.1	5,395.4	-942.0	-688.8	5,344.1	4,706.6
15.1	25.7	49.2	67.1	0.2	-0.1	49.4	67.0
50.8	1.5	128.9	73.3			128.9	73.3
140.8	72.0	350.0	199.5			350.0	199.5
		15.8	59.5			15.8	59.5
191.6	73.5	494.7	332.3			494.7	332.3
9.5	8.5	15.0	13.4			15.2	13.6
9.6	8.6	16.1	14.5			16.4	14.7

In each case, the revenue stemmed from both segments.

Until December 31, 2018, revenue from engine maintenance orders in the OEM maintenance business was also recognized by the OEM segment because the orders were placed with MTU Aero Engines AG by the consortium leader (OEM) as part of the participation in commercial engine programs. However, since this is commercial maintenance revenue, this revenue, which amounted to

€207.2 million in 2018, has been allocated exclusively to the MRO segment since January 1, 2019. The prior-year figures have been restated accordingly. There were no other changes in the definition of the segments from the previous year.

For more information on segment reporting, please see [Section V. "Segment information."](#)

I. Accounting policies and principles

Principles and methods

MTU Aero Engines AG, Munich, together with its consolidated companies (hereinafter referred to as MTU or the MTU Group) is a manufacturer of engine modules and components as well as a provider of maintenance services for commercial aircraft engines.

The group's business activities encompass the entire life-cycle of an engine program – from development, structural design, testing and manufacturing of new commercial and military engines and spare parts through to the maintenance, repair and overhaul of commercial and military engines. MTU divides its activities into two operating segments: the commercial and military engine business (OEM) and the commercial maintenance business (MRO).

MTU's commercial and military engine business covers the development and manufacturing of modules, components and spare parts for engine programs, and in some cases final assembly. The military engine business additionally includes the provision of maintenance services. The MRO segment consists of the commercial maintenance business, which covers all activities relating to the maintenance, repair and overhaul of commercial engines as well as associated services.

The parent company, MTU Aero Engines AG, with registered office at Dachauer Strasse 665, 80995 Munich, Germany, is registered under reference HRB 157 206 in the commercial registry of the district court of Munich.

The consolidated financial statements were approved for publication by the Executive Board of MTU Aero Engines AG, Munich, on March 17, 2020.

MTU's consolidated financial statements were prepared in accordance with International Financial Reporting Standards (IFRSs) as applicable in the European Union (EU), and the supplementary requirements of Section 315e (1) of the German Commercial Code (HGB). All IFRSs issued by the International Accounting Standards Board (IASB) that were in effect at the time these consolidated financial statements were prepared and were applied by MTU were endorsed by the European Commission for use in the EU.

The consolidated financial statements for the period ended December 31, 2019, and the combined management report for fiscal year 2019 were prepared in accordance with Section 315e (1) of the German Commercial Code (HGB) and published in the Federal Gazette (Bundesanzeiger).

The fiscal year is identical to the calendar year. Comparative figures for the previous year are included in the consolidated financial statements.

In the presentation of the balance sheet, a distinction is made between non-current and current assets and liabilities. A more detailed maturity analysis of certain items is provided in the Notes to the consolidated financial statements. An asset or liability is classified as current if:

- / it is held primarily for trading purposes,
- / it is expected to be realized or repaid respectively within 12 months of the reporting date,
- / it is cash or a cash equivalent, unless the exchange or utilization of the asset for the purpose of fulfilling an obligation is restricted for a period of at least 12 months after the reporting date, or
- / it is a net contract asset or liability that will be realized during MTU's normal business cycle, even if the period for realization exceeds 12 months.

The income statement is prepared according to the cost-of-sales method in which revenue is balanced against the expenses incurred to generate it, and expenses are classified by function: production, research and develop-

ment, sales and distribution, and general administration. The consolidated financial statements are denominated in euros. All amounts are stated in millions of euros (€ million), unless otherwise specified. Due to rounding, some of the totals presented in these financial statements may not correspond exactly to the sum of the individual figures, and some percentages may not precisely reflect the absolute figures on which they are based.

The financial statements of MTU Aero Engines AG, Munich, and its subsidiaries are included in the consolidated financial statements and are subject to uniform methods of recognition and measurement applicable to the group.

Accounting standards, interpretations, and amended standards and interpretations applied for the first time in fiscal year 2019

The following new and amended accounting standards and interpretations were applied for the first time in these consolidated financial statements:

[T51] New and amended standards and interpretations

Standard	Title
IFRS 9	Amendments: Prepayment Features with Negative Compensation
IFRS 16	Leases
IAS 19	Amendments: Plan Amendment, Curtailment or Settlement
IAS 28	Amendments: Long-term Interests in Associates and Joint Ventures
IFRIC 23	Uncertainty over Income Tax Treatments
Annual Improvements to IFRS Standards 2015 – 2017 Cycle	IFRS 3 Business Combinations and IFRS 11 Joint Arrangements IAS 12 Income Taxes IAS 23 Borrowing Costs

Except in the case of IFRS 16, application of these standards did not result in any significant changes to the MTU Group's financial reporting.

IFRS 16 Leases

Adoption of IFRS 16 introduced new accounting rules for leases. This new standard was endorsed by the European Union on November 9, 2017. IFRS 16 has replaced the previous standards and interpretations IAS 17 Leases, SIC 15 Operating Leases – Incentives, SIC 27 Evaluating the Substance of Transactions Involving the Legal Form of a Lease, and IFRIC 4 Determining whether an Arrangement Contains a Lease.

The main change in accounting for leases is that lessees now generally have to recognize all leases and the related contractual rights and obligations on their balance sheet. Leases for low-value assets are exempt from this

requirement. Also exempt from recognition are leases with a term not exceeding 12 months as long as these are not engine leases. From the perspective of the lessee, the classification of leases into finance leases and operating leases required by IAS 17 is no longer applicable. Instead, the balance sheet is extended by recognizing the rights to use the underlying asset (right-of-use asset) and a lease liability for the future obligations under the lease. Lease and non-lease components are recognized as a single lease component in accordance with the option permitted by IFRS 16. The right-of-use asset is carried at the present value of the lease liability. Depreciation of the right-of-use assets is recognized in function costs in accordance with IFRS 16. Interest on the lease liabilities is presented in interest expense. By contrast, under IAS 17 all expenses for leases classified as operating leases were recognized in the function costs.

Accounting for leases in which MTU is the lessor is different in IFRS 16 than in IAS 17. The changes relate to the presentation of headleases/subleases and sale and leaseback transactions, which did not have any material effect on MTU's net assets, financial position and results of operations.

The modified retrospective approach was used for initial application of this new standard as of January 1, 2019. Information from the balance sheet as of December 31, 2018, was used to assess whether there were any provisions for onerous leases in accordance with IAS 37 Provisions, Contingent Liabilities and Contingent Assets. The practical expedient for short-term leases was applied for leases with a remaining term of less than one year, whose original term was more than one year. A single discount rate is applied to a portfolio of leases with similar characteristics. For initial application of IFRS 16

as a lessee, the right-of-use assets were measured at the amount of the lease liability. The incremental borrowing rate as of the date of initial application (January 1, 2019) was used. The average incremental borrowing rate as of this date was 3.3%.

The equity effects resulting from initial application were recognized on an accumulated basis in the amount of €0.5 million as of January 1, 2019. The prior-year figures have not been restated. Right-of-use assets totaling €132.1 million were recognized for leases where MTU is the lessee as the result of the initial application of IFRS 16. That amount includes assets with a carrying amount of €7.3 million that were classified as finance leases in accordance with IAS 17 as of December 31, 2018. The following table shows the distribution of the right-of-use assets among the asset classes:

[T52] Right-of-use assets as of Jan. 1, 2019

in € million	Land and buildings	Technical equipment	Operational and office equipment, other equipment	Total
Capitalized right-of-use assets as of Jan. 1, 2019	21.0	0.4	110.7	132.1
thereof: carrying amounts of finance leases as of Dec. 31, 2018	5.6	0.4	1.3	7.3

The reconciliation from the unrecognized lease liabilities as of December 31, 2018, to the lease liabilities recognized as of January 1, 2019, is as follows:

[T53] Reconciliation to lease liabilities in accordance with IFRS 16

in € million

Other financial liabilities from rental and lease contracts in accordance with IAS 17 as of Dec. 31, 2018	89.7
Practical expedient for short-term leases with a lease term of up to 12 months	-8.8
Practical expedient for low-value leased assets	-0.6
Payments for extension and termination options	62.2
Payments for non-lease components	-2.7
Other	-2.4
Lease liabilities for operating leases (undiscounted)	137.4
Effect of discount rate	-10.2
Lease liabilities for operating leases (discounted)	127.2
Carrying amount of finance lease liabilities in accordance with IAS 17 as of Dec. 31, 2018	10.0
Carrying amount of lease liabilities in accordance with IFRS 16 as of Jan. 1, 2019	137.2

As a result of initial application of IFRS 16, in fiscal 2019 additional repayments of lease liabilities amounting to €41.1 million are recognized in the cash flow from financing activities and interest payments of €4.3 million are recognized in the cash flow from operating activities. Without the initial application of IFRS 16, these payments would have reduced the cash flow from operating activities by €45.4 million.

Accounting standards, interpretations, and amended standards and interpretations issued but not yet applied

The following new and amended standards and interpretations have been issued by the IASB but were not yet effective for annual periods beginning on or after January 1, 2019:

[T54] Accounting standards and interpretations not yet applied

Standard	Title
IFRS 3	Amendments: Definition of a Business ^{1) 4)}
IFRS 7, IFRS 9 and IAS 39	Amendments: Interest Rate Benchmark Reform ¹⁾
IFRS 17	Insurance Contracts ^{2) 4)}
IAS 1	Amendments: Classification of Liabilities as Current or Non-Current ^{3) 4)}
IAS 1 and IAS 8	Amendments: Definition of Material ¹⁾

¹⁾ Effective for annual periods beginning on or after Jan. 1, 2020.

²⁾ Effective for annual periods beginning on or after Jan. 1, 2021.

³⁾ Effective for annual periods beginning on or after Jan. 1, 2022.

⁴⁾ Still awaiting EU endorsement.

MTU does not intend to voluntarily apply any of these standards and interpretations, or any amendments made to them, in advance of their effective date.

In view of the MTU Group's current business model, the aforementioned standards are not expected to have a material impact on MTU's financial reporting in future reporting periods.

Application of Section 264 (3) of the German Commercial Code (HGB)

MTU Maintenance Hannover GmbH, Langenhagen, Germany, MTU Maintenance Berlin-Brandenburg GmbH, Ludwigfelde, Germany, and MTU Maintenance Coating Services GmbH, Ludwigfelde, Germany, are consolidated affiliated companies of MTU Aero Engines AG, Munich. These companies apply the exemption in Section 264 (3) of the German Commercial Code (HGB).

Consolidated group

As of December 31, 2019, the MTU Group including MTU Aero Engines AG, Munich, comprised 34 companies. These are presented in detail in the list of major shareholdings in [Note 40 "Related party disclosures."](#)

Changes in the consolidated group

The number of group companies and equity investments in associates and joint ventures included in the consolidated financial statements changed as follows:

[T55] Consolidated group			
	Germany	International	Total
Shareholdings as of Dec. 31, 2017	11	22	33
Additions 2018			
Disposals 2018	-1		-1
Shareholdings as of Dec. 31, 2018	10	22	32
Additions 2019	2	1	3
Disposals 2019		-1	-1
Shareholdings as of Dec. 31, 2019	12	22	34

MTU Maintenance Serbia d.o.o., Beograd-Novi Beograd, Serbia, was established on July 3, 2019. The purpose of this company is to create additional capacity for the maintenance of aircraft engines. MTU Aero Engines AG holds all shares in this company.

On July 26, 2019, MTU Aero Engines AG, Munich, acquired 39.98% of the shares of Turbo Union GmbH, Hallbergmoos, Germany, for €11,394.30. The company subsequently merged with the group company Turbo Union Ltd., Bristol, United Kingdom, to shift Turbo Union's activities to Germany in the interest of avoiding Brexit complications.

On September 19, 2019, MTU Maintenance Coating Services GmbH, Ludwigsfelde, Germany, was formed by way of the acquisition of a shelf company. The company's purpose is to provide coating services to MTU Maintenance Berlin-Brandenburg GmbH, Ludwigsfelde, Germany, which also holds all of the shares of the new company. In this context, under the contract of December 18, 2019, the net assets of Krauss GmbH, Ludwigsfelde, Germany, were acquired as of February 1, 2020, at a purchase price of €3.4 million.

Subsidiaries

The consolidated financial statements of MTU Aero Engines AG, Munich, include all material companies in which MTU Aero Engines AG, Munich, has a controlling interest as defined by IFRS 10, in other words entities in which MTU, as the investor, is exposed, or has rights, to variable returns from its involvement with the investee and has the ability to affect those returns through its power over the investee. There were no changes in the classification of these controlling interests during the reporting period.

Associates

Associated companies are companies over which MTU exercises significant influence in accordance with IAS 28 and which are neither subsidiaries nor joint ventures. The equity investments in these entities, over whose financial and operating policies MTU directly or indirectly exercises significant influence, are accounted for using the equity method, or at fair value if the effects of their consolidation under the equity method would be immaterial to the presentation of MTU's net assets, financial position and results of operations. There were no changes in the classification of these equity investments during the reporting period. MTU holds an 18% share in the voting rights of IAE International Aero Engines LLC, East Hartford, USA, and of PW1100G-JM Engine Leasing LLC, East Hartford, USA. The underlying agreements grant MTU significant influence over the management of these investees, as well as information and consultation rights, thus justifying their classification as associates.

Joint ventures

Joint ventures are companies over which MTU exercises joint control together with one or more other entities in accordance with IFRS 11. MTU's joint ventures, namely

- / MTU Maintenance Zhuhai Co. Ltd., Zhuhai, China;
- / Pratt & Whitney Canada Customer Service Centre Europe GmbH, Ludwigsfelde, Germany;
- / Ceramic Coating Center S.A.S., Paris, France;
- / Airfoil Services Sdn. Bhd., Kota Damansara, Malaysia;
- / AES Aerospace Embedded Solutions GmbH, Munich, Germany; and
- / Engine Maintenance Europe Aero sp. z.o.o., Jasionka, Poland

are accounted for in the consolidated financial statements using the equity method.

Non-material investments

Non-material investments are shares in companies and stakes in engine programs whose overall impact on the group's net assets, financial position and results of operations is currently and foreseeably insignificant. These investments are measured at fair value and recognized in other comprehensive income in the consolidated financial statements in compliance with the amended requirements of IFRS 9.

Restrictions

In certain cases, MTU or its subsidiaries may be subject to restrictions on their ability to transfer liquid funds or other assets to other group companies. Such restrictions may stem from regulatory requirements or from contractual agreements.

Consolidation principles

All business combinations are accounted for using the acquisition method in accordance with IFRS 3. Under the acquisition method, the acquirer accounts for the business combination by measuring and recognizing the identifiable assets acquired and the liabilities and contingent liabilities assumed. The identifiable assets, liabilities, and contingent liabilities are measured at fair value. Any excess of the purchase price over the net fair value of the acquired assets is recognized as goodwill in accordance with IAS 36 and tested for impairment at least annually, or at shorter intervals if there is an indication that the asset might be impaired. If the group's interest in the net fair value of the acquired identifiable net assets exceeds the cost of the business combination, that excess (negative goodwill) is recognized in the income statement after remeasurement as required by IFRS 3.36.

The effects of intragroup transactions are eliminated. In the accounting for dealings between entities of the consolidated group, accounts receivable are offset against accounts payable and expenses are offset against income. Internal sales are transacted on the basis of normal market transfer prices and intragroup profits and losses are eliminated.

In accordance with IAS 12, deferred tax assets and liabilities are recognized on temporary differences arising from the elimination of intragroup profits and losses.

Currency translation

Transactions in foreign currencies are translated to the functional currency using the exchange rate prevailing on the date of the transaction. At the reporting date, monetary items are translated using the exchange rate prevailing at that date, whereas non-monetary items are translated using the exchange rate prevailing on the transaction date. Translation differences are generally recognized in the income statement. The assets and liabilities of group companies whose functional currency is not the euro are translated from the corresponding local currency to the euro using the closing exchange rate at the reporting date. In the income statements of foreign group companies whose functional currency is not the euro, income and expense items are translated each month using the exchange rate applicable at the end of the month; the average exchange rate for the year can be derived from these end-of-month exchange rates. The translation differences arising in this way are recognized in other comprehensive income and do not have any impact on the net profit/loss for the year. In the case of non-monetary items, the date of initial recognition is used to determine the exchange rate for translation of the asset or liability at initial recognition and for the subsequent recognition of income and expenses arising on derecognition of the asset or liability.

Accounting policies

The consolidated financial statements of MTU Aero Engines AG, Munich, and its subsidiaries are prepared using uniform accounting policies based on the International Financial Reporting Standards (IFRSs).

Revenue

IFRS 15 states that revenue from contracts with customers should be recognized as an amount that reflects the consideration to which the entity expects to be entitled in exchange for the promised goods or services as part of its performance obligation. A five-step model framework is used to identify and measure this revenue:

1. Identify the contract(s) with the customer,
2. Identify each party's performance obligations in the contract,
3. Determine the transaction price,
4. Allocate the transaction price to the performance obligations in the contract,
5. Recognize revenue when (or as) the entity satisfies a performance obligation.

Identification of the contract(s) with the customer

Contracts may be entered into in writing, orally or implicitly in the ordinary course of business. In each case, the contracts must be enforceable and have commercial substance. A contract with a customer will be within the scope of IFRS 15 if these conditions are met and as soon as it is “probable” that MTU will collect the consideration to which it is entitled. When the probability that the consideration will be collected is assessed, the customer’s ability and intention to deliver the consideration by the due date are taken into account. MTU considers contracts to be within the scope of IFRS 15 if:

- / all parties are in agreement with the terms of the contract,
- / each party’s rights in relation to the goods or services to be transferred can be identified,
- / the payment terms for the goods or services to be transferred can be identified,
- / the contract has commercial substance, and
- / it is probable that the consideration to which MTU is entitled in exchange for the goods or services will be collected.

If, at the reporting date, a contract with a customer does not yet meet all of the above criteria, the company will continue to re-assess the contract at regular intervals until such time as the criteria are met. From this point onward, IFRS 15 will be applied to the contract.

In the commercial OEM segment, MTU identifies the respective consortium leaders (OEMs) as customers within the meaning of IFRS 15 in the case of the existing risk- and revenue-sharing partnerships in the commercial engine business. In the case of risk- and revenue-sharing partnerships with joint consortium leadership, as in the military engine business, the end customer served by the consortium (e.g., an air force) is identified as the customer as defined in IFRS 15. In the commercial maintenance business (MRO segment), MTU has identified its direct contractual partners as the customers as per IFRS 15 (e.g., aircraft operators, leasing companies).

Contract modification

Long-term service agreements in particular are often modified to take changes in the terms and conditions into account. The renewal of existing contracts is also regarded as a contract modification. A contract modification exists if the changes either create new rights and obligations or modify existing enforceable rights and obligations, thus altering the scope of the contract and/or the agreed price. Such changes must be accounted for either by modifying the accounting for the current contract or by establishing a separate, new contract. In

the commercial maintenance business (MRO segment) in particular, maintenance for engine fleets can be arranged by way of long-term service agreements. The renewal of such long-term service agreements is usually accounted for as the termination of the old contract and the simultaneous establishment of a new contract.

Identification of performance obligations

Once a contract has been identified as being within the scope of IFRS 15, its terms and conditions and the company’s general terms of business are assessed in order to identify the promised goods or services (or bundle of goods and services) to be treated as distinct performance obligations and subsequently recognized. A good or service is distinct if the customer can benefit from the good or services on its own or in conjunction with other readily available resources, and if the promise to transfer the good or services to the customer is separately identifiable from other promises in the contract.

MTU’s material performance obligations are as follows:

- / manufacturing/delivery of aircraft engine components (sometimes including their assembly into modules)
- / development/access to new technology
- / MRO services for individually commissioned shop visits
- / MRO services on the basis of fly-by-hour or pay-per-event agreements – typically, the agreed transaction price payments are calculated according to the number of flying hours accomplished (fly-by-hour) or the number of times defined MRO services are requested (pay-per-event)

Often, MTU’s contractual warranty obligations do not constitute distinct performance obligations, because their sole purpose is to guarantee to customers to the customary extent that engine components delivered by MTU or that services provided by MTU comply with the agreed specifications and do not include any other performance guarantees.

Determination of the transaction price

The transaction price is the amount of consideration to which a company expects to be entitled in exchange for the transfer of goods or delivery of services to a customer. Where a contract contains elements of variable consideration, the company may estimate the amount of variable consideration to which it is entitled under the terms of the contract.

Variable consideration is only included in the transaction price to the extent that MTU considers a subsequent revenue reversal highly improbable.

The agreed transaction price is reduced in the case of qualified payments to customers. MTU defines such payments to customers as payments that are not made in exchange for identifiable goods and services that are independent of MTU's performance obligations toward the customer. Payments to customers arise, in particular, in connection with the commercial engine business (OEM segment).

Allocation of transaction price to performance obligations

Where a contract comprises multiple performance obligations, the transaction price is allocated to the performance obligations by reference to their standalone selling prices. Standalone selling prices are based whenever possible on observable data. Certain components of variable consideration are allocated in full to a performance obligation, because their payment depends on MTU's satisfaction of that performance obligation, and the allocation is consistent with the contractual distribution of the transaction price. If no standalone selling price is directly observable, MTU as a general rule estimates the applicable transaction price on the basis of the expected costs plus an appropriate margin by assessing relevant information that can be obtained without undue effort.

In the case of contracts in the commercial and military engine business (OEM segment) in which MTU's role is effectively that of a supplier or service provider to the consortium leader (OEM), without the responsibility to provide development assets or engine technology, the transaction prices are fixed in the consortium agreement, including variable elements. These transaction prices must be allocated in full to the goods delivered or services provided (e.g., engine assembly). For commercial consortium agreements in which MTU assumes responsibility for providing development assets or engine technology to the consortium or consortium leader (OEM) in addition to supplying engine parts or performing engine and module assembly services, MTU allocates the fixed, market-driven transaction prices as per the consortium agreement (relative standalone selling prices) to the corresponding delivery and performance obligations concerning the delivery of components and assembly services. The variable compensation received in the form of a share in the profits of the engine program is treated as compensation for the provision of development assets or engine technology as sales-based royalties.

In the commercial maintenance business (MRO segment), transaction prices fixed in the consortium agreement, including variable elements, are allocated with reference to the relative standalone selling prices to the identified components of the serviced maintenance contracts.

Recognition of revenue when performance obligations are satisfied

Revenue is recognized, either over time or at a point in time, when control of a good or service is transferred.

Revenue from the delivery of engine modules and components is recognized at a point in time and calculated with respect to the effective transfer of control to the customer and the associated beneficial risks and opportunities. Revenue from customer-specific services – such as development projects and especially engine maintenance – is recognized over time if they meet the necessary criteria.

When such revenue is recognized over time, the amount of completed work is determined as the ratio of contract costs incurred up to the reporting date to total contract costs.

All recognized revenue from contracts with customers constitutes revenue in accordance with IFRS 15.

Contracts with subcontractors

MTU sometimes works with subcontractors to fulfill its performance obligations. When MTU subcontracts the repair of engine components to a third party, MTU remains responsible for the quality of these repairs vis-à-vis the customer. Moreover, MTU is responsible for obtaining certificates of airworthiness for all new parts and components it delivers to customers. The subcontractors invoice MTU for their services in accordance with their contractual agreement with the group. They have no influence over the prices charged by MTU to its customers.

MTU is thus the principal contractor and reports its revenue as a gross amount. In other words, the full amount of sales from the customer is reported as revenue, while the amount invoiced by the subcontractor is recognized under cost of goods sold.

Activity as agent for the sale of non-MTU parts

As a member of certain engine consortia in the military sector, MTU participates in the sale of parts made by other partners, in addition to its development and production activities. The specific tasks performed by MTU consist in particular of organizing the sales process for the non-MTU parts, and contract negotiations. The percentage commission on the sale is not recognized as revenue until no uncertainty exists as to the amount of revenue arising from the sale, which is then recognized at a point in time.

Since MTU is merely the agent in this transaction, it recognizes the net amount of the consideration to which it is entitled for its activity as an agent.

Cost of goods sold

The cost of goods sold comprises the manufacturing cost of goods and services sold, including the amortization charge from purchased development work, and the cost of products purchased for resale. In addition to direct material and production costs, it also comprises allocated manufacturing-related overheads, including amortization of production-related intangible assets and depreciation of production facilities, write-downs on inventories and an appropriate portion of production-related administrative overheads.

Research and development expenses

Research costs are expensed in the period in which they are incurred.

In the case of development costs, a distinction is drawn between customer-funded development work and company-funded development work. Services provided as part of customer-funded development projects (e.g., government-funded technology programs) are reported in cost of goods sold, in light of the fact that the incurred costs are reimbursed by a contracting entity.

Development costs generated in the context of self-generated development projects are capitalized in accordance with the requirements of IAS 38 or recognized as an expense in the period in which they are incurred. The capitalized development costs comprise all costs directly attributable to the development process and are amortized over the asset's respective useful life from the start of marketing of the engine program by MTU. The amortization expense is recognized in cost of goods sold.

Intangible assets

Externally acquired and self-generated intangible assets are recognized in accordance with IAS 38 if it is probable that a future economic benefit is associated with the asset and the cost of the asset can be measured reliably.

Intangible assets with a finite useful life are carried at their purchase or production cost and amortized on a straight-line basis over their useful lives.

Amortization is based on the following generally accepted useful lives:

[T56] Useful lives of assets (in years)	
Program assets arising from the purchase price allocation and self-generated development assets	maximum 30
Customer relationships	4–26
Other assets	3–5

The useful lives and amortization methods pertaining to intangible assets are regularly assessed for appropriateness, and adjustments are made where necessary to the estimates used when the financial statements are being prepared.

Goodwill is tested for impairment on a yearly basis in accordance with IAS 36. Each of the two operating segments, OEM (commercial and military engine business) and MRO (commercial maintenance business), is tested separately.

Public sector grants and assistance

In accordance with IAS 20, public sector grants and assistance are not recognized until there is reasonable assurance that the conditions attached to them will be complied with and that the grants will be received. Grants are recognized as income in the periods in which the related expenses arise. In the case of capital expenditure on property, plant and equipment and on intangible assets, the amount of the public sector grant awarded for this purpose is deducted from the purchase or production costs of the asset. The grants are then recognized in the income statement using reduced depreciation/amortization amounts over the lifetime of the asset.

Property, plant and equipment

Property, plant and equipment are subject to wear and tear and are carried at their purchase or production cost less cumulative depreciation charges and impairment losses. The cost of items of self-constructed plant and equipment comprises all directly attributable costs and an appropriate proportion of production-related overheads. These assets are assigned to an appropriate category once they have been completed or are operational. The revaluation model is not applied. Depreciation on property, plant and equipment is calculated using the straight-line method in accordance with the useful life of the asset.

Depreciation is based on the following generally accepted useful lives:

[T57] Useful lives of assets (in years)	
Buildings	25–50
Lightweight structures	10–14
Property facilities	10–20
Technical equipment, plant and machinery	5–25
Operational and office equipment	3–14

The useful lives of machines used in multi-shift operation are reduced accordingly to take account of additional usage.

Borrowing costs

Borrowing costs directly related to the acquisition, construction or production of qualifying assets are added to the purchase or production costs of those assets in accordance with IAS 23 until such time as the assets have been made ready for sale or for their intended use. Qualifying assets are those that require a substantial period of time to be made ready for sale or for their intended use.

Borrowing costs are capitalized only insofar as they relate to the purchase and preparation of qualifying assets for their intended use or sale, and only include activities that commenced on or after January 1, 2009.

Leases

A contract is accounted for as a lease if it grants the following rights:

- / right to control the use of an identified asset in return for compensation
- / right to obtain substantially all the economic benefits from that use.

At the start of the lease, a lease liability and a right-of-use asset are recognized. Right-of-use assets are recognized at cost less all cumulative depreciation charges and all cumulative impairment losses. The Group recognizes lease liabilities at the present value of the lease payments to be made over the term of the lease. Lease payments are both fixed and variable.

The Group calculates the present value of lease payments by applying its incremental borrowing rate at the delivery date, because the interest rate underlying the lease cannot easily be determined otherwise. After the delivery date, interest is added to the lease liabilities, and they are reduced by lease payments made. In addition, the carrying amount of the lease liabilities is remeasured when there is any modification of the lease, change in the lease term, change in the lease payments (e.g., change in future lease payments if the index or interest rate used to

calculate these payments is switched), or change in the assessment of an option to buy the underlying asset.

Lease payments are reported in the cash flow statement, with the amount of the lease liabilities paid recognized in cash flow from financing activities and the interest component paid recognized in cash flow from operating activities.

Certain future changes are only recognized if their occurrence is estimated to be sufficiently probable. Assets and liabilities are not recognized in the case of short-term leases or leases for low-value assets. Payments for short-term lease or low-value asset leases as well as variable lease payments are recognized as an expense in function costs in the income statement in the period in which they occur.

If the group acts as lessor, all leases at the start of their term are classified as either finance leases or operating leases.

Classifying a lease requires the group to make an overall assessment as to whether the lease transfers all significant risks and opportunities associated with ownership of the underlying asset. If this is the case, the lease is classified as a finance lease; if not, it is an operating lease. In making this assessment, the group takes into account certain indicators, such as whether the lease covers most of the useful life of the asset.

On the delivery date of the leased assets, assets held in a finance lease are recognized as a receivable in the amount of the net investment in the lease. The interest rate underlying the lease is used to measure the net investment in the lease.

In the previous year, leases were accounted for in accordance with IAS 17 as follows:

Leasing contracts are classified in accordance with IAS 17 as either operating leases or finance leases, depending on whether the lessor or lessee is attributed the beneficial ownership of the leased asset and bears the substantial risks and rewards associated with ownership of the leased asset. If the lessor retains the substantial risks and rewards (operating lease), the leased asset is recognized in the lessor's balance sheet. The lessee in an operating lease arrangement recognizes lease payments made throughout the duration of the lease arrangement as expenses.

If the substantial risks and rewards associated with ownership of the leased asset are transferred to the lessee (finance lease), the leased asset is recognized in the lessee's balance sheet. The leased asset is recognized at its fair value as measured at the date of acquisition, or

at the present value of future minimum lease payments if lower, and depreciated over its estimated useful life, or the contract duration if shorter. The lessee immediately recognizes a finance lease liability corresponding to the carrying amount of the leased asset. The effective interest rate method is employed to measure the lease liability in subsequent periods.

Acquired program assets and acquired development work

Acquired program assets and acquired development work represent payments to customers as defined in IFRS 15 and are recognized as non-current assets. They are capitalized at the nominal amount of these payments. These assets are amortized against revenue over the lifetime of the program in question, which generally means a period of up to 30 years.

When program assets are acquired that include significant deferred, conditional purchase price components, they are accounted for analogously to IFRIC 1. Changes resulting from the subsequent measurement of the conditional purchase price components are therefore accounted for as subsequent purchase costs, or as a reduction of such costs.

Subsequent payments to customers based on program lifetime that do not result from remeasurement are recognized as an increase in the payments based on program lifetime, insofar as these payments are associated with future economic benefits derived from the payments based on program lifetime.

Impairment of intangible assets, property, plant and equipment, acquired program assets and acquired development work

At each reporting date, an analysis is carried out to reveal any indication that the value of intangible assets, or property, plant and equipment, or acquired program or development work might be impaired. If impairment is indicated, the value of the asset in question is assessed on the basis of its recoverable amount.

Assets with an indefinite useful life, intangible assets that are not yet ready for use, and goodwill acquired in connection with a business combination are not subject to amortization, but are instead reviewed for impairment at least once each year.

The impairment loss on intangible assets, property, plant and equipment and, in analogy to IAS 36, acquired program and development work, is determined by comparing the carrying amount with the recoverable amount. The recoverable amount is either the fair value of the asset (or of the cash-generating unit) less costs to sell, or the value in use, whichever is higher. The recoverable amount is usually determined using a discounted cash flow (DCF) method. If it is not possible to attribute separate future cash flows to discrete assets that have been generated independently of other assets, then an impairment test must be carried out on the basis of the cash-generating unit to which the asset (group) ultimately belongs. That involves making forecasts of the cash flow that can be generated by the asset or cash-generating unit and applying a discount rate that takes into account the risks associated with the asset or cash-generating unit.

If the reasons for impairment losses recognized in a prior period no longer exist, the impairment loss on these assets is reversed, except in the case of goodwill.

Non-current financial assets

Investments in joint ventures and associates that have a material impact on the group's net assets, financial position and results of operations are accounted for using the equity method. The group's share in the profit or loss of these entities is therefore allocated on a pro rata basis to profit/loss and to the corresponding carrying amount of the investment. This profit/loss is reported as a separate line item under "profit/loss of companies accounted for using the equity method."

Investments in subsidiaries that are not fully consolidated, and other equity investments and loans, are recognized at fair value. Here, MTU makes use of the option of recognizing such assets in other comprehensive income. Dividend payments received from these equity investments are included in the profit/loss of equity investments.

Inventories

Raw materials and supplies are measured at average purchase cost or net realizable value, whichever is lower. Trade discounts and customer loyalty awards are taken into account when determining acquisition costs. Purchase cost comprises all direct costs of purchasing and other costs incurred in bringing the inventories to their present location and condition. Net realizable value is the estimated selling price generated in the ordinary course of business for the finished goods in question, less estimated costs necessary to make the sale (costs to complete and selling expenses).

Finished products and work in progress are recognized at production cost or net realizable value, whichever is lower. Production cost comprises all production-related expenses based on normal capacity utilization. In addition to direct costs, these include an appropriate and necessary portion of the cost of material and production overheads, including production-related depreciation. Administrative expenses are also included to the extent that they can be attributed to production operations.

Contract assets

A contract asset represents the group's right to consideration for goods or services it has transferred to a customer. A contract asset is recognized when the group has satisfied its performance obligations and when its right to consideration is conditional on something other than the passage of time. If the right to consideration is unconditional except for the passage of time, it is recognized as a trade receivable and accounted for in accordance with the accounting principles for financial instruments.

Financial instruments

A financial instrument is a contract that simultaneously gives rise to a financial asset in one company and to a financial liability or equity instrument in another company.

Financial assets

Financial assets include, in particular, cash and cash equivalents, trade receivables, loans to third parties, other receivables, and derivative financial assets.

At initial recognition, financial assets are measured at their fair value. The measurement of a financial asset subsequent to initial recognition depends on its classification. Financial assets are measured at amortized cost if their purpose is to hold financial assets in order to collect contractual cash flows and the contractual terms of the financial asset give rise on specified dates to cash flows.

Financial assets are measured at fair value through other comprehensive income if their purpose is to hold financial assets in order to collect contractual cash flows and the contractual terms of the financial asset give rise on specified dates to cash flows and, additionally, these assets are to be sold at maturity. A distinction is made between debt instruments for which the accumulated gains and losses are reclassified on derecognition and equity instruments for which this is not the case. MTU has elected to use the option offered by IFRS 9 of recognizing equity instruments at fair value through other comprehensive income.

All other financial assets are measured at fair value through profit or loss.

Impairment loss on financial assets

The impairment model in IFRS 9 is based on the premise of providing for expected losses.

In the case of trade receivables and contract assets, expected losses are recognized for the entire remaining duration of the contract (full lifetime loss allowance.) For all other financial instruments, expected credit losses are measured at an amount equal to the 12-month expected credit losses, unless there has been a significant increase in the credit risk. Otherwise, expected losses are also recognized for these financial assets over their remaining term to maturity.

To determine whether there has been a significant increase in the credit risk of a financial asset, the probability of default is assessed at least once a quarter using both external rating information and internal information on the credit quality of the financial asset. In the case of debt instruments, a significant increase in the credit risk is determined principally on the basis of past-due information or probability of default.

When calculating the expected credit losses, an amount is factored in for the possible impairment of groups of financial assets with a comparable credit rating. The loss allowance is based on credit spreads covering good, average and poor credit ratings. The classifications used by international rating agencies are applied when making these measurements.

The credit rating of financial assets is considered to be impaired in the following cases: significant financial difficulties of the debtor or a high probability that the debtor will enter bankruptcy or financial reorganization; the closure of an active market; significant changes in technological, economic, legal or market conditions affecting the issuer; or a significant or persistent decline

in the fair value of the financial asset below its amortized cost. Impairment losses are initially entered in a separate valuation allowance account and only recognized as such after it has been established that the value of the asset is unrecoverable.

Financial liabilities

Financial liabilities often oblige the holder to return the instrument to the issuer in return for cash or another financial asset. Financial liabilities include, in particular, bonds and other debts evidenced by certificates, trade payables, liabilities to banks, finance lease liabilities, borrowers' note loans, and derivative financial liabilities.

Financial liabilities are measured at their fair value at the time of acquisition, which is normally equivalent to the fair value of the settlement amount. Transaction costs directly attributable to the acquisition are deducted from the amount of all financial liabilities. If a financial liability is interest-free or bears interest at below the market rate, it is recognized at an amount that is consistently lower than the settlement price or nominal value. The financial liability initially recognized at fair value is amortized subsequent to initial recognition using the effective interest rate method.

Cash and cash equivalents

The salient features of cash and cash equivalents, which include demand deposits and short-term bank deposits, are that they have a maturity of three months or less from the date of acquisition and are measured at their nominal value. The associated credit risk is considered low; no write-down was therefore deemed necessary.

Derivative financial instruments

MTU uses derivative financial instruments as a hedge against currency and price risks arising from its operating activities and financing transactions.

At initial recognition and when measured subsequently, derivative financial instruments are measured at their fair value. This value is determined using quoted market prices in an active market and is represented by the amount that MTU would receive or would have to pay at the reporting date when the financial instrument is terminated. If no quoted market prices in an active market are available, the fair value is calculated using recognized financial mathematical models (DCF method) on the basis of the relevant exchange rates, interest rates and credit standing of the contractual partners at the reporting date.

Hedge accounting (hedging relationships)

MTU satisfies the requirements of IFRS 9 concerning instruments used to hedge future cash flows. When a hedge is undertaken, the relationship between the financial instrument designated as the hedging instrument and the underlying transaction is documented, as are the risk management objective and strategy for undertaking the hedge. This includes assessing the effectiveness of the hedging instrument used. Existing cash flow hedges are checked for effectiveness on a regular basis.

MTU uses cash flow hedges to hedge the exposure of future payment cash flows transacted in U.S. dollars (underlying transactions) to fluctuations in foreign currency exchange rates. At remeasurement subsequent to initial recognition, the effective portion of the hedging instrument is recognized in equity under other comprehensive income, together with attributable deferred taxes, until such time as the underlying hedged transaction is realized.

The amounts recognized in other comprehensive income at remeasurement are recycled to the income statement as soon as the underlying hedged transaction is recognized. As a result of the application of IFRS 9, the cost of effective hedging instruments designated as cash flow hedges in connection with future revenue transactions must be recognized in other comprehensive income rather than as a revenue item.

Current and deferred taxes

Current and deferred taxes are recognized in the consolidated financial statements in the manner prescribed in the relevant tax jurisdictions. Current and deferred taxes are recognized in equity if they relate to business transactions that directly lead to a decrease or increase in equity.

The MTU Group assesses whether it is probable that a tax authority will accept a specific tax treatment. If MTU concludes that it is probable that the tax authority will accept the tax treatment, it determines the taxable profit, tax bases, unused tax losses, unused tax credits or tax rates consistently with the tax treatment that it uses or plans to use in its income tax filings.

If MTU concludes that it is probable that the tax authority will not accept a tax treatment, it reflects the effect of this uncertainty when determining the related taxable profit, tax bases, unused tax losses, unused tax credits or tax rates through a best estimate (e.g., the amount/expected amount) or the most likely outcome.

If this tax treatment affects both current tax and deferred taxes (for example, if it affects both taxable profit used to determine current tax and tax bases used to determine deferred tax), the MTU Group makes consistent judgments and estimates for both current and deferred taxes.

Interest on back taxes and tax refunds arising from tax audits are recognized in interest expense in the income statement.

Deferred tax assets and liabilities are established for temporary differences between the tax bases of assets and liabilities and their carrying amount in the consolidated balance sheet. Tax assets are established on tax credits available for carry-forward at such time as the conditions attached to the award of the tax credit have been fulfilled. Similarly, deferred tax assets are established on tax losses available for carry-forward. Deferred tax assets are recognized to the extent of the probability that taxable income will be available against which the deductible temporary difference can be applied together with losses as well as tax credits that are permitted to be carried forward. Deferred tax assets and liabilities are measured using the tax rates applicable on the date when the temporary differences are reversed. Deferred tax assets and liabilities are offset insofar as this meets the requirements of IAS 12.74.

Pension obligations

Provisions for pension obligations are accounted for using the projected unit credit method in accordance with IAS 19. This method takes into account not only pension and other vested benefits known at the reporting date, but also expected increases in pensions and salaries, applying a conservative assessment of the relevant parameters.

In the case of defined contribution plans, the company has no obligations beyond the payment of contributions to the plan. In the case of defined benefit plans, the company has an obligation to fulfill commitments to current and former employees.

In some cases, it is difficult to differentiate between defined contribution and defined benefit plans. In Germany, for example, a minimum level of benefits is guaranteed for defined contribution plans, such that, even when the plan is provided through an external fund or insurance company, the employer remains liable. This “ultimate employer liability” is governed by Section 1 (1) sentence 3 of the German Occupational Pensions Act (BetrAVG). For financial reporting purposes, the term “defined benefit plan” is interpreted on the basis of the underlying eco-

nomical substance of the arrangement. Insofar as the MTU Group has no material obligations beyond its “ultimate liability” once the contributions have been paid to state and private pension funds, these plans are classified as defined contribution plans. Current contributions are recognized as expenses in the period in which they are paid.

Actuarial gains and losses – from the measurement of the defined benefit obligation (DBO) and the plan assets – may arise either from changes in the actuarial assumptions used or when the actual development diverges from those assumptions. They are recognized in other comprehensive income in the period in which they arise and are recognized separately in the statement of comprehensive income. Past service cost is recognized directly in profit and loss. Where reinsurance claims exist and the criteria given in IAS 19 are met, these claims are treated as plan assets and netted against the pension obligations. The interest expense resulting from the reversal of the discount on the net liability, comprising pension obligations less the corresponding plan assets, is recognized under other financial income/expense. Service cost is recognized in the income statement as personnel expenses allocated to the relevant function costs.

Other provisions

In accordance with IAS 37, other provisions are recognized to cover legal or de facto obligations resulting from past events if settlement is expected to result in an outflow of resources. Such obligations regularly arise in connection with claims on warranties and the risk from pending losses on onerous contracts, the recognition of losses arising from the settlement of accounts and subsequent costs, personnel costs, various taxes (especially consumer taxes), and other costs such as the risk of legal action and lawsuits, for instance in connection with government investigations. Non-current provisions for liabilities with an identifiable due date more than one year beyond the reporting date are measured at the present value of expected future cash flows. The company measures provisions for pending losses on onerous contracts at the lower of the expected costs on settlement of the contract and the expected costs on premature termination of the contract.

Provisions for personnel obligations are recognized in accordance with IAS 19 or IAS 37. Obligations relating to pre-retirement part-time working arrangements and long-service awards are measured on the basis of actuarial reports.

Contingent liabilities

Contingent liabilities are potential obligations arising from past events whose existence depends on the occurrence or non-occurrence of one or more uncertain future events that are not wholly within the control of MTU. Contingent liabilities are not recognized as liabilities in the balance sheet because at the reporting date it is considered that there is unlikely to be an outflow of economic resources, or the amount of the obligation cannot be reliably estimated.

Contract liabilities

When a customer pays the consideration for a performance obligation, or if the company has an enforceable right to receive a specified consideration prior to the transfer of a good or service to the customer, the company presents such contracts with customers as contract liabilities, recognizable on the due date or on the date of settlement in accordance with IFRS 15. Recognition of a contract liability signifies that MTU has entered into an agreement with a customer in which it promises to transfer goods or services to that customer in exchange for consideration.

Refund liabilities

In accordance with IFRS 15, a refund liability is recognized if the company receives consideration from a customer and expects to refund some or all of that consideration to the customer. Refund liabilities represent the amount of consideration to which the company does not expect to be entitled at the reporting date.

Dividend payment and profit distribution

The claims of shareholders to dividend payments and profit distribution relating to a specific reporting period (fiscal year) are recognized as a liability in the period in which the corresponding resolution is passed. Disclosures relating to the Executive Board's or Supervisory Board's proposal to the Annual General Meeting concerning the dividend payment are provided in [Section VII. "Determination of the net profit available for distribution on the basis of the annual financial statements."](#)

Discretionary scope, measurement uncertainties and sensitivity

Preparation of the consolidated financial statements in accordance with IFRSs requires that assumptions and estimations be made that have an impact not only on the amounts of the assets and liabilities as well as contingent liabilities, but also on how these items are recognized. These assumptions and estimations conform with the circumstances prevailing at the reporting date and, to that extent, also influence the amount of income and expenses

recognized in the fiscal years presented. The assumptions and estimations relate primarily to the group's own determination of the useful lives of intangible assets and property, plant and equipment or that serve as the basis for measuring acquired program assets and development work, the calculation of the fair value of financial instruments, the determination of the effective date of planned transactions that form part of a hedging relationship, the measurement and recognition of provisions and tax credits, and assumptions in connection with impairment tests and purchase price allocations.

Actual values may occasionally deviate from the assumed and estimated values. Changes are made when more reliable information becomes available and these may have an impact on the figures in the period in which the changes are made and, where applicable, on subsequent periods.

- / Due to the long product lifecycle, changes in the applied interest rates and payment flows, and in the expected volume of sales and its distribution over time, have a significant impact on the amounts recognized for program assets and their amortization. They therefore necessarily require judgments on the part of management.
- / The interpretation of a sensitivity analysis of the extent of possible consequences of changes to measurement parameters, in particular those relating to claims on warranties, price and quantity structure, the risk of pending losses on onerous contracts, the risk of losses arising from the settlement of accounts, and the measurement of risks arising from legal action and lawsuits, does not allow the consequences of individual events to be assessed, due to the multitude of sensitivity scenarios presenting high degrees of uncertainty.
- / The measurement of intangible assets, property, plant and equipment, and financial assets involves the use of estimations. Judgments by management form the basis for determining the fair value of assets and liabilities and the useful life of assets.
- / In the process of determining impairment losses, estimations are made concerning such parameters as the source, timing and amount of the impairment loss. Many different factors can give rise to an impairment loss, e.g., changes in the competitive situation, expectations concerning the growth of air travel and the aircraft industry, changes in the cost of capital, changes in the future availability of financing funds, aging and obsolescence of technologies, replacement costs, or purchase prices paid in comparable transactions.

- / Estimates are also involved when calculating the recoverable amounts for both operating segments as well as for assets as part of impairment tests. They concern the identification and verification of indicated impairments, expected cash flows, relevant discount rates, corresponding useful lives and residual values. In particular, the estimation of cash flows on which the recoverable amounts are based in the case of new engine programs depends on the assumption that it will be possible to raise funds on a continuous basis and that it will be necessary to make continuous ongoing investments. If the demand for engines is slower than expected, this could reduce earnings and cash flows and possibly lead to the recognition of impairment losses. These estimations and the method used to obtain them have a significant impact on the recoverable amount determined and on the amount of the impairment loss recognized on goodwill. Reference is made to [Note 36 "Sensitivity analysis of goodwill"](#) for a sensitivity analysis of the goodwill of the two operating segments.
- / Management recognizes allowances for expected credit losses in accordance with the requirements of IFRS 9. One factor used to identify the need to recognize impairment losses on receivables is the receivables balance structured according to the customer's credit standing and judgments concerning the available security interests. If the customer's credit standing should deteriorate, the volume of the impairments that then have to be recognized or receivables to be written off may exceed the provisions made for this purpose.
- / In certain cases, financial liabilities may be linked to deferred, conditional purchase price components, resulting in the need to make predictions about the conditions upon which their subsequent measurement is dependent. A particular case in point in this context is the purchase price obligation arising from the increase in the stake in IAE-V2500. To account for changes in this liability, MTU makes use of publicly available market data (interest rates, U.S. dollar exchange rates) and, in particular, an input parameter that is not publicly observable, namely the number of flight hours that a part of the V2500 engine fleet is expected to accumulate, on which the deferred payments up to the year 2027 are based. To predict the future number of flight hours, MTU makes use of an in-house forecasting model that is based on internally available information concerning the in-service V2500 fleet. The sensitivity analysis takes into account both the absolute number of flight hours on which payments are based and the time period within which these hours arise.
- / When revenue is recognized at a point in time, estimates are necessary because, as a partner in engine consortia, MTU receives a fixed and a variable revenue component. The variable revenue component, which is mainly made up of a profit share and revenue-reducing effects such as losses arising from the settlement of accounts and rebates, is determined on the basis of empirical data and parameters specified in customer contracts, which necessarily implies management judgments. Estimates are in particular needed with regard to refund liabilities toward the OEM as defined in IFRS 15.
- / Revenue recognized over time is accounted for using the percentage-of-completion method, if it is sufficiently probable that future economic benefits associated with the business will flow to MTU. Because in some cases it may not be possible to reliably estimate the outcome, revenue calculated using the percentage-of-completion method is recognized on the basis of the contract costs incurred up to the reporting date, to the extent that it is probable that these costs can be recovered. The measurement uncertainty is consistent with the complexity and long-term nature of the respective customer contract. Management regularly reviews all estimations made in connection with these customer contracts, making adjustments to the accounts where necessary.
- / Revenue and the cost of goods sold for engine components and spare parts is partially based on estimates for accounting purposes. These estimations are derived principally from preliminary data supplied by the consortium leaders. Moreover, the settlement of insurance claims in connection with customized production and maintenance services may in certain cases require the use of estimations as to the probability that the claimed amount will ultimately be paid.
- / Income taxes must be determined for each tax jurisdiction in which the group operates. Estimates are required when measuring actual and deferred taxes. The utilization of deferred tax assets depends on the possibility of generating sufficient taxable income in a particular tax category and tax jurisdiction. A variety of factors are used to assess the probability that it will be possible to utilize deferred tax assets, e.g., past operating results, operating business plans and the periods over which losses can be carried forward. If the actual results deviate from these estimations, or if these estimations have to be adjusted in a future period, this may have an impact on the group's net assets, financial position and results of operations.
- / The total value of provisions for pensions and similar obligations, and therefore the expenses in connection with employees' retirement benefits, are determined

using actuarial methods based on assumptions concerning interest rates, choice of optional payment modalities, wage, salary and pension trends, and life expectancy. If it should become necessary to modify these assumptions, this could have a significant effect on the future amount of pension provisions or the future expenses for pensions.

- / The measurement and recognition of other provisions, accrued liabilities (as defined in IAS 37), refund liabilities and contingent liabilities involve substantial estimations by MTU. These concern contractual penalties, the implications of forward-looking information from program partners and customers, the cost of developing suitable engineering solutions, changes in the requirements imposed by flight safety organizations and aviation authorities, and the cost of meeting warranty obligations. Similarly, when accounting for committed aircraft financing agreements, estimations are required concerning the probability that the loans will be realized, the consistency of the terms with market conditions, and the change in the value of the pledged securities. Due to the uncertainties attached to this assessment, the actual expenses may deviate from those originally estimated, and from the corresponding balance sheet items and explanatory disclosures in the Notes to the consolidated financial statements.
- / In connection with the recognition of leases in accordance with IFRS 16, the assessment whether extension and termination options will be exercised is based on probability. The specific circumstances of each lease are used for this. These circumstances relate, in particular, to the operational need to continue to use the leased asset, the options and limitations of other means of financing and the terms for continued leasing of the asset.

All assumptions and estimates are based on the prevailing conditions and judgments made at the reporting date. Any subsequent changes occurring before the financial statements are published are taken into account. Estimations of future business developments also take into account the economic environment of the industry and the regions in which MTU is active, such as are deemed realistic at that time. In order to obtain new information, MTU also relies on the services of external consultants such as actuaries and legal counsels. Changes to the estimations of these obligations can have a significant impact on future results of operations.

II. Notes to the consolidated income statement

1. Revenue

Revenue developed in the reporting period as follows:

[T58] Revenue – prior-year amounts adjusted, see segment reporting

in € million	Revenue recognized at a point in time	Revenue recognized over time	Jan. 1 to Dec. 31, 2019	Revenue recognized at a point in time	Revenue recognized over time	Jan. 1 to Dec. 31, 2018
Commercial engine business	1,536.9		1,536.9	1,395.6		1,395.6
Military engine business	300.7	158.0	458.7	291.8	139.3	431.1
Commercial and military engine business (OEM)	1,837.6	158.0	1,995.6	1,687.4	139.3	1,826.7
Commercial maintenance business (MRO)	100.2	2,611.2	2,711.4	112.2	2,687.6	2,799.8
Consolidation	-42.2	-36.4	-78.6	-38.0	-21.4	-59.4
Total revenue	1,895.6	2,732.8	4,628.4	1,761.6	2,805.5	4,567.1

Revenue included €534.8 million (previous year: €455.5 million) carried as contract liabilities at the beginning of the fiscal year and €44.3 million (previous year: €23.5 million) relating to performance obligations recognized in prior periods.

The group generates its revenue in the following geographical areas:

[T59] Revenue according to customer's country of domicile

in € million	2019	2018
Germany	486.1	492.2
Europe	448.0	438.3
North America	2,937.3	3,005.5
Asia	399.5	310.1
Other regions	357.5	321.0
Total revenue	4,628.4	4,567.1

In the reporting period, approximately 63% (previous year: 66%) of MTU's revenue was generated from business with customers in North America, with the U.S. market accounting for a share of 59% (previous year: 62%).

Contracted performance obligations which were not yet satisfied as of December 31, 2019, including variable components which could be estimated, amounted to a cumulative transaction price of €19.8 billion (previous year: €17.6 billion). Of this cumulative transaction price, €3.0 billion will be realized in revenue within one year, €9.4 billion will be realized in revenue within two to five years, and €7.4 billion is expected to be realized in revenue after five and within 25 years.

A more detailed presentation of revenue, broken down by external and intersegment revenue and their attribution to major customers, is provided under "[Consolidated segment report.](#)" Additional information can be found in the [disclosures relating to operating results in the Combined management report.](#)

2. Cost of goods sold

[T60] Cost of goods sold

in € million	2019	2018
Cost of materials	-2,912.3	-2,985.0
Personnel expenses	-721.7	-633.6
Depreciation and amortization	-201.7	-147.4
Other cost of goods sold	58.2	-30.0
Cost of goods sold	-3,777.5	-3,796.0
Capitalized development costs	80.4	80.2
Total cost of goods sold	-3,697.1	-3,715.8

Despite a higher volume of business, the cost of goods sold was reduced slightly. Combined with the increase in revenue, this development resulted in higher gross profit, in turn improving the gross margin, which is defined as the ratio of revenue less cost of sales to revenue, from 18.6% in the previous year to 20.1% in the reporting period. This development is marked, in particular, by the realized product mix in the OEM and MRO segments and the development of the U.S. dollar exchange rate during the reporting period. Changes in other cost of goods sold correspond to the development of changes in inventories and adjustments to accrued liabilities recognized in previous periods.

3. Research and development expenses

Company-funded research and development expenses developed as follows:

[T61] Research and development expenses

in € million	2019	2018
Cost of materials	-38.4	-36.2
Personnel expenses	-24.9	-22.1
Depreciation and amortization	-1.5	-1.2
Other development costs	-3.1	-2.6
Research and development expenditure	-67.9	-62.1
Capitalized development costs	2.1	1.4
Research and development expenses recognized in profit or loss	-65.8	-60.7

More information is given in the [“Research and development” section of the Combined management report](#).

4. Selling expenses

[T62] Selling expenses

in € million	2019	2018
Cost of materials	-19.9	-23.2
Personnel expenses	-70.5	-72.3
Depreciation and amortization	-1.2	-1.2
Other selling expenses	-26.9	-18.4
Total selling expenses	-118.5	-115.1

Selling expenses comprise expenses for marketing and advertising, expenses in connection with air shows, trade fairs and exhibitions, and media relations expenses, as well as impairment allowances and impairments of receivables from customers. The latter concern activities in both the OEM and MRO segments in the reporting period and affect the overall development of other selling expenses.

5. General administrative expenses

[T63] General administrative expenses

in € million	2019	2018
Cost of materials	-5.7	-7.4
Personnel expenses	-59.7	-59.2
Depreciation and amortization	-2.2	-1.7
Other administrative expenses	-17.2	-15.3
Total general administrative expenses	-84.8	-83.6

General administrative expenses are expenses incurred in connection with administrative activities that cannot be directly allocated to development, production or sales activities.

6. Other operating income and expenses

[T64] Other operating income and expenses

in € million	2019	2018
Income		
Gains from the disposal of intangible assets and property, plant and equipment	0.2	0.3
Reimbursement of insurance claims	1.5	1.0
Hedge income	0.9	
Rental income from		
Property owned by MTU	1.7	1.7
Sublet property owned by third parties	0.9	1.7
Miscellaneous other operating income	6.8	4.3
Total other operating income	12.0	9.0
Expenses		
Hedging costs	-43.5	-22.1
Losses from the disposal of intangible assets and property, plant and equipment	-0.7	-0.2
Expenses associated with insurance claims	-1.1	-0.6
Rental payments for sublet property	-0.9	-1.7
Miscellaneous other operating expenses	-5.1	-1.6
Total other operating expenses	-51.3	-26.2
Net other operating income/expenses	-39.3	-17.2

The MTU Group does not hold any investment property. An insignificant number of the buildings recognized under property, plant and equipment are rented out to external third parties.

7. Profit/loss of companies accounted for using the equity method and of equity investments

[T65] Profit/loss of companies accounted for using the equity method and of equity investments

in € million	2019	2018
Profit/loss of companies accounted for using the equity method		
Associates	29.8	10.8
Joint ventures	50.2	33.0
Total profit/loss of companies accounted for using the equity method	80.0	43.8
Profit/loss of equity investments		
Program management and coordination companies	1.5	0.6
Other related companies	1.2	1.1
Total profit/loss of equity investments	2.7	1.7

The business performance of the joint venture MTU Maintenance Zhuhai Co. Ltd., Zhuhai, China, was responsible for a significant part of MTU's profit/loss of companies accounted for using the equity method.

Information on companies accounted for using the equity method is provided in [Note 16 "Financial assets."](#)

8. Net interest income/expense

[T66] Net interest income/expense

in € million	2019	2018
Interest income	6.3	7.6
Interest expense		
Bonds and notes	-3.7	-3.8
Convertible bonds	-13.5	-4.6
Liabilities to banks	-1.3	-0.9
Lease liabilities	-4.4	-0.3
Other interest expense	-3.6	-1.9
Capitalized borrowing costs for qualifying assets	3.0	3.2
Interest expense	-23.5	-8.3
Net interest income/expense	-17.2	-0.7

The year-on-year decrease in interest income is due to a smaller amount of extended loans for aircraft and engine financing activities required by MTU's partnership in commercial engine programs.

The increase in interest expenses corresponds in particular to prepayment penalties paid in the reporting period toward the partial redemption of the convertible bond issued in 2016. In addition, IFRS 16 was applied for the first time, resulting in a significant increase in interest-bearing lease liabilities year on year.

The borrowing costs capitalized in the reporting period relate to qualifying assets acquired or constructed mainly in connection with the group's stake in the Pratt & Whitney GTF™ engine family and PW800. The capitalized amount was determined using a cost of debt capital of 1.9% (previous year: 2.1%).

9. Other financial income/expense

[T67] Other financial income/expense

in € million	2019	2018
Effects of currency translation: exchange rate gains/losses on		
Currency holdings	1.2	4.7
Financing transactions	0.1	4.9
Lease liabilities	-2.2	
Fair value gains/losses on derivatives		
Currency derivatives	4.7	5.4
Commodity forwards	2.0	-0.6
Interest included in measurement of assets and liabilities		
Relating to pensions	-15.2	-13.8
Receivables, other provisions and liabilities	-12.6	-12.7
Miscellaneous other financial income/expense	0.2	-0.1
Other financial income/expense	-21.8	-12.2

10. Income taxes

Recognized income taxes comprise current income taxes paid or payable in the countries in which the group operates, and deferred tax income or expense.

[T68] Analysis of current and deferred income taxes

in € million	2019	2018
Tax expense incurred in current period	-123.8	-113.9
Tax expense (-)/tax income incurred in prior periods	-23.9	-17.5
Current income taxes	-147.7	-131.4
Deferred tax expense (-)/tax income resulting from temporary differences	-25.8	-21.5
Deferred tax expense (-)/tax income resulting from tax credits	1.6	5.6
Deferred tax expense (-)/tax income resulting from tax losses carried forward	-6.3	-6.7
Deferred income taxes	-30.5	-22.6
Income tax expense	-178.2	-154.0

Tax reconciliation

Deferred tax assets and liabilities are generally measured using the applicable tax rate for the period when the asset is realized or the liability is settled, based on current tax legislation in the countries concerned.

In the reporting period, as in the previous year, the deferred taxes of the German group companies were measured using an income tax rate of 32.2%. The income tax rate for the domestic tax group of MTU Aero Engines AG rate is still comprised of the uniform corporation tax rate of 15.0% plus a solidarity surcharge of 5.5% on the calculated corporation tax expense and takes into account an average municipal trade tax rate of 16.4%.

The tax assets and liabilities of companies outside Germany were measured using the relevant tax rates for the countries in question, which range between 19% and 27%.

Information on changes in deferred tax assets and liabilities is provided in [Note 34 "Deferred taxes."](#)

The following table shows the reconciliation of expected tax expense to recognized tax expense:

[T69] Tax reconciliation

in € million	2019	2018
Earnings before income taxes	666.6	607.3
Income tax rate	32.2%	32.2%
Expected tax expense	-214.6	-195.6
Impact of		
Recognition and measurement adjustments and write-downs on deferred tax assets	1.8	8.7
Non-tax-deductible operating expenses and tax-exempt income	-1.3	0.2
Lower tax rates for companies outside Germany	15.3	13.1
Investments accounted for using the equity method	23.2	12.3
Tax audit and prior periods	-5.4	-0.3
Tax credits available for carry-forward	3.2	8.1
Withholding tax charge on dividends paid by companies outside Germany	-1.2	-1.0
U.S. tax reform (FDII)	0.9	
Other impacts	-0.1	0.5
Income tax expense	-178.2	-154.0
Effective tax rate	26.7%	25.4%

11. Earnings per share

To determine diluted earnings per share, the number of common shares that could potentially be issued through the granting of equity instruments is added to the weighted average number of outstanding shares.

The net income available for distribution to the shareholders of MTU Aero Engines AG amounted to €478.1 million (previous year: €447.0 million).

In the reporting period, the weighted average number of outstanding shares was 51,813,526 (previous year: 51,580,929 shares). Based on these parameters, basic earnings per share amounted to €9.23 (previous year: €8.67).

Diluting effects arose from 3,614,481 shares (previous year: 4,007,370) that could potentially be issued through the convertible bonds issued by MTU, which meant that diluted earnings per share amounted to €8.46 (previous year: €8.10).

12. Additional disclosures relating to the income statement

After adjustments to eliminate the depreciation and amortization effect of the purchase price allocation (PPA) and of the increase in the stake in the IAE-V2500 program, the following reconciliation produces the performance indicator “Adjusted earnings before interest and tax (adjusted EBIT)”:

[T70] Reconciliation of EBIT to adjusted EBIT, depreciation/amortization expense and special items

in € million	2019	2018
Earnings before interest and taxes (EBIT)	705.6	620.2
+ Depreciation/amortization effect of purchase price allocation		
Increase in the stake in IAE-V2500	30.4	30.2
Intangible assets	20.8	20.8
Property, plant and equipment	0.1	0.2
Adjusted earnings before interest and taxes (adjusted EBIT)	756.9	671.4

Costs by function include the following personnel expenses items:

[T71] Personnel expenses

in € million	2019	2018
Wages and salaries	730.7	656.6
Social security, pension and other benefit expenses	135.9	122.6
Total personnel expenses	866.6	779.2

Personnel expenses include pension benefits of €18.8 million (previous year: €20.4 million). Other social security expenses amounted to €117.2 million (previous year: €102.2 million).

The average number of persons employed during the fiscal year breaks down as follows:

[T72] Disclosures on the average number of employees

Number	2019	2018
Industrial staff	4,082	3,777
Administrative staff	4,571	4,074
Temporary employees	1,217	1,060
Employees in vocational training	269	281
Interns	188	199
Total average number of employees	10,327	9,391

The fees charged by the group auditor Ernst & Young GmbH Wirtschaftsprüfungsgesellschaft in 2019 in accordance with Section 314 (1) no. 9 of the German Commercial Code (HGB) amounted to a total of €1.1 million (previous year: €1.3 million).

[T73] Group auditor compensation

in € million	2019	2018
Financial statement auditing services	1.0	1.2
Other assurance services	0.1	0.1
Total group auditor compensation	1.1	1.3

The fee for financial statement auditing services primarily related to the audit of the consolidated financial statements and the separate financial statements of MTU Aero Engines AG and its subsidiaries, reviews of the interim financial statements integrated in the audit process as well as auditing services in connection with the implementation of new accounting standards. Other assurance services mainly included the limited assurance engagement on the non-financial statement and the EMIR audit.

III. Notes to the consolidated balance sheet

13. Changes in intangible assets and property, plant and equipment

[T74] Changes in non-financial assets – purchase and production costs 2019 – amounts carried forward adjusted due to IFRS 16

in € million	As of Jan. 1, 2019	Currency translation differences	Additions	Transfers	Disposals	As of Dec. 31, 2019
Program assets arising from the purchase price allocation	670.3					670.3
Program-independent technologies	124.7					124.7
Customer relationships	56.5					56.5
Rights and licenses	143.3	0.5	5.1	4.3		153.2
Goodwill	391.8	0.1				391.9
Prepayments on intangible assets			48.3			48.3
Development assets	411.9		75.5			487.4
Intangible assets	1,798.5	0.6	128.9	4.3		1,932.3
Land, leasehold rights and buildings, including buildings on third-party land	459.4	1.3	19.5	22.9	-6.2	496.9
Technical equipment, plant and machinery	665.7	2.4	39.2	51.8	-9.7	749.4
Other equipment, operational and office equipment	705.4	0.6	141.1	21.8	-25.7	843.2
Advance payments and construction in progress	152.3	0.8	150.2	-100.8	-1.2	201.3
Property, plant and equipment	1,982.8	5.1	350.0	-4.3	-42.8	2,290.8
Total	3,781.3	5.7	478.9		-42.8	4,223.1

[T75] Changes in non-financial assets – depreciation/amortization and carrying amount 2019 – amounts carried forward adjusted due to IFRS 16

in € million	As of Jan. 1, 2019	Currency translation differences	Depre- ciation/ amortization	Transfers	Disposals	As of Dec. 31, 2019	Carrying amount Dec. 31, 2019
Program assets arising from the purchase price allocation	412.2		18.4			430.6	239.7
Program-independent technologies	124.7					124.7	
Customer relationships	46.0		2.4			48.4	8.1
Rights and licenses	113.9	0.4	8.6	0.1		123.0	30.2
Goodwill							391.9
Prepayments on intangible assets							48.3
Development assets	29.0		14.1			43.1	444.3
Intangible assets	725.8	0.4	43.5	0.1		769.8	1,162.5
Land, leasehold rights and buildings, including buildings on third-party land	158.5	0.6	14.5	0.6	-0.7	173.5	323.4
Technical equipment, plant and machinery	504.1	1.1	48.0	0.7	-7.9	546.0	203.4
Other equipment, operational and office equipment	396.0	0.5	100.6	-1.4	-25.2	470.5	372.7
Advance payments and construction in progress							201.3
Property, plant and equipment	1,058.6	2.2	163.1	-0.1	-33.8	1,190.0	1,100.8
Total	1,784.4	2.6	206.6		-33.8	1,959.8	2,263.3

[T76] Changes in non-financial assets – purchase and production costs 2018

in € million	As of Jan. 1, 2018	Currency translation differences	Additions	Transfers	Disposals	As of Dec. 31, 2018
Program assets arising from the purchase price allocation	670.3					670.3
Program-independent technologies	124.7					124.7
Customer relationships	56.5					56.5
Rights and licenses	134.1	0.1	4.6	4.5		143.3
Goodwill	391.6	0.2				391.8
Development assets	343.0	0.2	68.7			411.9
Intangible assets	1,720.2	0.5	73.3	4.5		1,798.5
Land, leasehold rights and buildings, including buildings on third-party land	444.0	-1.4	0.8	0.7	-0.2	443.9
Technical equipment, plant and machinery	604.2	-1.9	25.1	44.9	-6.6	665.7
Other equipment, operational and office equipment	546.7	-0.4	71.2	7.4	-28.9	596.0
Advance payments and construction in progress	112.5	-0.8	102.4	-57.5	-4.3	152.3
Property, plant and equipment	1,707.4	-4.5	199.5	-4.5	-40.0	1,857.9
Total	3,427.6	-4.0	272.8		-40.0	3,656.4

[T77] Changes in non-financial assets – depreciation/amortization and carrying amount 2018

in € million	As of Jan. 1, 2018	Currency translation differences	Deprecia- tion/ amortization	Transfers	Disposals	As of Dec. 31, 2018	Carrying amount as of Dec. 31, 2018
Program assets arising from the purchase price allocation	393.9		18.3			412.2	258.1
Program-independent technologies	124.7					124.7	
Customer relationships	43.5		2.5			46.0	10.5
Rights and licenses	106.2	0.1	7.3	0.3		113.9	29.4
Goodwill							391.8
Development assets	19.4		9.6			29.0	382.9
Intangible assets	687.7	0.1	37.7	0.3		725.8	1,072.7
Land, leasehold rights and buildings, including buildings on third-party land	149.1	-0.4	9.9		-0.1	158.5	285.4
Technical equipment, plant and machinery	469.1	-0.9	41.9	0.5	-6.5	504.1	161.6
Other equipment, operational and office equipment	353.7	-0.3	62.0	-0.8	-18.6	396.0	200.0
Advance payments and construction in progress							152.3
Property, plant and equipment	971.9	-1.6	113.8	-0.3	-25.2	1,058.6	799.3
Total	1,659.6	-1.5	151.5		-25.2	1,784.4	1,872.0

14. Intangible assets

Intangible assets mainly comprise program assets and program-independent technologies which were capitalized as part of the purchase price allocation in connection with the acquisition by Kohlberg Kravis Roberts & Co. Ltd. (KKR) on January 1, 2004, of the shareholding in MTU previously held by DaimlerChrysler AG, and acquired goodwill. This item also includes capitalized, self-created development assets and software (the latter mostly for engineering applications).

In the reporting period, intangible assets totaling €128.9 million (previous year: €73.3 million) were recognized, of which €75.5 million (previous year: €68.7 million) were internally generated, almost exclusively for new engine programs.

The amortization expense on intangible assets is presented in the following line items in the following amounts: cost of goods sold €42.5 million (previous year: €37.1 million), research and development costs €0.2 million (previous year: €0.2 million), selling expenses €0.3 million (previous year: €0.3 million), and general administrative expenses €0.5 million (previous year: €0.1 million).

15. Property, plant and equipment

Through its capital expenditure on property, plant and equipment, MTU aims to expand its production capacity and modernize equipment and machinery to state-of-the-art standards.

In the reporting period, the group's total capital expenditure on property, plant and equipment amounted to €350.0 million (previous year: €199.5 million). Additions to this item also include the recognition of right-of-use assets under leases. Further information is provided in [Note 38 "Leases."](#)

The depreciation expense on property, plant and equipment is included in the presentation of the following line items: cost of sales €159.2 million (previous year: €110.3 million), research and development expenses €1.3 million (previous year: €1.0 million), selling expenses 0.9 million (previous year: €0.9 million), and general administrative expenses €1.7 million (previous year: €1.6 million).

Additions to land, leasehold rights and buildings, including buildings on third-party land, amounted to €19.5 million in the reporting period (previous year: €0.8 million) and relate mainly to new buildings and building extensions and to right-of-use assets for real estate leases (initial application of IFRS 16 in the reporting period).

Capital expenditure on technical equipment, plant and machinery totaling €39.2 million (previous year: €25.1 million) relates mainly to the purchase of plant and machinery for the production of modules belonging to the Pratt & Whitney GTF™ engine family.

The capital expenditure on other equipment, operational and office equipment in the amount of €141.1 million (previous year: €71.2 million) and additions to advance payments and construction in progress in the reporting period in the amount of €150.2 million (previous year: €102.4 million) relate principally to the expansion of production capacities at the European sites, including right-of-use assets relating to leases (initial application of IFRS 16 in the reporting period).

16. Financial assets

Financial assets accounted for using the equity method

The financial assets accounted for using the equity method in the consolidated financial statements amounted to €538.2 million at the reporting date (previous year: €426.9 million).

Associates

PW1100G-JM Engine Leasing LLC., East Hartford, USA, leases out spare engines of the PW1100G-JM series and is the only material investment in an associate included in MTU's consolidated financial statements.

MTU holds an 18% interest in the company, which is accounted for using the equity method in the consolidated financial statements.

The table below provides a summary of the unaudited financial data of PW1100G-JM Engine Leasing LLC., East Hartford, USA, for the reporting period:

[T78] Summary of financial data of PW1100G-JM Engine Leasing LLC.

in € million	2019	2018
Balance sheet as of Dec. 31		
Current assets	61.2	147.4
Non-current assets	1,650.7	1,208.2
Current liabilities	31.0	99.6
Non-current liabilities	19.7	9.0
Equity	1,661.2	1,247.0
Share of equity	299.0	224.5
Reconciliation	-7.6	-5.6
Carrying amount of companies accounted for using the equity method	291.4	218.9
Income statement		
Revenue	298.6	136.6
Net income	167.3	64.2
Other comprehensive income		
Total comprehensive income	167.3	64.2
Group's share in the income	28.0	9.2

The table below shows the aggregated unaudited financial data of associates that are not material when considered separately for the reporting period:

[T79] Aggregated financial information on the non-material associates

in € million	2019	2018
Carrying amount of companies accounted for using the equity method	29.0	26.7
Net income	10.7	10.9
Total comprehensive income	10.7	10.9
Group's share in the income	1.8	1.6

Joint ventures

Information on the material joint ventures in which MTU holds an equity investment is provided in the tables below:

[T80] Material joint ventures

Name of joint venture	Registered office	Shareholding
MTU Maintenance Zhuhai Co. Ltd.	Zhuhai, China	50%
EME Aero sp. z o.o.	Jasionka, Poland	50%

All companies listed in the above table are accounted for using the equity method in the consolidated financial statements.

MTU Maintenance Zhuhai Co. Ltd., Zhuhai, China, specializes in the maintenance, repair and overhaul of V2500 (IAE) and CFM56 (CFMI) engines, and serves the regions of China and Southeast Asia.

EME Aero sp. z o.o. focuses on providing maintenance services for the Pratt & Whitney GTF™ engine family, which powers the Airbus A320neo family and other aircraft. The company is currently being set up.

The table below provides a summary of the unaudited financial data of the material joint ventures in the MTU Group for the reporting period and the previous year:

[T81] Income statement, statement of comprehensive income and balance sheet information of the material joint ventures

in € million	2019		2018	
	Engine Maintenance Europe Aero sp. z o.o.	MTU Maintenance Zhuhai Co. Ltd.	Engine Maintenance Europe Aero sp. z o.o.	MTU Maintenance Zhuhai Co. Ltd.
Income statement data disclosures				
Revenue	0.2	1,275.8		1,049.0
Depreciation/amortization and write-downs	-1.8	-4.8	-0.3	-4.5
Interest income		0.3		0.2
Interest expense	-4.0	-8.4	-1.2	-8.2
Income tax credits	3.1		1.2	
Income tax expense		-17.5		-11.3
Other income and expenses	-10.6	-1,143.0	-6.5	-952.9
Net income	-13.1	102.4	-6.8	72.3
Other comprehensive income		2.9		
Total comprehensive income	-13.1	105.3	-6.8	72.3
Group's share in the income	-6.0	51.2	-3.4	35.9
Balance sheet disclosures				
Non-current assets	153.6	91.1	59.7	77.8
Cash and cash equivalents	4.0	3.5	8.3	102.1
Other current assets	14.7	844.7	6.9	597.4
Total assets	172.3	939.3	74.9	777.3
Equity	34.8	364.0	22.5	301.4
Non-current financial liabilities		43.3		47.7
Other non-current liabilities	13.7		3.4	
Current financial liabilities	122.1	451.4	48.5	374.5
Other current liabilities	1.7	80.6	0.5	53.7
Total equity and liabilities	172.3	939.3	74.9	777.3
Reconciliation to carrying amount				
Share of equity	17.4	182.0	11.3	150.7
Reconciliation to carrying amount	0.2		0.2	
Carrying amount of companies accounted for using the equity method	17.6	182.0	11.5	150.7
Dividend received from joint ventures		22.6		17.8

The aggregated unaudited financial information of joint ventures that are not material when considered separately is presented in the following table for the reporting period:

[T82] Aggregated financial information on the non-material joint ventures

in € million	2019	2018
Carrying amount of companies accounted for using the equity method	18.2	19.1
Net income	11.1	7.3
Other comprehensive income		0.2
Total comprehensive income	11.1	7.5
Group's share in the income	5.0	0.5

Other financial assets

The carrying amounts of financial assets included in the consolidated financial statements are presented below:

[T83] Breakdown of other financial assets

in € million	Total		Non-current		Current	
	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018
Financial assets measured at purchase cost	116.8	117.3	56.7	86.0	60.1	31.3
Loans to third parties ¹⁾	49.6	59.7	49.6	59.7		
Loans to related companies ¹⁾		19.5		19.5		
Receivables from employees	0.9	1.0			0.9	1.0
Receivables from suppliers	18.5	1.1			18.5	1.1
Miscellaneous other financial assets	47.8	36.0	7.1	6.8	40.7	29.2
Financial assets at fair value through other comprehensive income	16.2	16.4	16.2	16.4		
Other interests in related companies	16.2	16.4	16.2	16.4		
Derivatives without hedging relationship	1.2	0.3	0.3		0.9	0.3
Derivatives with hedging relationship	4.8	11.0	3.9	2.0	0.9	9.0
Total other financial assets	139.0	145.0	77.1	104.4	61.9	40.6

¹⁾ Included in net financial debt.

The decrease in loans to third parties relates to partial repayment or, in the case of loans to related parties, full repayment of loans granted for the purpose of financing aircraft and aircraft engines.

The receivables from suppliers primarily include short-term credit notes which were received for returned goods, amendments to invoices and trade discounts.

Miscellaneous other financial assets amounting to €47.8 million (previous year: €36.0 million) relate mainly to outstanding credit notes for trade discounts as well as to numerous individual non-material items.

Other interests in related companies include the carrying amounts of MTU's investments in companies that are neither fully consolidated nor accounted for using the equity method. This item mainly relates to the shares in SMBC Aero Engine Lease B.V., Amsterdam, Netherlands (Sumisho Aero Engines Lease B.V., Amsterdam, Netherlands, was renamed in the reporting period). Given that this is a long-term investment, it was decided to

recognize it at fair value through other comprehensive income in order to avoid short-term earnings volatility. In the reporting period, this resulted in a reduction of €1.8 million in the carrying amount of the investment. In addition, new investments totaling €1.6 million were added.

The valuation allowances for expected credit losses on other financial assets amounted to €0.6 million in the reporting period (previous year: €0.0 million).

At the reporting date, derivative financial assets comprised the following instruments:

[T84] Derivative financial instruments

in € million	Total		Non-current		Current	
	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018
Forward foreign exchange contracts/ currency options	4.8	11.0	3.9	2.0	0.9	9.0
Nickel forward contracts	1.2	0.3	0.3		0.9	0.3
Total derivative financial instruments	6.0	11.3	4.2	2.0	1.8	9.3

17. Acquired program assets, development work and other assets

In the reporting period, MTU spent €7.0 million (previous year: €44.8 million) on the acquisition of program assets. The total amount of acquired program assets recognized in profit or loss in the reporting period was €45.3 million (previous year: €43.3 million). In the reporting period, compensation payments for development work in an amount of €8.8 million (previous year: €14.7 million) paid to consortium leaders (OEMs) were capitalized. The total amount of accrued payments for acquired development assets offset against revenue in the reporting period was €7.6 million (previous year: €5.7 million).

Additions to program assets include €3.9 million (previous year: €7.0 million) arising from the value adjustment of the increase in the stake in IAE-V2500 as a result of the revaluation of the resulting contingent purchase price obligation.

Other assets include claims for tax refunds amounting to €31.0 million (previous year: €28.4 million) in respect of transactional taxes and prepaid maintenance charges, insurance premiums and rents.

18. Deferred tax assets

Deferred tax assets decreased by €4.7 million to €55.8 million (previous year: €60.5 million) in the reporting period. Further details are provided in [Note 34 "Deferred taxes."](#)

19. Inventories

The carrying amount of inventories, taking into account valuation allowances, comprises the following components:

[T85] Inventories

in € million	Change in write-downs	Dec. 31, 2019			Dec. 31, 2018		
		Gross amount	Write-down	Carrying amount	Gross amount	Write-down	Carrying amount
Raw materials and supplies	-14.8	687.7	-69.3	618.4	476.8	-54.5	422.3
Work in progress	5.0	495.0	-40.3	454.7	431.0	-45.3	385.7
Finished goods	-25.0	269.2	-77.1	192.1	220.0	-52.1	167.9
Advance payments		13.4		13.4	19.9		19.9
Total inventories	-34.8	1,465.3	-186.7	1,278.6	1,147.7	-151.9	995.8

Of the total volume of inventories, an amount of €307.6 million (previous year: €261.3 million) was considered to be impaired at the reporting date.

20. Trade receivables

[T86] Trade receivables

in € million	Dec. 31, 2019	Dec. 31, 2018
Third parties	441.9	447.7
Related companies	480.9	603.5
Total trade receivables	922.8	1,051.2

Transactions with related companies are presented in more detail in [Note 40 "Related party disclosures."](#) The carrying amount of trade receivables includes valuation allowances in the amount of €18.4 million (previous year: €18.1 million).

21. Contract assets

The contract assets result from performance obligations that have been satisfied, where receipt of the agreed consideration depends on acceptance of the performance obligation by the customer and the amounts becoming due for payment. Changes in the reporting period correspond, on the one hand, to business activity close to the reporting date, and on the other, to changes in the U.S. dollar exchange rate. In the fiscal year, contract liabilities amounting to €214.5 million (previous year: €246.7 million) were offset against the corresponding contract assets.

Valuation allowances on trade receivables and contract assets changed as follows in the fiscal year:

[T87] Valuation allowances

in € million	2019	2018
As of Jan. 1, as reported	20.3	11.8
IFRS 9 adjustment		2.9
As of Jan. 1, adjusted	20.3	14.7
Translation differences		0.1
Transferred	-3.2	3.2
Additions	11.9	5.5
Utilized	-3.4	-1.9
Reversed	-6.0	-1.3
As of Dec. 31	19.6	20.3

Contract assets account for €1.2 million of the reported valuation allowances. The additions to this item in the reporting period are consistent with changes in the credit standing of specific customers (non-payment risk) and country risk classifications (market risk) in the commercial engine business. The expenses resulting from the derecognition of trade receivables are offset against the corresponding revenue, resulting in net income of €3.3 million (previous year: net income of €0.3 million).

As in prior years, all expense and income amounts arising from valuation allowances and the derecognition of trade receivables are recognized as selling expenses.

In order to minimize the non-payment risk, an active receivables management system is operated both in the OEM segment, supported in particular by the engine consortium leader, and in the MRO segment.

22. Income tax receivables

At the reporting date, income tax receivables amounted to €115.8 million (previous year: €43.2 million). Of this amount, €110.6 million (previous year: €41.1 million) relate to income tax receivables from the German tax authority, principally in connection with the repurchase of the convertible bond 2016. MTU considers it highly probable that the loss from the repurchase of the convertible bond issued in 2016 will be tax deductible.

23. Cash and cash equivalents

The cash and cash equivalents amounting to €139.5 million (previous year: €99.0 million) comprise cash in hand and bank deposits. This item also includes foreign-currency holdings with an equivalent value of €131.2 million (previous year: €92.8 million).

24. Equity

Changes in group equity are presented in the consolidated statement of changes in equity.

Subscribed capital

The company's subscribed capital (capital stock) is €53.1 million and is divided into 53.1 million non-par-value registered shares. The increase in the reporting period was due to the exercise of conversion options from the convertible bond issued in 2016.

Authorized capital

In accordance with Article 4 (5) of the articles of association, the Executive Board is authorized until April 10, 2024, to increase the company's capital stock by up to €15.6 million, with the prior approval of the Supervisory Board, by issuing, either in a single step or in several steps, new registered non-par-value shares in return for cash contributions (Authorized Capital 2019).

Conditional capital

In accordance with Article 4 (6) of the articles of association, the company's capital stock may be conditionally increased by up to €5.2 million through the issue of up to 5,200,000 new registered non-par-value shares (Conditional Capital 2015). The purpose of this conditional capital increase is to issue shares to owners or creditors of convertible bonds and/or bonds with warrants in accordance with the authorization granted to the company under a resolution passed by the Annual General Meeting on April 15, 2015. Shares are issued at a conversion price or warrant exercise price determined on the basis of this authorization.

The Executive Board is authorized until April 14, 2020, to issue, in a single step or in several steps and with the prior approval of the Supervisory Board, bearer and/or registered convertible bonds and/or bonds with warrants (collectively referred to as "bonds"), with or without maturity date, with a total nominal value of up to €500 million, and to grant the owners of convertible bonds and/or bonds with warrants the right, obligation or option to convert them into registered non-par-value shares of the company representing a stake in the capital stock of up to €5.2 million under the conditions established for the issue of convertible bonds or bonds with warrants. The bonds may be issued in return for cash contributions only. They may be issued in euros or – to an equivalent value – in any other legal currency, for instance that of an OECD country. They may also be issued by an affiliated company where MTU exercises control. In such cases, and subject to the prior approval of the Supervisory Board, the Executive Board is authorized to act as guarantor for the bonds and to grant the owners of the bonds the right, obligation or option to convert them into new registered non-par-value shares in MTU.

In 2016, MTU made use of this authorization to increase the company's capital stock by issuing a convertible bond with a nominal value of €500 million.

Further, in accordance with Article 4 (7) of the articles of association, the company's capital stock may be conditionally increased by up to €2.6 million through the issue of up to 2,600,000 new registered non-par-value shares (Conditional Capital 2019). The purpose of this conditional capital increase is to issue shares to owners or creditors of convertible bonds and/or bonds with warrants in accordance with the authorization granted to the company under a resolution passed by the Annual General Meeting on April 11, 2019. Shares are issued at a conversion price or warrant exercise price determined on the basis of this authorization.

The Executive Board is authorized until April 10, 2024, to issue, in a single step or in several steps and with the prior approval of the Supervisory Board, bearer and/or registered convertible bonds and/or bonds with warrants (collectively referred to as "bonds"), with or without maturity date, with a total nominal value of up to €600 million, and to grant the owners of convertible bonds and/or bonds with warrants the right, obligation or option to convert them into registered non-par-value shares of the company representing a stake in the capital stock of up to €2.6 million under the conditions established for the issue of convertible bonds or bonds with warrants. The bonds may be issued in return for cash contributions only. They may be issued in euros or – to an equivalent value – in any other legal currency, for instance that of an OECD country. They may also be issued by an affiliated company where MTU exercises control. In such cases, and subject to the prior approval of the Supervisory Board, the Executive Board is authorized to act as guarantor for the bonds and to grant the owners of the bonds the right, obligation or option to convert them into new registered non-par-value shares in MTU.

In 2019, MTU made use of this authorization to increase the company's capital stock by issuing a convertible bond with a nominal value of €500 million. More details are provided in [Note 28 "Financial liabilities."](#)

Capital reserves

Capital reserves contain premiums from the issue of shares and the equity component (net of proportional transaction costs) pursuant to IAS 32.31 of convertible bonds issued in the reporting period or prior periods.

As a result of partial redemption of the convertible bond 2016, after taking into account the offsetting tax effects of €88.7 million, the capital reserves were reduced by €186.5 million. By contrast, the issue of new shares as a result of the exercise of options to convert the convertible bond 2016 increased the capital reserves by €131.2 million. The net effect from the convertible bond 2016 was a reduction in the capital reserves of €55.3 million.

Taking into account transaction costs and after deduction of deferred taxes of €5.9 million, the issuance of the convertible bond 2019 increased capital reserves by €31.6 million.

Capital reserves additionally include the difference between the fair value and the carrying amount of the treasury shares sold under the terms of the Restricted Stock Plan or the employee stock option program (MAP) employee stock program or the Stock Matching Plan (SMP) and, previously, the Matching Stock Plan (MSP).

Retained earnings

Retained earnings mainly comprise the net profit generated in the past by consolidated group companies that has not been distributed.

Treasury shares

Purchase of treasury shares in accordance with the authorization granted by the Annual General Meeting on April 11, 2019

The Executive Board of MTU Aero Engines AG, Munich, has been authorized by a resolution of the Annual General Meeting held on April 11, 2019, to purchase treasury shares. These shares may be purchased on the stock market or by means of a public offering addressed to all shareholders. The consideration paid for these shares must not be more than 10% above or below the quoted share price, not taking into account any ancillary transaction costs.

The Executive Board of MTU was thus authorized to purchase treasury shares with an aggregate nominal value not exceeding 10% of the company's issued capital stock, as applicable on the date of the resolution, during the period to April 10, 2024, pursuant to Section 71 (1) no. 8 of the German Stock Corporation Act (AktG). At no point in time may the value of the acquired shares, together with other treasury shares in the company's possession or which are attributed to it pursuant to Section 71a et seq. of the German Stock Corporation Act (AktG), exceed 10% of the company's capital stock.

Holdings of treasury shares

The shares purchased by MTU in prior years still serve the purpose of issuing shares in connection with the em-

ployee stock option program (MAP) and to make shares available for issue under the Restricted Stock Plan (RSP). As in the prior year, MTU did not purchase any treasury shares in fiscal year 2019. Based on the new compensation system for the Executive Board and senior managers in effect as from fiscal year 2016, 14,951 (previous year: 21,026) treasury shares were sold to the eligible senior managers, and 9,509 (previous year: 11,318) to members of the Executive Board. A total of 98,243 shares (previous year: 102,041 shares) were sold to group employees in the fiscal year under the employee stock program (MAP), of which 12,236 treasury shares (previous year: 14,484 shares) were sold to eligible senior managers.

Reconciliation of weighted average number of outstanding shares

In fiscal year 2019, the weighted average number of outstanding shares totaled 51,813,526 (prior year: 51,580,929). A total of 52,850,797 shares in MTU Aero Engines AG, Munich, were in circulation as of December 31, 2019 (prior year: 51,634,227 shares). The company held 243,070 treasury shares as of December 31, 2019 (previous year: 365,773 shares).

Accumulated other comprehensive income

Accumulated other comprehensive income declined by €67.3 million to €-327.0 million (previous year: €-259.7 million) in fiscal year 2019. This is due in particular to actuarial losses resulting from the remeasurement of pension provisions.

The table below shows the income and expenses recognized in other comprehensive income, including the associated deferred taxes:

[T88] Items recognized in other comprehensive income

in € million	2019			2018		
	Before	Income taxes	After	Before	Income taxes	After
Translation differences arising from the financial statements of foreign entities accounted for using the equity method	2.3		2.3	0.4		0.4
Translation differences arising from the financial statements of other consolidated foreign entities	11.6		11.6	-5.0		-5.0
Translation differences arising from the financial statements of foreign entities	13.9		13.9	-4.6		-4.6
Actuarial gains/losses on pension obligations and plan assets	-97.4	31.3	-66.1	-6.1	2.1	-4.0
Financial instruments designated as cash flow hedges for companies not accounted for using the equity method	-20.2	6.7	-13.5	-118.7	35.5	-83.2
Financial instruments designated as cash flow hedges for companies accounted for using the equity method	1.5		1.5			
Changes in the fair value of equity investments	-1.8		-1.8	2.5		2.5
Income and expense recognized in other comprehensive income	-104.0	38.0	-66.0	-126.9	37.6	-89.3

Disclosures relating to capital management

MTU strives to maintain a strong financial profile in the interests of assuring the company's continuation as a going concern and its financial flexibility, as well as ensuring confidence on the part of its shareholders. As part of its capital management, the company observes the statutory requirements on capital maintenance. The company's articles of association do not stipulate any capital requirements. In general, the dividend policy is based on distributing between 30% and 40% of the adjusted annual net income to shareholders if the financial situation permits and the corporate bodies give their approval. The group's capital management activities are focused on optimizing the balance between equity and net financial debt. A description of the financial indicators MTU is obliged to meet in the context of its liabilities to banks can be found in [Note 28 "Financial liabilities."](#)

25. Pension provisions

Defined benefit plans and defined contribution plans are in place for MTU employees. For group companies in Germany, these benefits are financed primarily by provisions recognized in the financial statements, which are covered only to a small extent by plan assets. In contrast, MTU Maintenance Canada Ltd., Richmond, Canada, has a funded retirement benefit plan.

Defined contribution plans

Since January 1, 2007, no direct pension commitments have been granted to new employees in Germany other than senior managers. Instead, MTU paid contributions in the amount of €2.7 million in the reporting period (previous year: €1.9 million) to an external pension fund for employees who joined the company after that date. Other plans within the MTU Group include direct insurance contracts funded by employee contributions.

Employer's contributions to the state pension scheme in fiscal year 2019 totaled €51.3 million (previous year: €45.9 million).

Defined benefit plans

The pension obligations of MTU are measured using the projected unit credit method in accordance with IAS 19, taking account of future salary and pension increases and other adjustments expected to be made to benefits and pension plans. The provision for defined benefit plans recognized in the balance sheet corresponds to the present value of the benefits payable for current and past service (the defined benefit obligation) of beneficiaries less the fair value of plan assets at the reporting date. An extensive actuarial analysis is carried out annually for each pension plan by independent actuaries.

Actuarial gains or losses may arise in connection with increases or decreases either in the present value of the defined benefit obligation or in the fair value of plan assets. Causes of actuarial gains or losses include the effect of changes in measurement parameters, changes in the assessment of risks on pension obligations, and differences between the actual return on plan assets and the proportional share of interest on the net liability.

In order to calculate the funding status and the pension obligation recognized, the present value of unfunded and funded obligations is offset against the fair value of the plan assets. In Germany, there are no legal or regulatory minimum funding requirements.

The present value and funding status of the defined benefit obligation is as follows:

[T89] Present value of defined benefit obligation (DBO)		
in € million	Dec. 31, 2019	Dec. 31, 2018
Present value of unfunded pension obligations	976.3	879.1
Fair value of plan assets	-0.1	-0.1
Total Germany	976.2	879.0
Present value of funded pension obligations	28.1	24.6
Fair value of plan assets	-29.7	-25.5
Total other countries (negative value = plan asset surplus)	-1.6	-0.9
Recognized pension obligations (net)	974.6	878.1

The following parameters were applied to measure the pension obligations as of December 31 of the respective year and to measure the pension plan expense in the respective reporting period:

[T90] Actuarial assumptions: Germany

in %	Dec. 31, 2019	Dec. 31, 2018
Interest rate for accounting purposes	0.79	1.58
Salary trend	2.70	2.70
Pension trend	1.75	1.75

[T91] Actuarial assumptions: International

in %	Dec. 31, 2019	Dec. 31, 2018
Interest rate for accounting purposes	2.75	3.50
Salary trend	3.00	3.00
Pension trend	2.50	2.50

The market yields on high-quality, fixed-interest corporate bonds with similar maturities in Germany decreased compared with the previous year. In view of the duration of the obligations, which currently stands at 12 years, pension obligations were discounted as of December 31, 2019, applying a discount rate of 0.79%. The mortality tables issued by Prof. Dr. Heubeck (RT 2018G) were used to measure the pension plan obligations in Germany. For group companies in other countries, up-to-date mortality assumptions for each country were applied. The expected salary trend refers to the expected rate of increase in salaries and other compensation, which is estimated based on inflation, the length of service of employees within the group, as well as other factors. Employee turnover, mortality rates and disability risk were estimated on the basis of statistical data.

The present value of pension obligations changed as follows in the fiscal year:

[T92] Present value of pension obligations

in € million	2019	2018
Defined benefit obligation as of Jan. 1	903.7	898.2
Current service cost	15.6	16.0
Past service cost	-0.4	2.3
Pension plan subscriber contributions	8.7	7.9
Interest expense	14.5	13.5
Translation differences	1.7	-1.0
Actuarial gains (-)/losses (+)		
Financial assumptions	92.4	-2.0
Assumptions based on experience	6.9	7.0
Plan settlements/transfers	-17.1	-15.9
Pension benefit and capital payments	-21.6	-22.3
Defined benefit obligation as of Dec. 31	1,004.4	903.7

The actuarial losses arising from updated assumptions based on experience relate in particular to the empirical behavior of beneficiaries of the company pension scheme when choosing the mode of payment.

The obligations resulting from plan settlements/transfers are attributable to the conversion of pension benefits into fixed-sum payments and the group's employee turnover rate.

Plan assets changed as follows in the fiscal year:

[T93] Fair value of plan assets

in € million	2019	2018
Fair value as of Jan. 1	25.6	27.9
Interest income on plan assets	0.9	0.9
Actuarial gains/losses (-)	2.6	-1.1
Translation differences/transfers	1.8	-1.1
Employer contributions	0.5	0.5
Employee contributions to plan		0.1
Pension benefit payments	-1.6	-1.6
Fair value as of Dec. 31	29.8	25.6

[T94] Breakdown of plan assets

in %	2019	2018
Acquired pension benefits	72.5	75.0
Fixed-interest securities	22.0	20.0
Shares	5.5	5.0
Total plan assets	100.0	100.0

The risk and reward profile of the investment strategy for the plan assets is reviewed each year for the purpose of asset/liability management and adjusted where necessary. The pension fund's statement of principles defines restrictions to be observed when choosing investments. In this respect, the group has made no changes to its risk management process compared with that used in previous years.

The expense from defined benefit pension plans and similar obligations recognized in the income statement for the reporting period comprises the following items:

[T95] Expense from defined benefit pension plans and similar obligations

in € million	2019	2018
Current service cost	15.6	16.0
Past service cost	-0.4	2.3
Service cost	15.2	18.3
Interest cost on pension provisions	14.5	13.5
Interest income on plan assets	-0.9	-0.9
Net interest cost	13.6	12.6
Interest cost on liabilities from pension capital	1.6	1.2
Total expense	30.4	32.1

Current and past service costs are recognized under personnel expenses. The other components of the pension expense recognized in the income statement are included in other financial income/expense. The measurement effects related to actuarial gains and losses are recognized in total comprehensive income as part of other comprehensive income.

Expected future pension benefit payments

In the coming years, the group expects to settle its pension provisions and liabilities through the following series of payments:

[T96] Expected yearly amount of pension benefit payments

in € million	2020	2021	2022	2023
Expected yearly amount of pension benefit payments	32.7	34.3	40.2	40.5

For all beneficiaries, the expected yearly amount of pension benefit payments takes into account the payment method agreed at the reporting date or the standard contractually agreed payment option. This means receiving pension benefits by installment (administrative staff) or as a one-time payment (Executive Board members), or any other payment method agreed at the reporting date.

The main actuarial assumptions used to calculate the defined benefit obligation (DBO), apart from the mode of payment, are the discount rate, salary and pension trends, and assumed life expectancy. The following sensitivity analysis shows how the DBO would have been influenced by potential changes in the underlying assumptions:

[T97] Sensitivity analysis of the defined benefit obligation

in € million	2019	2018
Discount rate 50 basis points higher	-60.5	-53.4
Discount rate 20 basis points lower	25.7	22.8
Pension trend 50 basis points higher	13.9	13.0
Assumed life expectancy 1 year longer	16.9	13.9

There are interdependencies between certain actuarial assumptions, especially between changes in the discount rate and the expected pension and salary trends. The sensitivity analysis does not take these interdependencies into account.

26. Income tax liabilities

The income tax liabilities comprise German corporation and municipal trade tax plus income taxes for group companies outside Germany.

[T98] Income tax liabilities

in € million	2019	2018
As of Jan. 1	9.9	2.9
Utilized	-9.9	-2.9
Allocated	5.2	9.9
As of Dec. 31	5.2	9.9

Income tax liabilities are due within one year.

27. Other provisions

[T99] Other provisions

in € million	Total		Non-current		Current	
	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018
Warranty obligations and risks from pending losses on onerous contracts	33.9	36.1			33.9	36.1
Personnel obligations	79.1	76.3	7.7	9.5	71.4	66.8
Unpaid invoices/overdue accounts	96.9	104.8	40.1	38.2	56.8	66.6
Other liabilities	6.2	7.8			6.2	7.8
Total other provisions	216.1	225.0	47.8	47.7	168.3	177.3

Non-current other provisions developed as follows:

[T100] Non-current other provisions 2019

in € million	As of Jan. 1, 2019	Transferred	Utilized	Reversed	Allocated	Discount reversed	As of Dec. 31, 2019
Personnel obligations	9.5	-2.8	-0.6		1.5	0.1	7.7
Unpaid invoices/overdue accounts	38.2		-7.7	-4.8	14.4		40.1
Total non-current other provisions	47.7	-2.8	-8.3	-4.8	15.9	0.1	47.8

The following cash outflows are expected from the carrying amounts of non-current other provisions:

[T101] Expected cash outflow from non-current other provisions

in € million	Carrying amount as of Dec. 31, 2019	Expected cash outflow 2021
Personnel obligations	7.7	3.1
Unpaid invoices/overdue accounts	40.1	5.8
Total expected cash outflow from non-current other provisions	47.8	8.9

[T102] Expected cash outflow from non-current other provisions

in € million	Carrying amount as of Dec. 31, 2018	Expected cash outflow 2020
Personnel obligations	9.5	3.1
Unpaid invoices/overdue accounts	38.2	11.0
Total expected cash outflow from non-current other provisions	47.7	14.1

MTU expects that the above obligations will become due for payment within the next five years.

Current other provisions developed as follows:

[T103] Current other provisions 2019

in € million	As of Jan. 1, 2019	Transferred	Utilized	Reversed	Allocated	Currency translation differences	As of Dec. 31, 2019
Warranty obligations and risks from pending losses on onerous contracts	36.1		-16.6	-14.0	28.1	0.3	33.9
Personnel obligations	66.8	2.8	-62.2	-1.8	65.8		71.4
Unpaid invoices/ overdue accounts	66.6		-12.8	-24.2	27.2		56.8
Other liabilities	7.8		-5.2	-0.6	4.1	0.1	6.2
Total current other provisions	177.3	2.8	-96.8	-40.6	125.2	0.4	168.3

The cash outflows relating to current other provisions are expected to be realized in the calendar year following the reporting period.

Warranty obligations and risks from pending losses on onerous contracts

The main component of this item of provisions is an amount of €32.6 million (previous year: €33.8 million) for liabilities associated with warranty obligations in connection with the delivery of goods and services.

MTU has furthermore identified onerous contracts in its commercial maintenance business in which the unavoidable costs of fulfilling contractual obligations are higher than the expected inflow of economic benefits from these contracts. A provision of €1.3 million (previous year: €2.3 million) was recognized to cover the difference.

Personnel obligations

The provisions for personnel expenses include provisions for long-service awards amounting to €4.0 million (previous year: €3.9 million) and provisions for pre-retirement part-time working arrangements based on the collective agreement on phased retirement and related works agreements. On the basis of these agreements, obligations amounting to €4.8 million (previous year: €7.9 million) were recognized at the end of the reporting period. The obligation takes account of relevant plan assets amounting to €11.2 million (previous year: €11.0 million). The item also includes provisions for profit-sharing bonuses, which amounted to €68.6 million (previous year: €61.8 million). They relate to short-term incentive (STI) awards to the Executive Board and senior managers as well as to the bonus for staff not covered by the collective wage agreement and the profit-sharing bonus for employees covered by the collective wage agreement.

Under the present compensation system, the Executive Board members and senior managers receive target direct compensation comprising non-performance-related components (fixed compensation and fringe benefits) and performance-related components. The performance-related components are divided into the STI (performance-related component with no long-term incentive effect) and the Restricted Stock Plan (performance-related component with a long-term incentive effect).

The STI is based on the extent to which the group's KPI targets are met, adjusted EBIT and free cash flow, and a component reflecting the employee's personal performance in the reporting year.

Detailed explanatory notes on the compensation system for members of the Executive Board are provided in the [Management compensation report in the Combined management report](#).

The Restricted Stock Plan entails a cash payment, which must be immediately re-invested in MTU shares. These shares are subject to a specific vesting period, defined according to the beneficiary's rank in the management hierarchy. The target compensation granted for the purchase of shares essentially depends on the proportionate target direct compensation weighted by the average STI payment in the three fiscal years preceding the grant date.

Unpaid invoices/overdue accounts

Subsequent costs include accruals for cost of sales components in the form of unpaid invoices/overdue accounts arising in particular from contracts with suppliers and service providers.

In the case of leases where MTU is obligated to meet specific maintenance conditions before returning the aircraft engine, provisions are established during the lease term. These are based on the nominal value of the expected future maintenance costs to satisfy the return conditions set out in the lease. These provisions are by nature long-term.

The reduction in provisions for unpaid invoices/overdue accounts corresponds, in particular, with business activity close to the reporting date and the development of the U.S. dollar exchange rate.

Other liabilities

This item includes a multitude of accrued liabilities which, considered individually, are judged to be of immaterial importance.

28. Financial liabilities

[T104] Financial liabilities

in € million	Total		Non-current		Current	
	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018
Bonds and notes	100.3	100.2	98.3	98.2	2.0	2.0
Convertible bonds	562.4	482.5	562.3	482.1	0.1	0.4
Financial liabilities arising from increase or acquisition of stakes in programs	300.0	350.4	217.9	251.1	82.1	99.3
Financial liabilities to banks						
Note purchase agreement	30.1	30.1	30.0	30.0	0.1	0.1
Revolving credit facility		14.5				14.5
Other liabilities to banks	10.0	9.8		9.8	10.0	
Loans from third parties		34.7				34.7
Lease liabilities	147.0	10.0	102.7	8.6	44.3	1.4
Total gross financial debt	1,149.8	1,032.2	1,011.2	879.8	138.6	152.4
Derivatives without hedging relationship		0.4		0.1		0.3
Derivatives with hedging relationship	67.0	33.2	20.3	8.9	46.7	24.3
Personnel-related financial liabilities	74.1	59.6	48.1	39.6	26.0	20.0
Repayment of grants toward development costs	6.6	14.2		6.3	6.6	7.9
Miscellaneous other financial liabilities	35.4	23.9	0.3	0.3	35.1	23.6
Total other financial liabilities	183.1	131.3	68.7	55.2	114.4	76.1
Total financial liabilities	1,332.9	1,163.5	1,079.9	935.0	253.0	228.5

Gross financial debt

Bonds and notes

MTU Aero Engines AG issued a registered bond on June 12, 2013, for a total nominal amount of €100.0 million. The registered bond is repayable on June 12, 2028, and is subject to interest of 3.55 % p.a. Interest is payable in arrears on June 12 of each year, for the first time on June 12, 2014. The registered bond, including transaction costs and a discount of €2.7 million, was recognized at amortized cost.

In the event of a change of control, every bondholder is entitled to declare due part or all of his/her bond units for the nominal amount plus any accrued interest. This does not apply if MTU has already called in the bond. A change-of-control event occurs if the rating is lowered in the course of the change of control. A lowering of the rating occurs if (1) during the change-of-control period a rating previously awarded by a rating agency to MTU or to one of its outstanding non-current liabilities is withdrawn or is changed from an investment grade rating equivalent to or higher than Baa3 (Moody's) or BBB- (Fitch or S&P), or if (2) at the time of the change of control, no investment grade rating has been awarded by a rating agency to the bond or to MTU and no rating

agency awards an investment grade rating to the bond within the change-of-control period.

Convertible bonds

In 2016, MTU Aero Engines AG issued a senior unsecured convertible bond for a total nominal amount of €500.0 million. This bond is convertible into registered non-par-value shares in MTU.

The convertible bond has an original maturity of seven years and is divided into units of €100,000. It bears an interest rate of 0.125% per annum, payable annually in arrears.

Bondholders have been entitled to convert their convertible bonds into common shares of MTU Aero Engines AG at any time since June 27, 2016. The initial conversion price was set at €124.7701, which represents a premium of 50% on the reference rate.

Under the terms of issue of the convertible bond, MTU has the right to cancel and repurchase the issued bond units at their nominal value (plus accrued unpaid interest) at any time, subject to a notice period of a minimum

of 30 days and a maximum of 60 days, if (i) on or after June 16, 2020, the quoted price of the common share rises to or above 130% of the applicable conversion price over a given period, or (ii) if no more than 20% of the nominal value of the convertible bond issue is outstanding. In the event of such cancellation by MTU, and within the above-mentioned notice period of a minimum of 30 days and a maximum of 60 days, the bondholders have the right to request that MTU convert their bonds into shares, rather than repurchase them.

On September 10, 2019, MTU Aero Engines AG repurchased convertible bonds with a nominal value of €275.0 million from bondholders and canceled them on the value date September 30, 2019. Moreover, MTU Aero Engines AG received conversion notices from creditors of the convertible bond with a nominal amount of €134.9 million. The nominal amount outstanding was thus €90.1 million as of December 31, 2019.

In 2019, MTU Aero Engines AG issued a senior unsecured convertible bond for a total nominal amount of €500.0 million at an issue price of 103%. This bond is convertible into registered non-par-value shares in MTU.

The convertible bond has an original maturity of seven-and-a-half years and is divided into units of €100,000. It bears an interest rate of 0.05% per annum, payable annually in arrears.

Bondholders have been entitled to convert their bonds into common shares of MTU Aero Engines AG at any time since September 18, 2024. The initial conversion price was set at €378.4252, which represents a premium of 55% on the reference rate.

Under the terms of issue of the convertible bond, MTU has the right to cancel and repurchase the issued bond units at their nominal value (plus accrued unpaid interest) at any time, subject to a notice period of a minimum of 30 days and a maximum of 60 days, if (i) on or after April 8, 2025, the quoted price of the common share rises to or above 130% of the applicable conversion price over a given period, or (ii) if no more than 20% of the nominal value of the convertible bond issue is outstanding. In the event of such cancellation by MTU, and within the above-mentioned notice period of a minimum of 30 days and a maximum of 60 days, the bondholders have the right to request that MTU convert their bonds into shares, rather than repurchase them.

For information on the effect of transactions with the convertible bonds on the company's subscribed capital and capital reserves, see [Note 24 "Equity."](#)

Financial liabilities arising from increased or new stakes in engine programs

These items include the deferred payment components arising from the increase in the stake in IAE-V2500 and the acquisition of shares in new engine programs. The latter are referred to in the following as financial liabilities arising from increased or new stakes in engine programs.

Financial liabilities arising from the increase in the stake in IAE-V2500

The agreement signed by MTU in fiscal year 2012 in order to increase its stake in the IAE-V2500 engine program by five percentage points to 16% included a deferred payment component contingent upon the number of flight hours performed over the next 15 years by the V2500 engine fleet in service at the time of the stake increase.

Financial liabilities arising from the acquisition of stakes in programs

The financial liabilities arising from the acquisition of stakes in programs mainly relate to program lifetime-related payments for the acquisition of shares in commercial engine programs, which are deemed to represent financing transactions in view of their long-term nature.

Financial liabilities to banks

Note purchase agreement

MTU Aero Engines AG issued a note purchase agreement on March 28, 2014, for a total nominal amount of €30.0 million and with a maturity date of March 27, 2021. The note purchase agreement has a variable interest rate corresponding to the six-month Euribor rate plus a percentage margin. The initial interest rate was 1.72%. The interest is calculated and paid twice a year, in March and September.

Revolving credit facility

The company has access to a revolving credit facility of €600.0 million with five banks, which runs until October 28, 2023. Any credit utilized is subject to interest at the customary market reference rates plus an additional margin. Unused credit facilities are subject to a loan commitment fee. As of December 31, 2019, a total of €36.0 million had been drawn down under this facility (previous year: draw-downs totaling €51.1 million, of which €36.6 million in the form of guarantees).

MTU has undertaken to ensure that certain financial indicators remain within defined boundaries throughout the term of the revolving credit facility as follows: MTU's debt-equity ratio (consolidated net financial debt in relation to adjusted EBITDA) at the end of each quarter shall not exceed 3.0; the times interest earned ratio (adjusted EBITDA in relation to the consolidated net interest expense) at the end of each quarter shall not fall below 4.0.

Other liabilities to banks

The other liabilities to banks result from financing of MTU's share in the restructuring of a long-term supply and service agreement with a manufacturer of business jets.

Loans from third parties

As in the previous year, loans from third parties relate to rescheduling agreements entered into in connection with the extraordinary termination of a maintenance contract.

Lease liabilities

The lease liabilities, which are recognized using the effective interest method, correspond to the accrual of right-of-use assets for procurement leases. More information can be found in [Note 38 "Leases"](#) and in [Section I. "Accounting policies and principles" under "IFRS 16 Leases."](#)

Changes in gross financial debt are shown in the following tables:

[T105] Changes in gross financial debt

in € million	As of Jan. 1, 2019	Deposits and withdrawals	Non-cash items				Currency translation differences	As of Dec. 31, 2019
			Addition	Interest	Transfers			
Bonds and notes	100.2			0.1			100.3	
Convertible bond 2016 ¹⁾	482.5	-550.7		11.3	144.6		87.7	
Convertible bond 2019	0.0	511.2		1.0	-37.5		474.7	
Financial liabilities arising from increase or acquisition of stakes in programs	350.4	-63.2	3.9	9.9	-8.2	7.2	300.0	
Financial liabilities to banks								
Note purchase agreement	30.1						30.1	
Revolving credit facility	14.5	-14.5					0.0	
Other liabilities to banks	9.8					0.2	10.0	
Loans from third parties	34.7	-35.7				1.0	0.0	
Lease liabilities	137.2	-42.4	49.5			2.7	147.0	
Total gross financial debt	1,159.4	-195.3	53.4	22.3	98.9	11.1	1,149.8	

¹⁾ Reclassification comprises the effect of exercise of conversion option (€-134.9 million) and the premium on the nominal value relating to the proportionate repurchase (€275.7 million).

[T106] Changes in gross financial debt

in € million	As of Jan. 1, 2018	Deposits and withdrawals	Non-cash items				Currency translation differences	As of Dec. 31, 2018
			Addition	Discount reversed	Transferred			
Bonds and notes	100.0	-3.6		3.8			100.2	
Convertible bond	478.5	-0.6		4.6			482.5	
Financial liabilities arising from increase or acquisition of stakes in programs	370.5	-69.9	23.5	11.1		15.2	350.4	
Financial liabilities to banks								
Note purchase agreement	30.1	-0.3		0.3			30.1	
Revolving credit facility	77.9	-63.4					14.5	
Other liabilities to banks	0.2	-0.2			9.8		9.8	
Loans from third parties	18.2	-18.0			34.7	-0.2	34.7	
Finance lease liabilities	11.5	-1.5					10.0	
Total gross financial debt	1,086.9	-157.5	23.5	19.8	44.5	15.0	1,032.2	

Other financial liabilities

Liabilities from derivatives

The increase in financial liabilities from derivatives to €74.0 million (previous year: €33.6 million) is attributable to a decrease in the fair value of forward foreign exchange contracts.

Personnel-related financial liabilities

Personnel-related financial liabilities amounting to €74.1 million (previous year: €59.6 million) mainly result from claims on pension capital amounting to €54.6 million (previous year: €45.6 million) relating to the company pension scheme.

In addition, obligations under the employee stock option program (MAP) of €8.9 million (previous year: €7.8 million), which the Executive Board of MTU Aero Engines

AG, Munich, offered again in fiscal year 2019, are also reported here. Under the employee stock option program (MAP), MTU offers all eligible employees within and outside of the collective wage agreement and members of senior management the opportunity to invest in MTU shares. At the end of a two-year vesting period, employees within and outside of the collective wage agreement receive a taxable “matching” payment corresponding to 50% of the amount invested by the employee in MTU shares at the beginning of the program. Members of senior management receive a taxable “matching” payment at the end of the two-year vesting period corresponding to one-third of the amount individually invested.

The number of shares sold to group employees under the terms of the employee stock option program (MAP) in fiscal years 2019 and 2018 was as follows:

[T107] Employee stock option program (MAP)

Issue date	Number of shares sold	Average purchase cost (in € million)	Total proceeds of sale (in € million)	Selling price per share (in €)
June 2019	98,243	4.4	18.8	191.75
June 2018	102,041	4.6	16.3	159.90

The total expense for the issue of matching shares in connection with the employee stock option program (MAP) in fiscal year 2019 amounted to €8.0 million (previous year: €7.1 million).

The shares transferred to the employees, measured at the average acquisition cost, were removed from the equity item “treasury shares.” The difference of €14.4 million (previous year: €11.7 million) between the proceeds of the sale and the original acquisition cost was allocated to the capital reserves.

Repayment of grants toward development costs

In the fiscal years from 1976 through 1991, MTU received grants from the German Federal Ministry of Economics and Technology toward the development costs of the PW2000 engine. Once the sales figures of PW2000 production engines for the Boeing 757 and C-17 as set down in the grant notice have been reached, MTU is obliged to reimburse the full sum of the grants received within a period of ten years. In fiscal years 2011 through 2018, a total amount of €52.4 million was repaid, with a further €8.1 million repaid in 2019.

Miscellaneous other financial liabilities

This item is used to present numerous liabilities that are immaterial when viewed separately.

29. Trade payables

[T108] Trade payables

in € million	Dec. 31, 2019	Dec. 31, 2018
Accounts payable to:		
Third parties	306.0	230.4
Related companies	7.1	0.2
Total trade payables	313.1	230.6

Trade payables include open purchase invoices and accruals for purchased goods and services.

The total amount of trade payables is due in less than one year.

30. Contract liabilities

The contract liabilities contain advance payments for the delivery of engine modules and components and for maintenance services. Where there are corresponding contract assets, the assets and liabilities are netted. Changes in the reporting period are attributable to business activity close to the reporting date and the development of the U.S. dollar exchange rate. As of the reporting date, contract liabilities amounting to €214.5 million (previous year: €246.7 million) were offset against the corresponding contract assets.

31. Refund liabilities

[T109] Refund liabilities

in € million	Total		Non-current		Current	
	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018
Warranty and liability risks	521.3	390.0			521.3	390.0
Invoice corrections	539.3	453.5			539.3	453.5
Subsequent costs	642.4	693.0	20.7	30.3	621.7	662.7
Total refund liabilities	1,703.0	1,536.5	20.7	30.3	1,682.3	1,506.2

The refund liabilities for warranty and liability risks correspond to the compensation obligations resulting from defective workmanship and the share of the consortium leader's (OEM) expenses under risk- and revenue-sharing models for commercial engine programs.

The refund liabilities for invoice corrections are retrospective adjustments to the prices in contracts with customers. The increase in the reporting period corresponds to business activity close to the reporting date and the development of the U.S. dollar exchange rate. In accordance

with invoicing practice for shares in commercial engine programs, retrospective adjustments are regularly made to the allocated share of revenue. Settlement of these price corrections was still outstanding as of the reporting date.

The subsequent costs mainly comprise accruals for the share of marketing expenses for civil engine programs for which a final invoice has yet not been issued by the consortium leader (OEM) but which are already recognized as revenue reductions.

32. Other liabilities

[T110] Other liabilities

in € million	Total		Non-current		Current	
	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018
Personnel-related liabilities						
Social security	1.2	1.0			1.2	1.0
Other personnel-related liabilities	42.2	38.3			42.2	38.3
Other tax liabilities	43.1	35.6			43.1	35.6
Other liabilities	3.6	2.8	0.4	0.7	3.2	2.1
Total other liabilities	90.1	77.7	0.4	0.7	89.7	77.0

Personnel-related liabilities

Personnel-related liabilities in particular concern vacation entitlements and flex-time credits.

Other tax liabilities

The other tax liabilities relate to payable wage and church taxes, solidarity surcharges, and transactional taxes.

33. Additional disclosures relating to financial instruments

Carrying amounts, measurement/recognition methods and fair value by measurement category

In the following tables, the carrying amounts of financial instruments are aggregated by measurement category, irrespective of whether or not the instruments fall within the scope of IFRS 7 or IFRS 9. The information presented

also includes separate amounts for each measurement category as a function of the measurement/recognition method applied. Finally, the carrying amounts of the measurement categories are set opposite the fair values for comparison.

[T111] Disclosures relating to financial instruments Carrying amounts, measurement/recognition methods and fair values as of Dec. 31, 2019

in € million	Carrying amount as of Dec. 31, 2019	Amount carried in balance sheet			Amount carried in balance sheet IFRS 16	Financial instruments not within the scope of IFRS 9 or IFRS 7	Total	Fair value as of Dec. 31, 2019
		Measured at amortized cost	Fair value through other comprehensive income	Fair value through profit or loss				
ASSETS								
Financial assets								
Loans and receivables	116.8	109.4				7.4	116.8	116.8
Other interests in related companies	16.2		16.2				16.2	16.2
Trade receivables	922.8	922.8					922.8	922.8
Derivative financial assets								
Derivatives without hedging relationship	1.2			1.2			1.2	1.2
Derivatives with hedging relationship	4.8		4.8				4.8	4.8
Cash and cash equivalents	139.5	139.5					139.5	139.5
EQUITY AND LIABILITIES								
Refund liabilities	1,703.0	1,703.0					1,703.0	1,703.2
Trade payables	313.1	313.1					313.1	313.1
Financial liabilities								
Bonds and notes	100.3	100.3					100.3	119.2
Convertible bonds (2016 and 2019)	562.4	562.4					562.4	727.2
Financial liabilities arising from increase or acquisition of stakes in programs	300.0	300.0					300.0	303.8
Financial liabilities to banks	40.1	40.1					40.1	40.1
Lease liabilities	147.0				147.0		147.0	147.0
Derivative financial liabilities								
Derivatives with hedging relationship	67.0		67.0				67.0	67.0
Other financial liabilities	116.1	42.0				74.1	116.1	116.2

Financial instruments not within the scope of IFRS 7 or IFRS 9 relate to personnel-related liabilities and the corresponding plan assets accounted for in accordance with IAS 19.

[T112] Disclosures relating to financial instruments
Carrying amounts, measurement/recognition methods and fair values as of Dec. 31, 2018

in € million	Carrying amount as of Dec. 31, 2018	Amount carried in balance sheet			Amount carried in balance sheet IAS 17	Financial instruments not within the scope of IFRS 9 or IFRS 7	Total	Fair value as of Dec. 31, 2018
		Measured at amortized cost	Fair value through other comprehensive income	Fair value through profit or loss				
ASSETS								
Financial assets								
Loans and receivables	117.3	112.2				5.1	117.3	117.3
Other interests in related companies	16.4		16.4				16.4	16.4
Trade receivables	1,051.2	1,051.2					1,051.2	1,051.2
Derivative financial assets								
Derivatives without hedging relationship	0.3			0.3			0.3	0.3
Derivatives with hedging relationship	11.0		11.0				11.0	11.0
Cash and cash equivalents	99.0	99.0					99.0	99.0
EQUITY AND LIABILITIES								
Refund liabilities	1,536.5	1,536.5					1,536.5	1,536.5
Trade payables	230.6	230.6					230.6	230.6
Financial liabilities								
Bonds and notes	100.2	100.2					100.2	113.4
Convertible bond (2016)	482.5	482.5					482.5	696.3
Financial liabilities arising from increase or acquisition of stakes in programs	350.4	350.4					350.4	344.2
Financial liabilities to banks	54.4	54.4					54.4	54.4
Loans from third parties	34.7	34.7					34.7	34.7
Finance lease liabilities	10.0				10.0		10.0	10.0
Derivative financial liabilities								
Derivatives without hedging relationship	0.4			0.4			0.4	0.4
Derivatives with hedging relationship	33.2		33.2				33.2	33.2
Other financial liabilities	97.7	38.1				59.6	97.7	98.2

The financial assets and liabilities carried at amortized cost contain cash and cash equivalents, trade receivables, other receivables, trade payables and other liabilities which are generally due within a relatively short time. The carrying amounts of these assets and liabilities therefore correspond approximately to their fair value at the reporting date.

Apart from the convertible bonds (2016 and 2019), which are traded on the stock market and are allocated to Level 1 of the fair value hierarchy, the other financial instruments are allocated to Level 2. The difference between the book value and fair values of these instruments was determined using a discounted cash flow model.

Classification of fair value measurements of financial assets and liabilities according to the fair value hierarchy

To take account of the relevance of the estimated parameters used in the measurement of financial assets and liabilities measured at fair value, MTU's financial assets and liabilities are allocated to three levels.

The three levels of the fair value hierarchy are described below, together with their utilization when measuring financial assets and liabilities:

- Level 1 Quoted prices in active markets for identical assets or liabilities (unadjusted input);
- Level 2 Prices of assets or liabilities that can be observed directly or indirectly (derived);
- Level 3 Unobservable inputs used to measure prices of assets or liabilities.

The following tables show the allocation of financial assets and liabilities measured at fair value to the three levels of the fair value hierarchy for 2019 and 2018:

[T113] Classification within the fair value hierarchy for the fiscal year 2019

in € million	Level 1	Level 2	Level 3	Total
Financial assets measured at fair value				
Derivative financial instruments		6.0		6.0
Other interests in related companies			16.2	16.2
Total financial assets		6.0	16.2	22.2
Financial liabilities measured at fair value				
Derivative financial instruments		67.0		67.0
Total financial liabilities		67.0		67.0

[T114] Classification within the fair value hierarchy for the fiscal year 2018

in € million	Level 1	Level 2	Level 3	Total
Financial assets measured at fair value				
Derivative financial instruments		11.3		11.3
Other interests in related companies			16.4	16.4
Total financial assets		11.3	16.4	27.7
Financial liabilities measured at fair value				
Derivative financial instruments		33.6		33.6
Total financial liabilities		33.6		33.6

The fair value of the derivative financial instruments assigned to Level 2 is measured using the discounted cash flow (DCF) method. Equity investments, which are allocated to Level 3, are also measured using the discounted cash flow (DCF) method based on internal planning figures. The discount rate is calculated using both internal planning data and available market data.

Payment cash flows for financial liabilities

The following tables list the contractually agreed interest and principal payments for the financial liabilities measured at fair value at the reporting date.

[T115] Payment cash flows for financial liabilities 2019

in € million	Carrying amount as of Dec. 31, 2019	Cash flow 2020			Cash flow 2021			Cash flow 2022			Cash flow 2023 and subsequent years		
		Fixed interest	Variable interest	Principal	Fixed interest	Variable interest	Principal	Fixed interest	Variable interest	Principal	Fixed interest	Variable interest	Principal
Refund liabilities	1,703.0			1,682.3			11.2			10.7			
Trade payables	313.1			313.1									
Bonds and notes	100.3	3.6			3.6			3.6			21.3		100.0
Convertible bonds	562.4	0.4			0.4			0.4			1.3		590.1
Financial liabilities arising from increase or acquisition of stakes in programs	300.0			82.1			55.0			52.5			138.3
Financial liabilities to banks	40.1		0.3	10.0		0.1	30.0						
Lease liabilities	147.0	3.5		44.3	2.8		31.6	1.0		48.3	1.5		22.8
Derivative financial liabilities													
Derivatives with hedging relationship	67.0			46.7			18.1			2.2			
Other financial liabilities	116.1			67.8			10.9			8.3			36.9

[T116] Payment cash flows for financial liabilities 2018

in € million	Carrying amount as of Dec. 31, 2018	Cash flow 2019			Cash flow 2020			Cash flow 2021			Cash flow 2022 and subsequent years		
		Fixed interest	Variable interest	Principal	Fixed interest	Variable interest	Principal	Fixed interest	Variable interest	Principal	Fixed interest	Variable interest	Principal
Refund liabilities	1,536.5			1,506.4			10.6			10.3			9.4
Trade payables	230.6			230.6									
Bonds and notes	100.2	3.6			3.6			3.6			24.8		100.0
Convertible bond	482.5	0.6			0.6			0.6			1.3		500.0
Financial liabilities arising from increase or acquisition of stakes in programs	350.4			99.3			53.6			51.4			183.1
Financial liabilities to banks	54.4		0.3	14.5		0.3	9.8		0.1	30.0			
Loans from third parties	18.2	0.7		34.7									
Finance lease liabilities	10.0	0.3		1.4	0.3		1.8	0.2		1.0	2.1		5.8
Derivative financial liabilities													
Derivatives without hedging relationship	0.4			0.3			0.1						
Derivatives with hedging relationship	33.2			24.3			8.9						
Other financial liabilities	97.7			51.5			15.6			6.4			31.4

These include all instruments in the portfolio at the reporting date for which payment terms had been contractually agreed. Amounts denominated in a foreign currency are translated at the exchange rate at the respective reporting date. The variable-rate interest payments on the financial instruments are based on the most recent interest rate fixed prior to the reporting date. Financial liabilities with no fixed repayment date are always assigned to cash flows on the basis of the earliest likely repayment dates.

Within the scope of its partnerships in engine programs, MTU is a party to aircraft financing agreements for the purpose of promoting sales. Such commitments are always made collectively in favor of the consortium leader (OEM). They are provided in two basic forms: predelivery payments (PDP) and backstop commitments. In both cases, any funds made available to the aircraft purchaser are always transferred directly to the aircraft manufacturer solely by the consortium leader (OEM).

MTU classifies loan commitments granted up to the reporting date totaling a nominal amount, translated into euros, of €840.0 million (previous year: €832.0 million) as part of its gross liquidity risk in accordance with the requirements of IFRS 7. However, based on experience, it is considered to be very unlikely that these nominal loan amounts will actually be utilized to their full extent.

The agreed loan conditions are linked to the prevailing market conditions when the loan is utilized and, in the case of the backstop commitments, are cost-prohibitive. In the case of PDP financing, the consortium has collateral rights to the aircraft while it is still in production and thus in the possession of the aircraft manufacturer; in the case of backstop commitments, the consortium retains direct ownership of the asset up to the delivery date. After delivery the lender retains a security interest in the aircraft. MTU also assumes that other lenders will become third parties to any loans that are established, particularly in view of the offered modes of financing. Credit risk is further limited through the inclusion of additional financial conditions in the financing offers, which the aircraft purchaser must demonstrate to have been satisfied before the contract is signed.

With respect to the notional impact on MTU's liquidity of the financing offers, the company ensures that its credit lines ([see Note 28](#)) provide adequate liquidity reserves, even in the unlikely event of all financing offers being taken up at the same time, and considers the possibility of extending these credit lines to back up future financing offers. In the event that loan commitments are utilized, MTU considers the associated liquidity and credit risks to be manageable.

Explanatory comments relating to net gain/loss on financial instruments by measurement category

The tables below show the gains/losses arising from transactions involving financial instruments, aggregated by measurement category, for the reporting period

and the previous year. Interest income and expense in connection with financial assets and liabilities that are measured at fair value through profit or loss are not included:

[T117] Net gain/loss on financial assets and liabilities 2019

in € million	From interest	From investments	From remeasurement	Currency translation	Write-down	Net gain/loss 2019
Financial assets measured at cost	5.9			25.5	-6.3	25.1
Financial assets measured at fair value through other comprehensive income		2.7				2.7
Financial assets measured at fair value through profit or loss			12.8			12.8
Financial liabilities measured at cost	-18.9		-12.6	-32.5		-64.0
Financial liabilities measured at fair value through profit or loss			-5.9			-5.9
Financial instruments not within the scope of IFRS 7 or IFRS 9	-4.2	80.0		-1.0		74.8
Total	-17.2	82.7	-5.7	-8.0	-6.3	45.5

[T118] Net gain/loss on financial assets and liabilities 2018

in € million	From interest	From investments	From remeasurement	Currency translation	Write-down	Net gain/loss 2018
Financial assets measured at cost	8.3			84.9	-2.3	90.9
Financial assets measured at fair value through other comprehensive income		1.7				1.7
Financial assets measured at fair value through profit or loss			36.3			36.3
Financial liabilities measured at cost	-7.9		-13.6	-118.3		-139.8
Financial liabilities measured at fair value through profit or loss			-31.5			-31.5
Financial instruments not within the scope of IFRS 7 or IFRS 9	-0.3	43.8		4.7		48.2
Total	0.1	45.5	-8.8	-28.7	-2.3	5.8

The interest component of financial instruments is recognized under net interest expense (see Note 8). MTU presents other components of the net gain/loss in the other financial income/expense item (see Note 9), with the exception of valuation allowances on financial assets, which is recognized under selling expenses (see Note 4).

Moreover, gains/losses arising from translation differences on trade receivables and payables are recognized under revenue (see Note 1) or cost of goods sold (see Note 2).

Explanatory comments relating to net interest income/expense

The net interest income/expense on financial assets and liabilities includes interest income from long-term loans and interest expenses arising from the corporate bond, the convertible bonds, loan agreements with banks and lease liabilities. In addition, in the reporting period this item contains the prepayment penalty of €8.7 million for the partial redemption of the convertible bond 2016 as a one-time effect.

Explanatory comments relating to measurement subsequent to initial recognition

The net gain/loss on financial instruments measured at fair value mainly comprises exchange rate gains and losses on derivatives not designated in a hedging rela-

tionship. The amount stated for “financial liabilities measured at amortized cost” mainly results from reversing the discount on this category of financial instruments.

Gains amounting to €25.5 million (previous year: €84.9 million) from the currency translation of financial assets are mainly attributable to the measurement of trade receivables. These gains are offset principally by currency translation losses amounting to €32.5 million (previous year: €118.3 million) on trade payables and refund liabilities.

Offsetting financial assets and financial liabilities

The following financial assets and financial liabilities subject to offsetting agreements existed at the reporting date:

[T119] Offset amounts of financial assets and financial liabilities as of Dec. 31, 2019

	(a)	(b)	(c)	(d)	(e) = (c) - (d)
in € million	Gross amounts of recognized financial assets/liabilities	Gross amounts of recognized financial assets/liabilities offset in the balance sheet	Net financial assets/liabilities recognized in the balance sheet	Related amounts not offset in the balance sheet	Net amount
Other assets					
Loans and receivables	116.9	0.1	116.8		116.8
Other interests in related companies	16.2		16.2		16.2
Trade receivables	1,785.6	862.8	922.8		922.8
Derivative financial assets					
Derivatives without hedging relationship	1.2		1.2	1.2	
Derivatives with hedging relationship	4.8		4.8	4.8	
Cash and cash equivalents	140.9	1.4	139.5		139.5
Refund liabilities	1,703.0		1,703.0		1,703.0
Trade payables	1,175.9	862.8	313.1		313.1
Financial liabilities					
Bonds and notes	100.3		100.3		100.3
Convertible bonds	562.4		562.4		562.4
Financial liabilities arising from increase or acquisition of stakes in programs	300.0		300.0		300.0
Financial liabilities to banks	41.5	1.4	40.1		40.1
Lease liabilities	147.0		147.0		147.0
Derivative financial liabilities					
Derivatives with hedging relationship	67.0		67.0	6.0	61.0
Other financial liabilities	116.2	0.1	116.1		116.1

[T120] Offset amounts of financial assets and financial liabilities as of Dec. 31, 2018

	(a)	(b)	(c)	(d)	(e) = (c) - (d)
in € million	Gross amounts of recognized financial assets/liabilities	Gross amounts of recognized financial assets/liabilities offset in the balance sheet	Net financial assets/liabilities recognized in the balance sheet	Related amounts not offset in the balance sheet	Net amount
Other assets					
Loans and receivables	117.4	0.1	117.3		117.3
Other interests in related companies	16.4		16.4		16.4
Trade receivables	1,700.9	649.7	1,051.2		1,051.2
Derivative financial assets					
Derivatives without hedging relationship	0.3		0.3	0.3	0.0
Derivatives with hedging relationship	11.0		11.0	11.0	0.0
Cash and cash equivalents	119.6	20.6	99.0		99.0
Refund liabilities	1,536.5		1,536.5		1,536.5
Trade payables	880.3	649.7	230.6		230.6
Financial liabilities					
Bonds and notes	100.2		100.2		100.2
Convertible bond	482.5		482.5		482.5
Financial liabilities arising from increase or acquisition of stakes in programs	350.4		350.4		350.4
Financial liabilities to banks	75.0	20.6	54.4		54.4
Loans from third parties	34.7		34.7		34.7
Finance lease liabilities	10.0		10.0		10.0
Derivative financial liabilities					
Derivatives without hedging relationship	0.4		0.4	0.1	0.3
Derivatives with hedging relationship	33.2		33.2	11.2	22.0
Other financial liabilities	97.8	0.1	97.7		97.7

The related amounts not offset in the balance sheet refer to financial assets and liabilities arising from derivatives that can be offset against debt if the issuer becomes insolvent.

34. Deferred taxes

Deferred tax assets and liabilities arise on temporary differences between the tax bases of assets and liabilities of the individual group companies and the corresponding carrying amounts in the consolidated balance sheet. Deferred tax assets were also recognized for tax credits and losses available for carry-forward.

Deferred tax assets and liabilities were recognized in OCI in connection with the subsequent measurement of pension obligations and the corresponding plan assets and in connection with the fair value measurement of derivative financial instruments which were part of an effective hedging relationship, and in respect of the difference between the fair value and initial carrying amounts of the equity components of the convertible bonds.

[T121] Changes in deferred tax assets and liabilities

	Dec. 31, 2019		Dec. 31, 2018		2019	
	Deferred tax assets	Deferred tax liabilities	Deferred tax assets	Deferred tax liabilities	Tax income/expense (-) in the income statement	Recognized in equity/OCI
in € million	in equity		in equity			
Assets						
Intangible assets		223.0		210.1	-12.9	
Property, plant and equipment	8.2	79.3	6.9	48.2	-29.9	0.1
Financial assets		1.2		1.3	0.1	
Inventories	63.1		66.5		-3.4	
Receivables and other assets	44.0	72.8	31.4	72.4	13.3	-1.1
Total assets	115.3	376.3	104.8	332.0	-32.8	-1.0
Equity						
Net hedging instrument assets and liabilities	17.7		11.0			6.7
Equity portion of convertible bond		12.4		7.7		-4.7
Actuarial gains/losses on pension obligations and plan assets	149.4		118.1			31.3
Total equity	167.1	12.4	129.1	7.7		33.3
Liabilities						
Pension provisions		7.0		5.2	-1.8	
Other provisions	5.0	13.3	15.7	0.1	-24.5	0.6
Liabilities	157.5		124.4		32.4	0.7
Total liabilities	162.5	20.3	140.1	5.3	6.1	1.3
Deferred taxes on assets and liabilities	444.9	409.0	374.0	345.0	-26.7	33.6
Tax credits and tax losses available for carry-forward						
Tax credits available for carry-forward	34.7		33.0		1.3	0.4
Tax losses available for carry-forward	3.9		9.9		-6.2	0.2
Valuation allowances and unrecognized recoverable tax payments						
Valuation allowances on tax credits carried forward	-6.2		-6.4		0.3	-0.1
Valuation allowances on tax losses carried forward	-2.3		-2.2		-0.1	
Temporary differences for which no deferred tax assets were recognized	-10.4		-11.2		0.9	-0.1
Total tax credits and losses carried forward	19.7		23.1		-3.8	0.4
Deferred tax assets/liabilities before offset	464.6	409.0	397.1	345.0	-30.5	34.0
Offset	-408.8	-408.8	-336.6	-336.6		
Net deferred tax assets/liabilities	55.8	0.2	60.5	8.4	-30.5	34.0

Please refer to [Note 10 "Income taxes"](#) for further information relating to current and deferred income tax assets and liabilities resulting from the balance sheet items listed above and to the tax reconciliation between the expected and recognized tax expense.

Tax assets and liabilities are offset against one another only if they relate to the same type of tax levied by the same tax jurisdiction and are due within the same period.

Deferred tax assets were recognized for deferred tax losses/credits available for carry-forward in the case of the following group companies:

[T122] Deferred tax assets recognized for tax losses/credits available for carry-forward as of Dec. 31

in € million	USA 2019	Poland 2019	Total 2019	Total 2018
Tax credits available for carry-forward	1.4	33.3	34.7	33.0
Tax losses available for carry-forward	2.4	1.5	3.9	9.9
Potential tax impact of tax losses/credits available for carry-forward	3.8	34.8	38.6	42.9
Valuation allowances on tax credits carried forward		-6.2	-6.2	-6.4
Valuation allowances on tax losses carried forward	-2.2	-0.1	-2.3	-2.2
Deferred tax assets recognized for tax losses/credits available for carry-forward	1.6	28.5	30.1	34.3

USA

MTU Aero Engines North America Inc., Rocky Hill, USA, (AENA) and Vericor Power Systems LLC., Alpharetta, USA, have been a single tax entity since July 1, 2016. Tax losses available for carry-forward as of December 31, 2019 relate exclusively to state tax, which after the application of valuation allowances amounted to the equivalent of €6.9 million (previous year: €8.1 million).

Furthermore, recoverable tax credits are recognized by the tax entity for this tax type. These mainly result from development activities. Deferred tax assets were similarly recognized in respect of these recoverable tax credits.

Poland

MTU Aero Engines Polska sp. z o.o. receives government support through Poland's economic development program by virtue of its location in a special economic zone. Because its business investments help to create jobs, the company has been awarded tax credits in respect of the profits it expects to achieve through its production activities, with separate amounts being accorded each year through to 2026. Deferred tax assets amounting to €27.1 million (previous year: €25.4 million) were recognized on the basis of the business investments realized up to the reporting date, taking into account the currently expected earnings from the activities for which tax credits were awarded.

In addition to the activities for which tax advantages are granted, the company also provides services that are subject to normal taxation. In fiscal years 2012 through 2016,

this area of business resulted in tax losses, while in 2017 through 2019 taxable profit was generated. The use of the tax losses available for carry-forward of €7.7 million is limited to a period of five years and a ceiling is imposed on the amount carried forward each fiscal year. As a result, it was possible to recognize deferred tax assets amounting to €1.4 million (previous year: €7.4 million), in view of the currently expected earnings from the relevant activities. A valuation allowance corresponding to the difference between this amount and the maximum allowable amount of deferred tax assets was therefore recognized in the balance sheet.

At the reporting date, there were temporary differences amounting to €54.9 million (previous year: €58.9 million) for which no deferred tax assets were recognized, in view of the relevant income expectations for the next five years. The resulting potential tax impact of €10.4 million (previous year: €11.2 million) was therefore not taken into account in the calculation of the income tax expense.

Deferred tax liabilities for taxable differences arising from investments in subsidiaries and joint ventures

In accordance with IAS 12, no deferred tax liabilities were recognized for temporary differences amounting to €412.7 million (previous year: €247.3 million) that arose in connection with investments in subsidiaries and joint ventures. If these differences were to lead to the creation of deferred tax liabilities, they would result in a tax liability amounting to €17.6 million (previous year: €10.7 million), based on the current tax legislation.

IV. Other disclosures

35. Measurement of recoverable amounts of operating segments to which goodwill has been allocated

The group tests the goodwill of its group of cash-generating units (CGUs) for impairment annually by determining whether, as a minimum, their carrying amounts exceed their recoverable amounts. At MTU, the identifiable group of CGUs utilized for the purpose of the goodwill impairment test correspond to its two operating segments – commercial and military engine business (OEM) and commercial maintenance business (MRO).

The value in use of each of the two operating segments as of the reporting date (June 30, 2019) was calculated in order to determine their respective recoverable amounts, based on the operational business plans for the second half of the period under review. In the period between the date of the impairment test and the reporting date, no new information came to light that might significantly affect goodwill measurement.

The calculations of the recoverable amounts are based on the following assumptions: The first step involves the use of models to predict future changes in the engine fleet and the corresponding market shares of engines for which MTU holds or expects to hold supply responsibility or that are or will be of significance to its service business, especially in the MRO segment. MTU applies these forecasts systematically as a basis for its revenue and corresponding capacity planning, from which the planned EBIT and cash flows for each of the two operating segments are derived. The outcome of this process is therefore necessarily based on expectations as regards future market shares, growth in the individual markets, the profitability of products as well as macroeconomic developments such as trends in exchange rates, interest rates and commodity prices. The values in use, and the corresponding carrying amounts, are determined without reference to financing activities. More information can be found in [Section I. "Accounting policies and principles" under "IFRS 16 Leases."](#)

The cash flows on which the value in use of the OEM segment is based include an average growth rate for revenue within the detailed planning horizon in the mid-single digit range, an EBIT margin at the current level and a discount rate before tax of 9.5% (previous year: 8.7%). The value of the perpetuity for the OEM segment was derived from the estimated revenue in the final year of the detailed planning period (2024), assuming an annual growth rate of 0.5% (previous year:

1.0%), plus an annuity based on the average cost of capital to account for revenue in the period up to the long-term strategic planning horizon. When deriving the perpetuity, it should be noted that the EBIT margin used for long-term strategic planning in the OEM segment is dominated by the start-up of new programs that are not yet established. In view of the associated planning uncertainty and to ensure conservative measurement, the average EBIT margin for operational and strategic planning are each given a 50% weighting in order to derive the EBIT margin for the OEM perpetuity.

For the MRO segment, revenue growth within the detailed planning horizon is expected to be in the high single digits, while the EBIT margin is anticipated to be moderately lower than the current level, and a discount rate before tax of 9.8% (previous year: 8.8%) is expected. The perpetuity for the MRO segment, given its shorter business cycles, was derived from the revenue and EBIT margin of the final year of the detailed planning period (2024) plus a growth rate of 0.5% (previous year: 1.0%).

When applying the discounted cash flow (DCF) method, the weighted average cost of capital (WACC) before tax for each segment is determined iteratively on the basis of a corresponding after-tax discount rate. This is derived from the cost of equity after tax, which is based on a risk-free base interest rate and a risk premium (market risk premium multiplied by the beta coefficient calculated on the basis of a peer group analysis). The cost of debt of the peer group companies is also factored into the calculation. Cost of equity and cost of debt are weighted according to the average capital structure of the peer group companies when determining WACC after tax. In order to determine the weighted average cost of capital (WACC) in the reporting period, MTU used a risk-free interest rate of 0.60% (previous year: 1.25%), a market risk premium of 6.50% (previous year: 6.50%), and a beta coefficient of 1.07 (previous year: 0.87). The cost of debt used in this calculation was 1.92% (previous year: 1.98%) after tax.

The recognized amount of goodwill for the commercial and military engine business (OEM) was unchanged compared with the previous year, at €304.4 million, while that for the commercial maintenance business (MRO) segment was €87.5 million (previous year: €87.4 million). The year-on-year increase in the amount of goodwill of the MRO segment is due to the effects of currency translation. The value in use of the OEM segment is €7,710.3 million (previous year: €6,955.5 million), and

that of the MRO segment is €3,035.6 million (previous year: 3,298.1 million). The corresponding carrying amounts to be recognized for the cash-generating units are €2,593.0 million (previous year: 2,539.5 million) for the OEM segment and €1,391.5 million (previous year: 1,007.2 million) for the MRO segment. There is therefore no indication that the recognized amounts of goodwill are impaired.

36. Sensitivity analysis of goodwill

Sensitivity analyses were carried out to determine the possible impact that a sustained reduction in planned earnings before interest and taxes (EBIT) might have on the goodwill amounts allocated to each of the two operating segments. These analyses included sensitivity factors affecting the weighted average cost of capital to be applied.

Assuming an unchanged weighted average cost of capital (WACC), the sensitivity analyses concluded that there would be no need to recognize an impairment loss on goodwill either in the OEM or MRO operating segment, even in the event of a sustained reduction in EBIT to 30% below the planning figure forecast by management. Similarly, with EBIT unchanged, no impairment losses would have to be recognized in either segment if the cost of capital before taxes rose by 30%.

37. Financial risk

In the ordinary course of business, MTU is exposed to credit risks, liquidity risks and market risks. The objective of financial risk management is to minimize the risks arising from operating activities and the resulting financing requirements through the use of selected derivative and non-derivative hedging instruments.

Risks in connection with the procurement, financing and sale of MTU's products and services are described in detail in the management report. In order to counter financial risks, MTU has put in place an integrated risk management system, which is monitored by the Supervisory Board. The principles of this system aim at promptly identifying, analyzing and communicating risks and taking mitigating actions. Market risks, particularly commodity price risks, currency risks, and interest rate risks, are analyzed in respect of their potential impact on earnings before interest and taxes (EBIT) and on net income/expense, and managed through the targeted use of derivative financial instruments.

Credit risk

MTU is exposed to credit risks arising from its operating activities in both the OEM and MRO segments. The group strives to minimize these risks by means of a systematic, structured risk management system. Consequently, all financial transactions are embedded in a detailed process environment with a clearly defined separation of functions.

In view of the importance of managing credit risks, engine and aircraft financing arrangements to which MTU is a party as a result of its engine program and MRO alliances are managed by the central treasury department. Further details on engine and aircraft financing arrangements are provided in [Note 33 "Additional disclosures relating to financial instruments"](#) and in the ["Risk and opportunity report," which forms part of the Combined management report.](#)

Financing transactions in connection with liquidity management, e.g., time deposits or forward foreign exchange contracts, also expose the group to a certain degree of credit risk. MTU's internal guidelines therefore

stipulate that such transactions may only be entered into centrally by the central Treasury department, and only with contracting parties with a credit rating of at least investment grade.

The maximum credit risk is represented by the carrying amounts of the financial assets recognized in the balance sheet, plus the amount of financial guarantees and loan commitments. As of December 31, 2019, financial assets of €1,034.6 million were not exposed to any credit risk, because corresponding liabilities were recognized in the same amount. Another group of financial assets amounting to €452.2 million is secured with collateral under substantive law. Credit insurance had been arranged for receivables amounting to €25.9 million.

Relevant unsecured portions of financial assets were included in the calculation of the expected credit losses using an impairment matrix. For this purpose, the assets were allocated to groups with credit standings A, B and C, for which the respective credit loss rate was determined using published information from international rating agencies:

[T123] Expected credit losses as of Dec. 31, 2019

in € million	Credit standing A	Credit standing B	Credit standing C	Total
Expected credit loss rate	0.06%	1.28%	3.65%	
Gross amount	653.4	44.9	97.9	796.2
Expected credit losses	0.4	0.6	3.6	4.5

[T124] Expected credit losses as of Dec. 31, 2018

in € million	Credit standing A	Credit standing B	Credit standing C	Total
Expected credit loss rate	0.24%	1.10%	3.07%	
Gross amount	60.2	286.3	61.0	407.5
Expected credit losses	0.2	3.1	1.9	5.2

Other than collateralization rights for engine and aircraft financing loans issued, there were no material agreements at the reporting date that could reduce the maximum credit risk. Nonetheless, MTU is exposed to other, proportionate liability risks and therefore potential additional credit risks as a result of its membership in engine consortia. Further details can be found in [Note 39 "Contingent liabilities and other financial obligations."](#)

Market risk

Currency risk

More than 80% of MTU's revenue is generated in U.S. dollars. Approximately half of this currency risk is naturally hedged by costs settled in U.S. dollars. Most other costs are incurred in euros, and to a lesser extent in Canadian dollars and Polish zloty. Translation differences for the unhedged portion of the portfolio have a direct impact on net income and cash flow.

Hedging strategy

MTU uses a defined hedging model to protect hedge portions of its expected net foreign currency surplus in order to minimize the effects of the volatility of the U.S. dollar exchange rate on the group's net income and cash flow. The forward foreign exchange contracts and currency options used for this purpose are designated as financial instruments to hedge cash flows from expected sales realized in U.S. dollars. The hedge ratio decreases the longer the hedging horizon is. In 2019, the hedge ratio was 97% of the net foreign currency surplus. As of December 31, 2019, it was 72% for 2020, 51% for 2021, 22% for 2022, and 5% for 2023.

An economic hedging relationship exists between the hedged item and the hedging instrument, since the terms of the forward foreign exchange contracts and currency options correspond to the terms of the highly probable forecast transactions (this is true for the nominal amount and the expected payment date). MTU uses the hypothetical derivative method to measure the effectiveness of the hedge and prospectively compares the changes in fair value of the hedging instrument with the changes in fair value of the hedged items that are attributable to the hedged risk.

Hedge ineffectiveness can arise for a number of reasons:

- / when the timing of the cash flows from the hedged item and the hedging instruments differs or the expected amount of cash flows from the hedged item and the hedging instrument changes.

MTU considers the occurrence of such an event to be unlikely, since only the net foreign currency surplus is hedged and sufficient gross foreign currency payments are available to service the hedging instruments.

- / different effects of the counterparty credit risk on the changes in fair value of the hedged item and the hedging instrument

The occurrence of such an event is currently considered unlikely, since all banks with which MTU enters into hedging transactions must have an investment grade rating, as must MTU itself. The priced credit risk between MTU and the commercial banks is therefore very low at present and thus immaterial.

Translation differences arising from the translation of financial statements of international subsidiaries into the group's functional currency are not included here.

Forward foreign exchange contracts

As of December 31, 2019, MTU held open forward foreign exchange contracts with maturities up to September 2023 in a nominal amount of U.S. \$2,600.0 million. At the exchange rate prevailing on the reporting date, that translates into €2,314.4 million. The fair values of the open forward foreign exchange contracts maturing in and after 2020 decreased by €52.6 million in the reporting period (previous year: €67.2 million for maturities in and after 2019). As of December 31 of the previous year, MTU had hedged cash flows for fiscal years 2019 through 2020 amounting to U.S. \$1,570.0 million (which translates into €1,371.2 million at the exchange rate prevailing on December 31, 2018).

Currency option transactions

The options give MTU the right (long options) or obligation (short options) to sell a defined quantity of U.S. dollars for euros at agreed euro exchange rates at a specific time. The risk of financial loss from a long option is limited to the premiums that have already been paid. In the case of short options MTU collects a premium. Losses can be incurred if the exchange rate at maturity, compared with that agreed when the option was sold, falls by more than the amount of premiums received for these options. As of December 31, 2019, MTU held long options amounting to U.S. \$150.0 million (previous year: U.S. \$90.0 million) and short options in an amount of U.S. \$150.0 million (previous year: U.S. \$70.0 million).

The forward foreign exchange contracts and currency options open at the reporting date had the following maturities:

in € million	Dec. 31, 2019			Total
	Due in less than 1 year	Due in more than 1 year and less than 2 years	Due in more than 2 years	
[T125] Cash flow hedges				
Forward foreign exchange contracts				
Nominal amounts (in U.S. \$ million)	1,160.0	920.0	520.0	2,600.0
Average forward rate (€/U.S. \$)	1.19	1.18	1.19	1.19
Thereof recognized as				
Financial assets				
Nominal amounts (in U.S. \$ million)				500.0
Carrying amounts (in € million)				4.1
Financial liabilities				
Nominal amounts (in € million)				2,100.0
Carrying amounts (in € million)				63.7
Currency option transactions				
Nominal amounts (in U.S. \$ million)	130.0	20.0		150.0
Average forward rate (€/U.S. \$)	1.18	1.19		1.18
Thereof recognized as				
Financial assets				
Nominal amounts (in U.S. \$ million) ¹⁾				150.0
Carrying amounts (in € million)				0.7
Financial liabilities				
Nominal amounts (in U.S. \$ million) ¹⁾				150.0
Carrying amounts (in € million)				3.3

¹⁾ Combination of call and put options that partially offset each other.

[T126] Cash flow hedges

in € million	Dec. 31, 2018			Total
	Due in less than 1 year	Due in more than 1 year and less than 2 years	Due in more than 2 years	
Forward foreign exchange contracts				
Nominal amounts (in U.S. \$ million)	1,090.0	480.0		1,570.0
Average forward rate (€/U.S. \$)	1.18	1.21		1.19
Thereof recognized as				
Financial assets				
Nominal amounts (in U.S. \$ million)				420.0
Carrying amounts (in € million)				8.2
Financial liabilities				
Nominal amounts (in € million)				1,150.0
Carrying amounts (in € million)				31.5
Currency option transactions				
Nominal amounts (in U.S. \$ million)	20.0	70.0		90.0
Average forward rate (€/U.S. \$)	1.10	1.20		1.18
Thereof recognized as				
Financial assets				
Nominal amounts (in U.S. \$ million) ¹⁾				90.0
Carrying amounts (in € million)				2.8
Financial liabilities				
Nominal amounts (in U.S. \$ million) ¹⁾				70.0
Carrying amounts (in € million)				1.7

¹⁾ Combination of call and put options that partially offset each other.

Hedging instruments designated as cash flow hedges

In addition, the liability arising from the deferred purchase price component in connection with the increase in MTU's program share in the IAE-V2500 engine program, which has to be serviced in U.S. dollars, serves as an instrument for hedging cash flows arising from revenue generated in U.S. dollars. This liability matures in 2027 and has a nominal amount of U.S. \$335.2 million (previous year: U.S. \$387.8 million), which translates into €298.4 million (previous year: €338.7 million) at the exchange rate prevailing at the reporting date. As of December 31, 2019, the carrying amount of the purchase price liability was €270.5 million (previous year: €301.9 million) and is recognized under financial liabilities as part of the net debt.

As of the reporting date at the end of fiscal year 2019, the following amounts arising from the fair value measurement of forward foreign exchange contracts and other hedging instruments were recognized in equity:

[T127] Impact of hedging relationships on equity				
in € million	Hedge reserves	Hedging costs reserves	Currency translation reserves	Total
Carrying amount as of Jan. 1, 2018	51.4		0.3	51.7
Changes in fair value of forward foreign currency sales and options	-59.6	-36.6		-96.2
Amounts recycled to profit or loss	-17.8	16.1	2.2	0.5
Currency translation for financial liabilities			-23.0	-23.0
Deferred taxes	25.0	6.6	3.9	35.5
Carrying amount as of Jan. 1, 2019	-1.0	-13.9	-16.6	-31.5
Changes in fair value of forward foreign currency sales and options	39.3	18.9		58.2
Amounts recycled to profit or loss	-32.4	-47.6	5.2	-74.8
Currency translation for financial liabilities			-2.1	-2.1
Deferred taxes	-2.2	9.2	-0.3	6.7
Carrying amount as of Dec. 31, 2019	3.7	-33.4	-13.8	-43.5

No transactions were hedged in prior periods that are no longer expected to occur.

As a further element of its hedging strategy, MTU employs derivative financial instruments to which hedge accounting under IFRS 9 is not applied:

Currency swaps

In the course of the reporting period, amounts denominated in U.S. dollars were sold at the daily rate and repurchased after a short time using a swap. As the selling and buying rates differ marginally, these swaps are immaterial in terms of risk. The purpose of these transactions was to optimize the hedging of currency risk. As of December 31, 2019, currency swaps expiring in the period up to January 2, 2020, with a notional value of U.S. \$93.0 million were concluded (previous year: U.S. \$134.0 million).

Exchange rate sensitivity analysis

The sensitivity analysis showing the effects of hypothetical changes in exchange rates on net income and equity relates to the foreign currency positions included in the respective balance sheet items at the reporting date. In this context, it is assumed that the volume at the reporting date is representative of the full year.

A significant proportion of trade receivables and payables, refund liabilities and finance lease liabilities is invoiced in U.S. dollars and is thus exposed to exchange rate fluctuations. All other non-derivative financial instruments to which hedge accounting is not applied are already denominated in the functional currency, the euro, and are therefore not included in the exchange rate sensitivity analysis. The equity instruments held by the group are not of a monetary nature and therefore do not present a currency risk as defined by IFRS 7.

If the exchange rate of the euro to the U.S. dollar at December 31, 2019, or at the prior-year reporting date had been 10% higher or lower, this would have produced the following hypothetical effects on net income and equity:

[T128] Exchange rate sensitivity analysis

in € million	2019		2018	
	-10%	+10%	-10%	+10%
Exchange rate sensitivity (€/U.S. \$)				
Rate at reporting date				
Dec. 31, 2019: 1.1234				
(Dec. 31, 2018: 1.1450)	1.01	1.24	1.03	1.26
Net income	-77.9	63.3	-44.4	36.3
Equity ¹⁾	-179.6	148.5	-111.3	96.0

¹⁾ After tax.

Interest rate risk

MTU is exposed to interest rate risk principally in the eurozone, and to a lesser extent in Canada, China, Poland and the USA. MTU's interest rate risks are mainly related to pension obligations and financial liabilities.

Interest rate sensitivity analysis

Interest rate risk is presented in accordance with IFRS 7 using sensitivity analysis, which shows the effects of changes in market interest rates on interest payments, interest income and expense, other income statement items, net income and equity. The interest rate sensitivity analysis is based on the following assumptions:

Changes in the market interest rate of non-derivative financial instruments bearing fixed market interest rates have an effect on net income and equity only if these financial instruments are measured at fair value through profit or loss or were classified as such at initial recognition. Consequently, all fixed-interest financial instruments measured at amortized cost have no interest-rate-induced effects on net income and equity that must be accounted for, apart from future amounts to be charged to net interest income/expense.

In fiscal year 2019, floating-rate financial instruments and financial instruments measured at fair value held at the reporting date were not exposed to any significant interest rate risks.

Price risk

There is a general risk of price increases for commodities. This risk is mitigated mainly by procuring goods with appropriate price agreements and only to a small extent by entering into derivative financial instruments for nickel forward contracts.

As of December 31, 2019, MTU had entered into nickel forward contracts with credit institutions for a volume of 950 metric tons of nickel (previous year: 350 metric tons) for the years 2020 through 2022 and contracted fixed prices for nickel of between U.S. \$12.2 and U.S. \$13.7 per metric ton (previous year: between U.S. \$9.7 and U.S. \$13.5 per metric ton).

If the market price for nickel on the respective maturity date exceeds the agreed fixed price, MTU will receive a payment for the difference from the bank. In the opposite case, MTU is obligated to make a payment to the bank. No hedge accounting was applied to these transactions within the meaning of IFRS 9. The fair value loss of €2.0 million (previous year: €0.6 million) arising from these forward commodity purchases is recognized in other financial income/expense (*see Note 9*).

If the market prices in nickel forward contracts had been 10% higher or lower, net income would have been €0.8 million higher or lower (previous year: €0.2 million).

Liquidity risk

MTU's liquidity risk relates to its inability to meet payment obligations due because of insufficient cash or cash equivalents being available. In order to ensure the solvency and financial flexibility of MTU at all times, long-term credit lines and liquid funds are held available based on multi-year financial planning and rolling monthly liquidity planning.

MTU has entered into long-term syndicated loans and bilateral credit agreements with a number of banks. The credit facilities made available as of the reporting date are considered adequate to meet potential obligations arising from loan commitments in connection with sales financing arrangements in future years. For further details, please refer to *Notes 28 "Financial liabilities" and 33 "Additional disclosures relating to financial instruments."*

38. Leases

Group as lessee

The group has entered into leases for land and buildings, a variety of technical equipment, plant and machinery, motor vehicles, and operational and office equipment. The terms of leases for land and buildings range from two to 33 years. Lease terms for technical equipment, plant and machinery and for motor vehicles and operational and office equipment are typically between two and five years. A number of leases have renewal and termination options as well as variable lease payments, which are explained in detail below.

The group primarily acts as lessee in the following cases:

- / Engine leasing: The underlying leases regularly take into account variable (usage-based) components of the

lease rates. The lease terms are between one and ten years; some leases have renewal options. Engines are provided to MRO customers on the basis of sub-leases.

- / Real estate leases are for production, logistics and office capacities. Some of the underlying contracts include price escalation clauses linked to the consumer price index. The lease terms are between four and 17 years; some leases have renewal options.
- / Leasing of vehicles and industrial trucks: The underlying leases regularly take into account variable (usage-based) components of the lease rates. The lease terms are between two and five years; some leases have renewal options.

The table below shows the changes in carrying amounts and depreciation expenses of the right-of-use assets recognized in the balance sheet:

[T129] Right-of-use assets

in € million	As of Jan. 1, 2019	Currency translation differences	Additions	Transfers	Disposals	As of Dec. 31, 2019
Purchase cost						
Land, leasehold rights and buildings, including buildings on third-party land	21.7	0.3	6.5		-6.2	22.3
Technical equipment, plant and machinery	2.4					2.4
Other equipment, operational and office equipment	111.4		47.0	-5.1	-3.1	150.2
Total purchase cost	135.5	0.3	53.5	-5.1	-9.3	174.9
Depreciation						
Land, leasehold rights and buildings, including buildings on third-party land	-0.7		-4.0		0.7	-4.0
Technical equipment, plant and machinery	-2.0		-0.3			-2.3
Other equipment, operational and office equipment	-0.7		-32.8	0.5	3.1	-29.9
Total depreciation	-3.4		-37.1	0.5	3.8	-36.2
Carrying amount	132.1	0.3	16.4	-4.6	-5.5	138.7

The maturity analysis for lease liabilities is presented in [Note 28](#).

The following amounts for leases were recognized in profit or loss:

[T130] Amounts recognized in profit or loss for leases	
in € million	2019
Income	
Income from subleasing right-of-use-assets	55.8
Gains arising from sale and leaseback transactions	1.6
Lease income	57.4
Expenses	
Depreciation/amortization of right-of-use assets	37.1
Interest expense for lease liabilities	4.4
Short-term lease expense	3.6
Low-value asset lease expense	1.7
Variable lease payment expense not included in the measurement of lease liabilities	15.9
Lease expense	62.7

The group's cash outflows for leases amounted to €68.0 million in 2019. Future cash outflows for leases are presented in [Note 39](#).

Payments of €56.8 million under rental and lease agreements were expensed in fiscal year 2018. The assets under finance lease agreements recognized in the previous year relate to the following:

[T131] Lease payments under finance lease agreements	
in € million	2018
Lease payments	
Due in less than 1 year	1.8
Due in more than 1 year and less than 5 years	3.7
Due in more than 5 years	3.8
Total future minimum lease payments	9.3
Interest on lease payments	
Due in less than 1 year	0.2
Due in more than 1 year and less than 5 years	0.4
Due in more than 5 years	1.4
Total interest portion of future minimum lease payments	2.0
Present value of lease payments	
Due in less than 1 year	1.6
Due in more than 1 year and less than 5 years	3.3
Due in more than 5 years	2.4
Total present value of future minimum lease payments	7.3

The net carrying amount of assets recognized under finance lease agreements amounted to €7.4 million in the previous year. Property, plant and equipment acquired under such agreements were subject to restrictions of use in the previous year.

Group as lessor

MTU leases out engines that are owned by the group as well as engines that are in turn leased by MTU. The leases have terms of between one and three years. In this context, tailored engine leases are offered by the group to customers, aviation companies and companies with engine maintenance (MRO) activities. The engines are primarily leased out under operating leases. Renewal and premature termination options are granted on a case-by-case basis.

The maturity analyses of lease receivables are as follows:

[T132] Maturity analysis of finance lease receivables

in € million	Dec. 31, 2019
Finance lease receivables	
Less than 1 year	2.5
1 to 2 years	1.5
2 to 3 years	0.3
3 to 4 years	
4 to 5 years	
More than 5 years	
Undiscounted finance lease receivables	4.3
Unearned finance income	-0.1
Unguaranteed residual value	0.3
Net investment in finance leases	4.5

[T133] Maturity analysis of operating lease payments

in € million	Dec. 31, 2019
Operating lease receivables	
Less than 1 year	16.9
1 to 2 years	4.4
2 to 3 years	1.5
3 to 4 years	0.2
4 to 5 years	
More than 5 years	
Total	23.0

Lease revenue of €87.3 million was earned from operating leases. Divestment gains of €3.0 million were recorded in connection with finance leases.

As of December 31, 2018, the future minimum income from operating subleases for engines and office space totaled €35.6 million. Half of this amount was due within one year and the rest in stages within five years. Expenses of €59.7 million under these subleases were recognized in fiscal year 2018.

39. Contingent liabilities and other financial obligations

Contingent liabilities

Proceedings are pending before the tax courts contesting land transfer tax assessments in connection with mergers. In view of these proceedings, the collection of the land transfer tax in connection with the merger of MTU Aero Engines GmbH into MTU Aero Engines Holding AG has been suspended by the tax authorities. However, based on the current assessment, it cannot conclusively be ruled out that land transfer tax of around €15 million will be levied. As in the previous year, MTU does not currently believe that there is a material tax risk that this amount will be utilized.

The contingent liabilities from risk- and revenue-sharing agreements result from MTU's membership in the consortium formed to manage the V2500 engine program, which is structured as a risk- and revenue-sharing partnership, and hence also include liabilities arising from MTU's indirect interest in this program via Pratt & Whitney Aero Engines International GmbH, Lucerne, Switzerland (PWAEL).

The guarantees and other contingent liabilities principally comprise contract performance and customs bonds and guarantees assumed for credit facilities and investment subsidies.

MTU also receives a small amount of public sector grants and assistance to subsidize research and development expenses. The risk of repayment obligations exists until such time as the relevant project has been completed and all the conditions associated with it have been met. At the reporting date, the probability that risks of this kind could materialize was deemed to be very low.

[T134] Contingent liabilities

in € million	Dec. 31, 2019	Dec. 31, 2018
Contingent liabilities arising from risk- and revenue-sharing agreements	19.1	20.0
thereof IAE International Aero Engines AG	11.2	13.7
Bank guarantees	59.0	63.7
Guarantees and other contingent liabilities	64.1	8.3
Total contingent liabilities	142.2	92.0

Other financial obligations

Obligations arising from leases

The breakdown by maturity of future cash outflows for leases for which lease liabilities have not yet been recognized is as follows:

[T135] Future cash outflows from leases

in € million	Dec. 31, 2019
Variable lease payments	
Due in less than 1 year	0.2
Due in more than 1 year and less than 5 years	0.3
Due in more than 5 years	
Extension and termination options	
Due in less than 1 year	1.4
Due in more than 1 year and less than 5 years	
Due in more than 5 years	
Leases that have not yet commenced	
Due in less than 1 year	1.9
Due in more than 1 year and less than 5 years	25.4
Due in more than 5 years	62.1
Total future cash outflows from leases	91.3

Future minimum lease payments as of December 31, 2018, amounted to €89.7 million. Of this amount, €37.0 million was due within one year, €47.5 million after one year and in less than five years, and €5.2 million after five years.

Purchase commitments for financial obligations

As of December 31, 2019, purchase commitments amounted to €7.6 million (previous year: €9.0 million) for the purchase of intangible assets and to €90.8 million (previous year: €98.4 million) for the purchase of property, plant and equipment and were therefore in the normal range for the business.

40. Related party disclosures

Related companies

Transactions between group companies and joint ventures or associates were, without exception, entered into in the normal course of business and on an arm's length basis.

Transactions between consolidated companies were eliminated in the consolidated financial statements and are therefore not disclosed separately in this Note.

Business with related companies

In the reporting period, intragroup transactions involving the supply of goods and services were conducted by group companies as part of their normal operating activities (e.g., development, repairs, assembly, IT support). The following transactions with non-consolidated related companies resulting in current receivables and liabilities were entered into in the reporting period and the previous year:

[T136] Trade receivables from and trade payables to related companies

in € million	Trade receivables		Trade payables	
	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018
Associates	410.9	515.3		
Joint ventures	65.6	79.9	6.8	0.2
Subsidiaries accounted for at fair value	0.7	1.5	0.3	
Other related companies	3.7	6.8		
Total	480.9	603.5	7.1	0.2

[T137] Income/expense from trade receivables from related companies

in € million	Income		Expenses	
	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018
Associates ¹⁾	1,225.7	1,604.7	-1,030.3	-805.3
Joint ventures	416.0	383.6	-68.5	-382.9
Subsidiaries accounted for at fair value	0.8	0.9	-18.8	-16.2
Other related companies	4.2	4.4	-18.8	-7.2
Total	1,646.7	1,993.6	-1,136.4	-1,211.6

¹⁾ Prior-year amount adjusted – does not include any deferred/accrued amounts.

In connection with MTU's membership in the consortium for the V2500 engine program, which is structured as a risk- and revenue-sharing partnership, there are contingent liabilities of €7.7 million to the related party IAE International Aero Engines AG. Furthermore, there is a guarantee of €55.8 million for credit lines of EME Aero Sp.z.o.o., which is recognized as a contingent liability.

Major shareholdings

The list of major shareholdings shows the equity investments of MTU Aero Engines AG, Munich, and the equity

of each company as of December 31, 2019, and its net income in the reporting period:

[T138] Major shareholdings

Name and registered office of entity	Consolidation method ⁷⁾	Shareholding (in %) Dec. 31, 2019	Equity (in € thousand) Dec. 31, 2019	Profit/loss (in € thousand) Dec. 31, 2019
I. Investments in subsidiaries				
MTU Maintenance Hannover GmbH, Langenhagen, Germany	Full	100.00	65,470	²⁾
MTU Maintenance Berlin-Brandenburg GmbH, Ludwigsfelde, Germany	Full	100.00	88,620	²⁾
MTU Aero Engines North America Inc., Rocky Hill, USA	Full	100.00	35,018 ³⁾	-692 ⁴⁾
MS Engine Leasing LLC., Rocky Hill, USA ⁸⁾	Full	74.03	299,144 ³⁾	30,038 ⁴⁾
MTU Maintenance Canada Ltd., Richmond, Canada	Full	100.00	69,026 ³⁾	2,127 ⁴⁾
Vericor Power Systems LLC., Alpharetta, USA ⁸⁾	Full	100.00	34,097 ³⁾	3,229 ⁴⁾
MTU Aero Engines Polska sp. z o.o., Rzeszów, Poland	Full	100.00	376,706 ³⁾	81,641 ⁴⁾
MTU Maintenance Lease Services B.V., Amsterdam, Netherlands	Full	80.00	34,900	8,243
MTU Maintenance Coating Services GmbH, Ludwigsfelde, Germany	Full	100.00	25	²⁾
MTU Versicherungsvermittlungs- und Wirtschaftsdienst GmbH, Munich, Germany	Fair value	100.00	26	²⁾
MTU Maintenance Service Centre Ayutthaya Ltd., Ayutthaya, Thailand	Fair value	100.00	541 ^{1,5)}	247 ^{1,6)}
MTU Maintenance Dallas Inc., Grapevine, USA	Fair value	100.00	123 ³⁾	1,263 ⁴⁾
MTU Maintenance IGT Service do Brasil Ltda., São Paulo, Brazil	Fair value	100.00	247 ^{1,5)}	-22 ^{1,6)}
MTU Maintenance Serbia d.o.o., Belgrad, Serbia	Fair value	100.00	1,552 ³⁾	-50 ⁴⁾
MTU Aero Engines Finance Netherlands B.V., Amsterdam, Netherlands	Fair value	100.00	23 ¹⁾	15 ¹⁾
MTU Maintenance Service Centre Australia Pty. Ltd., Perth, Australia	Fair value	100.00	361 ^{1,5)}	-134 ^{1,6)}
MTU Aero Engines Shanghai Ltd., Shanghai, China	Fair value	100.00	158 ³⁾	22 ⁴⁾
II. Investments in associates				
IAE International Aero Engines AG, Zurich, Switzerland	At equity	25.25	87,142 ^{1,5)}	6,926 ^{1,6)}
IAE International Aero Engines LLC., East Hartford, USA	At equity	18.00	17,580 ³⁾	6,502 ⁴⁾
PW 1100G-JM Engine Leasing LLC., East Hartford, USA	At equity	18.00	1,661,192 ³⁾	167,251 ⁴⁾
III. Equity investments in joint ventures				
MTU Maintenance Zhuhai Co. Ltd., Zhuhai, China	At equity	50.00	326,258 ³⁾	105,894 ⁴⁾
MTU Maintenance Hong Kong Ltd., Hong Kong, China ⁸⁾	Fair value	50.00	10 ³⁾	13 ⁴⁾
Pratt & Whitney Canada Customer Service Centre Europe GmbH, Ludwigsfelde, Germany ⁸⁾	At equity	50.00	13,943	2,178
Ceramic Coating Center S.A.S., Paris, France	At equity	50.00	6,586	364
Airfoil Services Sdn. Bhd., Kota Damansara, Malaysia	At equity	50.00	19,319 ³⁾	7,792 ⁴⁾
AES Aerospace Embedded Solutions GmbH, Munich, Germany	At equity	50.00	3,390	772
EME Aero sp. z.o.o., Jasionka, Poland	At equity	50.00	34,846 ³⁾	-13,417 ⁴⁾
Turbo Union GmbH, Hallbergmoos, Germany	Fair value	39.98	275 ^{1,9)}	-3 ^{1,9)}
EUROJET Turbo GmbH, Hallbergmoos, Germany	Fair value	33.00	1,384 ¹⁾	275 ¹⁾
EPI Europrop International GmbH, Munich, Germany	Fair value	28.00	4,015 ¹⁾	669 ¹⁾
MTU Turbomeca Rolls-Royce GmbH, Hallbergmoos, Germany	Fair value	33.33	61 ¹⁾	23 ¹⁾
MTU Turbomeca Rolls-Royce ITP GmbH, Hallbergmoos, Germany	Fair value	25.00	64 ¹⁾	37 ¹⁾
IV. Other equity investments				
SMBC Aero Engine Lease B.V., Amsterdam, Netherlands (formerly Sumisho Aero Engines Lease B.V.)	Fair value	10.00	91,790 ^{1,5)}	8,230 ^{1,6)}

¹⁾ Prior-year figures, current figures not yet available.

²⁾ Profit/loss according to German Commercial Code (HGB) was transferred/absorbed.

³⁾ Translated at the closing exchange rate on Dec. 31, 2019.

⁴⁾ Translated at the annual average exchange rate for 2019.

⁵⁾ Translated at the closing exchange rate on Dec. 31, 2018.

⁶⁾ Translated at the annual average exchange rate for 2018.

⁷⁾ - Full = fully consolidated.

- Fair value = measured at fair value.

- Equity = carrying amount of investment increased or decreased in proportion to group's interest in equity.

⁸⁾ Indirect shareholding.

⁹⁾ Prior-year figures of Turbo-Union Limited, Bristol, United Kingdom.

Related persons

Other than the transactions specified in [“Other related party transactions,”](#) no group companies entered into any transactions subject to disclosure requirements with members of the group’s Executive Board or Supervisory Board or with any other individuals in key management positions, or with companies of whose governing or supervisory bodies these individuals are members. The same applies to close members of the families of those individuals.

Members of the Executive Board

As of December 31, 2019, the Executive Board of MTU Aero Engines AG, Munich, had the following members:

[T139] Members of the Executive Board

Reiner Winkler Chief Executive Officer	Munich, Germany
Peter Kameritsch Chief Financial Officer and Chief Information Officer	Munich, Germany
Lars Wagner Chief Operating Officer	Munich, Germany
Michael Schreyögg Chief Program Officer	Munich, Germany

Executive Board compensation

Detailed information on the compensation system for MTU’s Executive Board, including their company pension entitlements, is provided in the [Management compensation report in the Combined management report.](#)

The members of the Executive Board received total compensation amounting to €10.3 million (previous year: €10.6 million) for their work as board members in fiscal year 2019. Total compensation breaks down into the following components:

[T140] Compensation of the Executive Board

	2019		2018	
	in € million ¹⁾	in %	in € million ¹⁾	in %
Short-term employee benefits				
Non-performance-related components	2.6		2.1	
Performance-related components without long-term incentive effect ²⁾	3.0		2.2	
Performance-related components with long-term incentive effect	3.9		3.2	
Total	9.5	92.2	7.5	70.8
Post-employment benefits				
Service cost/ past service cost	0.8		3.1	
Total	0.8	7.8	3.1	29.2
Total compensation	10.3	100.0	10.6	100.0

¹⁾ Amounts relate to compensation awarded to active members of the Executive Board in the respective reporting period for their work as board members.

²⁾ Performance-related portion of short-term incentive (STI) for the reporting period, which will be paid in the following year.

Members of the Executive Board did not receive any compensation for board appointments in group companies.

In the reporting period, as in the previous year, no loans or advances were granted to members of the Executive Board. Similarly, as in the previous year, no contingent liabilities were assumed by the company in favor of members of the Executive Board.

As of December 31, 2019, provisions for current and future pension obligations to former members of the Executive Board amounted to €18.4 million (previous year: €16.3 million).

Members of the Supervisory Board

As in the previous year, members of the Supervisory Board did not receive any additional compensation for board appointments over and above that received for their appointment to the Supervisory Board of MTU Aero Engines AG, Munich. The compensation amounted to €1.1 million (previous year: €1.1 million).

In fiscal year 2019, MTU employees appointed as employee representatives to the Supervisory Board of MTU Aero Engines AG received salaries under their normal employment contracts (excluding Supervisory Board compensation) totaling €0.5 million (previous year: €0.5 million). The total amount represents the sum of their respective gross salaries.

In the reporting period, as in the previous year, no loans or advances were granted to members of the Supervisory Board. Similarly, as in the previous year, no contingent liabilities were assumed by the company in favor of members of the Supervisory Board.

Details of the compensation awarded to individual members of the Supervisory Board, and other related information, are presented in the [Management compensation report in the Combined management report](#).

Other related party transactions

MTU shares and options bought or sold by members of the Executive Board and the Supervisory Board in fiscal year 2019 were bought or sold on an arm's length basis. The transactions were published in the register of companies and on [MTU's website at www.mtu.de > Investor Relations > Corporate Governance > Directors' Dealings](#).

Shareholders

Pursuant to Section 160 (1) no. 8 of the German Stock Corporation Act (AktG), disclosure is required of shareholdings of which the company has been notified pursuant to Section 21 (1) or (1a) of the German Securities Trading Act (WpHG). Detailed information can be found under ["The MTU share."](#)

V. Segment information

41. Segment reporting

MTU reports on two operating segments: the OEM segment (commercial and military engine business) and the MRO segment (commercial maintenance business). Segmentation is based on the internal organizational structure and reporting system, which takes into account the different risks and return structures for both segments. A detailed description of the operating segments is provided in the Consolidated segment report.

Commercial and military engine business (OEM)

In the commercial and military engine business, the group develops, manufactures, assembles and delivers commercial and military engines and components. The maintenance, repair and overhaul of military engines is also included in this segment.

Commercial maintenance business (MRO)

In the commercial maintenance business, the group maintains, repairs and overhauls aircraft engines and industrial gas turbines. In addition to complete engine maintenance, the services provided include engine module and parts repairs as well as related services.

Profit/loss of companies accounted for using the equity method

The carrying amount and the share in profit/loss of consolidated group companies accounted for using the equity method are included in the consolidated financial statements if these companies can be directly allocated to an operating segment.

Segment assets and segment liabilities

Segment assets comprise all assets that can be directly allocated to specific operating activities and whose positive or negative operating results have an impact on earnings before interest and tax (EBIT/adjusted EBIT). Assets and liabilities are allocated to the operating segment in which they are used to generate business. The consolidation/reconciliation amount in the segment assets line relates to the consolidation of the carrying amount of subsidiaries and of accounts receivable from intersegment sales of €1,282.4 million (previous year: €1,029.6 million) and to segment liabilities of €942.0 million (previous year: €688.8 million).

The cash and cash equivalents of the German group companies are managed centrally by the parent company in a cash pooling system. The parent company's operating activities are allocated to the OEM segment, which is why the associated interest income and expense arise mainly in that segment.

Segment capital expenditures

Segment capital expenditures relate to additions to tangible and intangible fixed assets, acquired program assets and acquired development assets.

[T141] Capital expenditure on intangible assets, property, plant and equipment, acquired program assets and acquired development work

in € million	2019	2018
Germany	356.1	280.6
Europe	126.8	44.5
North America	11.8	7.2
Total capital expenditure	494.7	332.3

Approximately 72% (previous year: approximately 84%) of capital expenditures on intangible assets and on tangible fixed assets relates to group companies in Germany.

Consolidation/reconciliation column

The amounts in the “consolidation/reconciliation” column for earnings before interest and tax (EBIT/adjusted EBIT) are used to eliminate the effect of intersegment sales.

Segment information by region

External revenue, capital expenditure on tangible and intangible fixed assets, and non-current assets are divided according to the following regions: Germany, Europe (excluding Germany), North America, Asia and other regions. Revenue from business with third parties is allocated according to the country where the customer is domiciled. Further details relating to the breakdown of revenue by region are presented in [Note 1 “Revenue.”](#)

Capital expenditures on tangible and intangible fixed assets as well as non-current assets are allocated to the geographical area in which the respective asset is located.

[T142] Non-current assets

in € million	2019	2018
Germany	2,932.2	2,733.8
Europe (excluding Germany)	865.0	715.3
North America	357.8	266.8
Total non-current assets	4,155.0	3,715.9

VI. Events after the reporting date

In light of the spread of the coronavirus 2019-nCoV since December 2019, the global situation is being monitored closely to derive the potential impact on MTU’s business. An ongoing epidemic and, in particular, the associated restrictions on air travel could have a negative impact on the demand for spare parts and maintenance services. Moreover, if the economic situation should deteriorate, this could impact the use of passenger and freight aircraft, reduce the need for maintenance services and prompt a more cautious approach to orders for new transportation capacity. No other events of material importance with any significant impact on the net assets, financial position and results of operations of the MTU Group occurred after the end of the reporting period.

VII. Determination of the net profit available for distribution on the basis of the annual financial statements

Unlike the consolidated financial statements, which are based on the IFRSs issued by the IASB and endorsed by the EU, the annual financial statements of MTU Aero Engines AG, Munich, are prepared in accordance with the requirements of the German Commercial Code (HGB) and German Stock Corporation Act (AktG).

[T143] Income statement of MTU Aero Engines AG

in € million	2019	2018	Change against previous year	
			in € million	in %
Revenue	4,087.2	3,639.7	447.5	12.3
Cost of goods sold	-3,811.2	-3,417.7	-393.5	-11.5
Gross profit	276.0	222.0	54.0	24.3
Selling expenses	-74.8	-90.5	15.7	17.3
General administrative expenses	-44.9	-45.8	0.9	2.0
Net other operating income/expenses	42.6	81.3	-38.7	-47.6
Net financial income/expense	-79.3	209.9	-289.2	<-100
Earnings from ordinary operating activities	119.6	376.9	-257.3	-68.3
Tax expense	-39.4	-115.4	76.0	65.9
Net profit for the year	80.2	261.5	-181.3	-69.3
Withdrawal from other retained earnings	99.5		99.5	-99.5
Allocation to other retained earnings		-114.0	114.0	100.0
Net profit available for distribution	179.7	147.5	32.2	21.8

Proposed profit distribution

The Executive Board is recommending to the Supervisory Board that in view of the latest developments of the global coronavirus pandemic, the proposal should be made to the Annual General Meeting to bring forward the net profit for fiscal year 2019 to new account. Based on the developments in the coming weeks and the expected consequences for MTU's business development, the Executive Board can present the Supervisory Board as appropriate with an updated recommendation regarding profit distribution.

Federal Gazette (Bundesanzeiger)

The annual financial statements, consolidated financial statements and combined management report of MTU Aero Engines AG, Munich, are published in the Electronic Federal Gazette (elektronischer Bundesanzeiger). Print copies can be obtained on request from MTU Aero Engines AG, 80995 Munich, Germany.

Declaration of conformity with the German Corporate Governance Code

The declaration of conformity by the Executive Board and Supervisory Board of MTU Aero Engines AG, Munich, pursuant to Section 161 of the German Stock Corporation Act (AktG) is published in the MTU Annual Report 2019 and also permanently available to shareholders on the MTU website at www.mtu.de.

Munich, March 17, 2020



Reiner Winkler
Chief Executive Officer



Peter Kameritsch
Chief Financial Officer
and Chief
Information Officer



Michael Schreyögg
Chief Program Officer



Lars Wagner
Chief Operating
Officer

Translation of the German independent auditor's report concerning the audit of the consolidated financial statements and combined management report prepared in German:

Independent auditor's report

To MTU Aero Engines AG

Report on the audit of the consolidated financial statements and of the combined management report

Opinions

We have audited the consolidated financial statements of MTU Aero Engines AG, Munich, and its subsidiaries (the "Group"), which comprise the consolidated income statement and consolidated statement of comprehensive income for the fiscal year from 1 January 2019 to 31 December 2019, the consolidated balance sheet as of 31 December 2019, the consolidated statement of changes in equity and the consolidated cash flow statement for the fiscal year from 1 January 2019 to 31 December 2019, and the notes to the consolidated financial statements, including the recognition and measurement principles presented therein. In addition, we have audited the group management report, which is combined with the management report of MTU Aero Engines AG, Munich ("combined management report"), for the fiscal year from 1 January 2019 to 31 December 2019. In accordance with the German legal requirements, we have not audited the content of the non-financial statement, the "Corporate governance statement" and the "Responsibility statement" contained in the "Other disclosures" section of the combined management report.

In our opinion, on the basis of the knowledge obtained in the audit,

- / the accompanying consolidated financial statements comply, in all material respects, with the International Financial Reporting Standards (IFRSs) as adopted by the EU and the supplementary provisions of German law pursuant to Sec. 315e (1) HGB ["Handelsgesetzbuch": German Commercial Code] and give a true and fair view of the assets, liabilities and financial position of the Group as of 31 December 2019 and of its financial performance for the fiscal year from 1 January 2019 to 31 December 2019 in accordance with German legally required accounting principles, and
- / the accompanying combined management report as a whole provides an appropriate view of the Group's position. In all material respects, this combined management report is consistent with the consolidated financial statements, complies with German legal requirements and appropriately presents the oppor-

tunities and risks of future development. Our opinion on the combined management report does not cover the content of the above-mentioned non-financial statement, "Corporate governance statement" and "Responsibility statement".

Pursuant to Sec. 322 (3) Sentence 1 HGB, we declare that our audit has not led to any reservations relating to the legal compliance of the consolidated financial statements and of the combined management report.

Basis for the opinions

We conducted our audit of the consolidated financial statements and the combined management report in accordance with Sec. 317 HGB and the EU Audit Regulation (No 537/2014, referred to subsequently as "EU Audit Regulation") and in compliance with German Generally Accepted Standards for Financial Statement Audits promulgated by the Institut der Wirtschaftsprüfer [Institute of Public Auditors in Germany] (IDW). Our responsibilities under those requirements and principles are further described in the "Auditor's responsibilities for the audit of the consolidated financial statements and of the combined management report" section of our auditor's report. We are independent of the Group in accordance with the requirements of European law and German commercial and professional law, and we have fulfilled our other German professional responsibilities in accordance with these requirements.

In addition, in accordance with Art. 10 (2) f) of the EU Audit Regulation, we declare that we have not provided non-audit services prohibited under Art. 5 (1) of the EU Audit Regulation. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinions on the consolidated financial statements and on the combined management report.

Key audit matters in the audit of the consolidated financial statements

Key audit matters are those matters that, in our professional judgment, were of most significance in our audit of the consolidated financial statements for the fiscal year from 1 January 2019 to 31 December 2019. These matters were addressed in the context of our audit of the consolidated financial statements as a whole, and in forming our opinion thereon; we do not provide a separate opinion on these matters.

Below, we describe what we consider to be the key audit matters:

1. Recognition of revenue from risk- and revenue-sharing partnerships

Reasons why the matter was determined to be a key audit matter

The MTU Group primarily generates its revenue in the commercial and military engine business (OEM segment (Original Equipment Manufacturing)) from risk- and revenue-sharing partnerships with other engine manufacturers. Revenue is recognized when the Company fulfills the performance obligation identified in the contract by delivering the goods. Revenue is therefore recognized when the customer has gained control of the asset pursuant to IFRS 15.31. Furthermore, risk- and revenue-sharing partnerships mean that MTU is obliged to provide other partners with licenses to its technology. MTU receives variable remuneration for these licenses. Pursuant to IFRS 15.58, this variable remuneration is recorded based on reports from the risk- and revenue-sharing partnerships, because this is when there is no longer any uncertainty surrounding the amount. If this reporting is delayed, revenue from the provision of this license is allocated based on qualified estimates that take the contractual arrangements into account.

There is a risk of error when allocating revenue as well as of fraud on account of incentives to achieve certain performance targets and forecasts. The significance of revenue for the consolidated financial statements, the discretionary scope involved in estimates and the fact that revenue and EBIT are financial performance indicators for the Group in terms of corporate management and forecasts meant that the recognition of revenue from variable license fees from risk- and revenue-sharing partnerships as of the reporting date was a key audit matter.

Auditor's response

We took a substantive audit approach to assess the appropriateness of revenue recognition from risk- and revenue-sharing partnerships. We evaluated the structure of the underlying corporate processes. Considering the requirements of IFRS 15, we also assessed the accounting effects of the performance obligations identified from the risk- and revenue-sharing partnerships. To assess the amount of revenue estimated for the month of December 2019, we carried out substantive audit procedures by reconciling the estimated values with the reporting of the risk- and revenue-sharing partnerships from January 2020 on a sample basis. We also analyzed the interim transaction data for anomalies. In this context, our procedures included correlation analyses and time series analyses. We reconciled non-standard transactions, journal entries and closing entries to the underlying documents on a sample basis.

Our audit procedures did not lead to any reservations relating to the recognition of revenue from risk- and revenue-sharing partnerships.

Reference to related disclosures

The disclosures in the notes to the consolidated financial statements on the principles of revenue recognition are contained in section I. "General information" in the subsections on "IFRS 15, Revenue from Contracts with Customers", "Revenue" as well as "Discretionary scope, measurement uncertainties and sensitivity". The significance of revenue in connection with corporate management as well as with regard to the business development and forecast is also presented in the "Group internal control system" and "Financial performance indicators" sections of the combined management report.

2. Measurement of liabilities from warranty obligations as well as risks from pending transactions

Reasons why the matter was determined to be a key audit matter

In the consolidated financial statements of MTU Aero Engines AG, liabilities from warranty obligations and risks from pending transactions are reported as "Refund liabilities" and "Other provisions" under non-current and current liabilities in the balance sheet. They relate to statutory and agreement-specific obligations and comprise estimates made on both a case-by-case and a general basis. During the audit, we determined the measurement of liabilities from warranty obligations as well as risks from pending transactions relating to specific individual matters and subject to high levels of estimation uncertainty to be a key audit matter because the measurement of these items, the amounts of which are significant, is based to a large extent on the executive directors' estimates and assumptions, in particular with regard to the technical risks as well as the amount of the anticipated costs.

Auditor's response

To assess the measurement of liabilities from warranty obligations as well as risks from pending transactions, we examined the process of preparing the separate and consolidated financial statements, interviewed representatives of MTU Aero Engines AG and inspected agreements, correspondence and other documentation. In particular, we assessed the underlying measurement methods and key valuation parameters and checked the calculations for arithmetical accuracy. We also obtained and evaluated confirmations from lawyers and interviewed representatives from the legal department to assess the measurement.

Our audit procedures did not lead to any reservations relating to the measurement of liabilities from warranty obligations as well as risks from pending transactions.

Reference to related disclosures

The disclosures in the notes to the consolidated financial statements on refund liabilities as well as other provisions are contained in section I. "General information" in the subsections on "Other provisions", "Refund liabilities" as well as "Discretionary scope, measurement uncertainties and sensitivity" and in section III. "Notes to the consolidated balance sheet" in the subsections "27. Other provisions" and "31. Refund liabilities".

3. Recoverability of payments to customers based on the program term and capitalized development costs from risk- and revenue-sharing partnerships

Reasons why the matter was determined to be a key audit matter

The MTU Group participates in risk- and revenue-sharing partnerships with other engine manufacturers. Payments are made and proportionate costs are assumed in order to enter into these partnerships in the commercial OEM segment. These payments to customers based on the program term are recognized as "Acquired program assets, development work and other assets" under non-current assets in the consolidated financial statements. Furthermore, internally funded development services are rendered, which are capitalized as development costs. The management board of MTU Aero Engines AG analyzes these assets for impairment at each reporting date. The basis for this is the planning of the individual engine programs over the remaining program term. An asset's or overarching cash-generating unit's discounted cash surpluses are compared to the corresponding carrying amount. The Company determines the discount rate (WACC) using external valuation experts. The assessment of whether the assets are impaired is based to a large extent on estimates by the Company's executive directors. The resulting discretionary scope gives rise to a generally higher risk for accounting misstatements. Against this background, the assessment of whether the payments to customers based on the program term and capitalized development costs from risk- and revenue-sharing partnerships were impaired was a key audit matter.

Auditor's response

We examined the planning process of MTU Aero Engines AG in order to assess the impairment of payments to customers based on the program term and capitalized development costs. We also requested evidence to show to what extent external sources are included in the planning process. Building on this, we used variance analyses to compare the program planning with the prior-year planning and assessed the planning assumptions based on interviews with the responsible program officers. We assessed the WACC department by consulting internal valuation specialists, in particular by comparing the peer group with comparable companies from an external database, reconciled market data and checked for arithmetical accuracy. We checked the completeness of the net assets' carrying amount. We examined the underlying valuation models to test impairment both in terms of clerical accuracy and the methods used. We checked the results of the impairment testing performed by the executive directors using sensitivity analyses for plausibility and compared these with the sensitivity analyses performed by the Company on a sample basis.

Our audit procedures did not lead to any reservations relating to whether the payments to customers based on the program term and capitalized development costs from risk- and revenue-sharing partnerships were impaired.

Reference to related disclosures

The disclosures in the notes to the consolidated financial statements on program assets and capitalized development costs are contained in section I. "General information" in the subsections on "Research and development expenses", "Intangible assets", "Acquired program assets and acquired development work", "Impairment of intangible assets, property, plant and equipment, acquired program assets and acquired development work" as well as "Discretionary scope, measurement uncertainties and sensitivity". There are also disclosures in the notes to the consolidated financial statements in section II. "Notes to the consolidated income statement" in the subsection on "3. Research and development expenses" as well as in section III. "Notes to the consolidated balance sheet" in the subsections on "13. Changes in intangible assets and property, plant and equipment", "14. Intangible assets" and "17. Acquired program assets, development work and other assets". Further disclosures on capitalized research and development costs are presented in the "The MTU Group/Research and development" as well as "Business environment/Financial situation" sections of the combined management report.

Other information

The Supervisory Board is responsible for the Report of the Supervisory Board in the “Corporate governance” section of the 2019 annual report. In all other respects, the executive directors are responsible for the other information. The other information, of which we received a version prior to issuing this auditor’s report, includes:

- / the non-financial statement, “Corporate governance statement” and “Responsibility statement” in accordance with Sec. 297 (2) Sentence 4 HGB as well as Sec. 315 (1) Sentence 5 HGB in the “Other disclosures” section of the combined management report
- / the “Information on MTU shares”, “Key facts and figures with year-on-year comparison”, “From evolution to revolution”, “Letter to our shareholders”, “Corporate governance” and “Additional information” sections of the 2019 annual report.

Our opinions on the consolidated financial statements and combined management report do not cover the other information, and we therefore do not provide an opinion or any other form of audit conclusion on these matters.

In connection with our audit, our responsibility is to read the other information and to assess whether the other information

- / is inconsistent in any material respect with the consolidated financial statements, the combined management report or our knowledge obtained in the audit, or
- / otherwise appears to be misstated in any material respect.

If, based on the work we have performed, we conclude that there is a material misstatement of this other information, we are required to report that fact. We have nothing to report in this regard.

Responsibilities of the executive directors and the Supervisory Board for the consolidated financial statements and the combined management report

The executive directors are responsible for the preparation of the consolidated financial statements that comply, in all material respects, with IFRSs as adopted by the EU and the supplementary provisions of German law pursuant to Sec. 315e (1) HGB, and for the preparation of consolidated financial statements that give a true and fair view of the assets, liabilities, financial position and financial performance of the Group in accordance with these requirements. In addition, the executive directors are responsible for such internal control as they have determined necessary to enable the preparation of consolidated financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the consolidated financial statements, the executive directors are responsible for assessing the Group’s ability to continue as a going concern. They also have the responsibility for disclosing, as applicable, matters related to going concern. In addition, they are responsible for financial reporting based on the going concern basis of accounting unless there is an intention to liquidate the Group or to cease operations, or there is no realistic alternative but to do so.

Furthermore, the executive directors are responsible for the preparation of the combined management report that, as a whole, provides an appropriate view of the Group’s position and is, in all material respects, consistent with the consolidated financial statements, complies with German legal requirements and appropriately presents the opportunities and risks of future development. In addition, the executive directors are responsible for such arrangements and measures (systems) as they have considered necessary to enable the preparation of a combined management report that is in accordance with the applicable German legal requirements, and to be able to provide sufficient appropriate evidence for the assertions in the combined management report.

The Supervisory Board is responsible for overseeing the Group’s financial reporting process for the preparation of the consolidated financial statements and of the combined management report.

Auditor's responsibilities for the audit of the consolidated financial statements and of the combined management report

Our objectives are to obtain reasonable assurance about whether the consolidated financial statements as a whole are free from material misstatement, whether due to fraud or error, and whether the combined management report as a whole provides an appropriate view of the Group's position and, in all material respects, is consistent with the consolidated financial statements and the knowledge obtained in the audit, complies with the German legal requirements and appropriately presents the opportunities and risks of future development, as well as to issue an auditor's report that includes our opinions on the consolidated financial statements and on the combined management report.

Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Sec. 317 HGB and the EU Audit Regulation and in compliance with German Generally Accepted Standards for Financial Statement Audits promulgated by the Institut der Wirtschaftsprüfer (IDW) will always detect a material misstatement. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these consolidated financial statements and this combined management report.

We exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- / Identify and assess the risks of material misstatement of the consolidated financial statements and of the combined management report, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinions. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- / Obtain an understanding of internal control relevant to the audit of the consolidated financial statements and of arrangements and measures (systems) relevant to the audit of the combined management report in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of these systems.
- / Evaluate the appropriateness of accounting policies used by the executive directors and the reasonableness of estimates made by the executive directors and related disclosures.
- / Conclude on the appropriateness of the executive directors' use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Group's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in the auditor's report to the related disclosures in the consolidated financial statements and in the combined management report or, if such disclosures are inadequate, to modify our respective opinions. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Group to cease to be able to continue as a going concern.
- / Evaluate the overall presentation, structure and content of the consolidated financial statements, including the disclosures, and whether the consolidated financial statements present the underlying transactions and events in a manner that the consolidated financial statements that comply with IFRSs as adopted in the EU and the additional requirements of German commercial law pursuant to Sec. 315e (1) HGB give a true and fair view of the assets, liabilities, financial position and financial performance of the Group.
- / Obtain sufficient appropriate audit evidence regarding the financial information of the businesses or business activities within the Group to express opinions on the consolidated financial statements and on the combined management report. We are responsible for the direction, supervision and performance of the group audit. We remain solely responsible for our opinions.
- / Evaluate the consistency of the combined management report with the consolidated financial statements, its conformity with [German] law and the view of the Group's position it provides.
- / Perform audit procedures for the forward-looking disclosures made by the executive directors in the combined management report. On the basis of sufficient appropriate audit evidence we evaluate, in particular, the significant assumptions used by the executive directors as a basis for the prospective information, and evaluate the proper derivation of the prospective information from these assumptions. We do not

express a separate opinion on the prospective information and on the assumptions used as a basis. There is a substantial unavoidable risk that future events will differ materially from the prospective information.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

We provide those charged with governance with a statement that we have complied with relevant ethical requirements regarding independence, and communicate with them all relationships and other matters that may reasonably be thought to bear on our independence, and related safeguards.

From the matters communicated with those charged with governance, we determine those matters that were of most significance in the audit of the consolidated financial statements of the current period and are therefore the key audit matters. We describe these matters in our auditor's report unless law or regulation precludes public disclosure about the matter.

Other legal and regulatory requirements

Further information pursuant to Art. 10 of the EU Audit Regulation

We were elected as auditor of the consolidated financial statements by the annual general meeting on 11 April 2019. We were engaged by the Supervisory Board on 21 October 2019. We have been the auditor of MTU Aero Engines AG for an uninterrupted period since the audit of the consolidated financial statements for fiscal year 2014.

We declare that the opinions expressed in this auditor's report are consistent with the additional report to the audit committee pursuant to Art. 11 of the EU Audit Regulation (long-form audit report).

German Public Auditor responsible for the engagement

The German Public Auditor responsible for the engagement is Siegfried Keller.

Munich, March 17, 2020,

Ernst & Young GmbH
Wirtschaftsprüfungsgesellschaft

Keller

Westermeier

Wirtschaftsprüfer
[German Public Auditor]

Wirtschaftsprüfer
[German Public Auditor]r

The assurance engagement performed by Ernst & Young (EY) relates exclusively to the German version of the non-financial statement 2019 of MTU Aero Engines AG. The following text is a translation of the original German Independent Assurance Report.

Independent Auditor's Limited Assurance Report

To MTU Aero Engines AG, Munich

We have performed a limited assurance engagement on the non-financial statement of MTU Aero Engines AG according to § 289b HGB ("Handelsgesetzbuch": German Commercial Code), which is combined with the non-financial statement of the group according to § 315b HGB, consisting of the chapter "Non-financial statement" in the group management report as well as the section "The enterprise MTU" in the group management report being incorporated by reference, for the reporting period from 1 January 2019 to 31 December 2019 (hereafter non-financial statement).

Management's responsibility

The legal representatives of the Company are responsible for the preparation of the non-financial statement in accordance with §§ 315c in conjunction with 289c to 289e HGB.

This responsibility includes the selection and application of appropriate methods to prepare the non-financial statement as well as making assumptions and estimates related to individual disclosures, which are reasonable in the circumstances. Furthermore, the legal representatives are responsible for such internal controls that they have considered necessary to enable the preparation of a non-financial statement that is free from material misstatement, whether due to fraud or error.

Auditor's declaration relating to independence and quality control

We are independent from the Company in accordance with the provisions under German commercial law and professional requirements, and we have fulfilled our other professional responsibilities in accordance with these requirements.

Our audit firm applies the national statutory regulations and professional pronouncements for quality control, in particular the by-laws regulating the rights and duties of Wirtschaftsprüfer and vereidigte Buchprüfer in the exercise of their profession [Berufssatzung für Wirtschaftsprüfer und vereidigte Buchprüfer] as well as the IDW Standard on Quality Control 1: Requirements for Quality Control in audit firms [IDW Qualitätssicherungs-

standard 1: Anforderungen an die Qualitätssicherung in der Wirtschaftsprüferpraxis (IDW QS 1)].

Auditor's responsibility

Our responsibility is to express a limited assurance conclusion on the non-financial statement based on the assurance engagement we have performed.

We conducted our assurance engagement in accordance with the International Standard on Assurance Engagements (ISAE) 3000 (Revised): Assurance Engagements other than Audits or Reviews of Historical Financial Information, issued by the International Auditing and Assurance Standards Board (IAASB). This Standard requires that we plan and perform the assurance engagement to obtain limited assurance about whether the non-financial statement of the Company has been prepared, in all material respects, in accordance with §§ 315c in conjunction with 289c to 289e HGB. In a limited assurance engagement the assurance procedures are less in extent than for a reasonable assurance engagement and therefore a substantially lower level of assurance is obtained. The assurance procedures selected depend on the auditor's professional judgment.

Within the scope of our assurance engagement, which has been conducted between November 2019 and March 2020, we performed amongst others the following assurance and other procedures:

- / Inquiries of employees regarding the selection of topics for the non-financial statement, the risk assessment and the concepts of MTU for the topics that have been identified as material,
- / Inquiries of employees responsible for data capture and consolidation as well as the preparation of the non-financial statement, to evaluate the reporting processes, the data capture and compilation methods as well as internal controls to the extent relevant for the assurance of the non-financial statement,
- / Identification of likely risks of material misstatement in the non-financial statement,
- / Inspection of relevant documentation of the systems and processes for compiling, aggregating and validating data in the relevant areas, e.g. compliance and employees in the reporting period and testing such documentation on a sample basis,
- / Analytical evaluation of disclosures in the non-financial statement,
- / Inquiries and inspection of documents on a sample basis relating to the collection and reporting of selected data,
- / Evaluation of the presentation of disclosures in the non-financial statement.

Assurance conclusion

Based on our assurance procedures performed and assurance evidence obtained, nothing has come to our attention that causes us to believe that the non-financial statement of MTU Aero Engines AG for the period from 1 January 2019 to 31 December 2019 has not been prepared, in all material respects, in accordance with §§ 315c in conjunction with 289c to 289e HGB.

Intended use of the assurance report

We issue this report on the basis of the engagement agreed with MTU Aero Engines AG. The assurance engagement has been performed for the purposes of the Company and the report is solely intended to inform the Company as to the results of the assurance engagement and must not be used for purposes other than those intended. The report is not intended to provide third parties with support in making (financial) decisions.

Engagement terms and liability

The “General Engagement Terms for Wirtschaftsprüfer and Wirtschaftsprüfungsgesellschaften [German Public Auditors and Public Audit Firms]” dated 1 January 2017 are applicable to this engagement and also govern our relations with third parties in the context of this engagement (www.de.ey.com/general-engagement-terms). In addition, please refer to the liability provisions contained there in no. 9 and to the exclusion of liability towards third parties. We assume no responsibility, liability or other obligations towards third parties unless we have concluded a written agreement to the contrary with the respective third party or liability cannot effectively be precluded.

We make express reference to the fact that we do not update the assurance report to reflect events or circumstances arising after it was issued unless required to do so by law. It is the sole responsibility of anyone taking note of the result of our assurance engagement summarized in this assurance report to decide whether and in what way this result is useful or suitable for their purposes and to supplement, verify or update it by means of their own review procedures.

Munich, 17 March 2020

Ernst & Young GmbH
Wirtschaftsprüfungsgesellschaft

Nicole Richter
Wirtschaftsprüferin
(German Public Auditor)

ppa. Dr. Patrick Albrecht

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Glossary of engine terms

Blisk

Blisks (blade integrated disks) are high-tech components where the disk and blades are manufactured as a single part. This configuration delivers greater strength and better aerodynamic properties with a lower weight.

Compressor

The task of the compressor is to ingest air and compress it before it is fed into the combustor. Compressors consist of bladed disks (rotors) that rotate at very high speed between stationary guide vanes (stators). In order to achieve a compression ratio of over 40:1, which is standard in all modern two-shaft engines, it is necessary to use multi-stage low-pressure and high-pressure compressors rotating at different speeds on dual concentric shafts. These are driven by the corresponding turbines.

Fan

The first rotor of the low-pressure compressor is called the fan. It accelerates the bypass stream flowing aftward and provides the engine's main thrust. It is driven by the low-pressure turbine via the low-pressure shaft.

Geared Turbofan™

What sets the Geared Turbofan™ propulsion system apart is that it features a reduction gearbox between the fan and low-pressure shaft on which the low-pressure compressor and low-pressure turbine that drives the fan are seated. The gearbox allows the fan with its large diameter to rotate more slowly and, at the same time, the low-pressure compressor and turbine to rotate much faster. This enables lower fan pressure ratios and therefore higher bypass ratios to be achieved so the individual components can operate at their respective optimum speeds. As a result, the efficiency of the Geared Turbofan™ is greatly boosted. Therefore, fuel consumption as well as carbon dioxide and noise emissions are significantly reduced. The propulsion system is moreover lighter than a conventional engine owing to the reduced compressor and turbine stage count. In addition, the maintenance costs are lower.

Industrial gas turbines

The operating principle of an industrial gas turbine is essentially the same as that of an aero engine. However, instead of the customary low-pressure turbine used in aircraft, industrial gas turbines have a power turbine. This turbine delivers the power, either directly or via a gear unit, to an additional attached power unit such as a pump or generator. Nearly all industrial gas turbines of the lower and intermediate power classes are aero-engine derivatives.

MRO business

MRO stands for maintenance, repair and overhaul. At MTU, the term "MRO business" is also used more specifically to designate one of the company's operating segments, where it refers to maintenance services for commercial engines, or commercial MRO.

OEM business

OEM stands for original equipment manufacturer. At MTU, the term "OEM business" is used to designate one of the company's operating segments, where it refers to the development, manufacture and assembly of (new) commercial and military engines. Spare parts for (in-service) commercial and military engines and maintenance services for military engines are also included in this operating segment.

Risk- and revenue-sharing partnership

In a risk- and revenue-sharing partnership, each partner contributes a certain share of the resources needed for a specific engine program (work capacity and funding), thus bearing part of the risk. In return, each partner is entitled to a corresponding percentage of the overall sales revenue from that program.

Subsystem

A complete aircraft engine is made up of a number of subsystems. These include the high-pressure and low-pressure compressors, the combustor, the high-pressure and low-pressure turbines and the engine control system.

Thrust class

Jet engines are generally grouped into three thrust classes: engines with a thrust of between 2,500 and around 20,000 pounds (roughly 10 to 90 kN), mainly used to power business and regional jets; engines with a thrust of between 20,000 and approximately 50,000 pounds (roughly 90 to 225 kN), used to power medium-haul aircraft; and engines with a thrust ranging from 50,000 to over 100,000 pounds (roughly 225 to 450 kN), used to power long-haul aircraft.

Turbine

In a turbine, the energy contained in the gases emerging from the combustor is converted into mechanical energy. Like the compressor, the turbine is subdivided into a high-pressure and a low-pressure section, each of which is directly connected to the corresponding compressor via the respective shaft. The turbine has to withstand much higher stresses than the compressor, as it has to deal not only with the high gas temperatures but also with extreme centrifugal forces of several tons acting on the outer rim of its disks.

Turbine center frame

The turbine center frame connects the high-pressure to the low-pressure turbine. It has to be able to withstand high mechanical and thermal loads. The center frame includes struts, clad with an aerodynamic fairing, to support the shaft bearings and the air and oil supply lines.

Turbofan engine

The turbofan is an advancement of the turbojet principle, the main difference being its enlarged first compressor stage, the fan. While in turbojet engines all of the ingested air flows consecutively through the compressor, the combustor and the turbine, turbofans separate the air stream behind the fan. Part of the air flows through further compressor stages to the combustor and then the turbine, flowing through the core engine. The rest, however – which constitutes a much larger fraction – is channeled around the inner components, providing the engine's main thrust. The ratio between these two airflows is known as the bypass ratio. The greater the bypass ratio, the more economical, environmentally compatible and silent the engine.

Turboprop engine

The most noticeable external feature of a turboprop is its propeller. Inside, however, the engine differs only slightly from the turbojet and the turbofan. The turbine is larger and drives not only the compressor but also the propeller, the latter via a gear unit. Consequently, more energy has to be drawn from the exhaust gas stream in the turbine of a turboprop than in other engine types. Over 90% of the energy is required for the compressor and the propeller. Turboprop airplanes can achieve flight speeds of up to 800 km/h. They are thus slower than turbojet or turbofan airplanes, but they do have the advantage of consuming far less fuel. This predestines them for use in roles where speed is less important, such as on short-haul routes or for air freight.

Turboshaft engine

Turboshaft engines are used in helicopters and are similar to turboprops.

Overview of engines

Commercial engines

Long-haul aircraft

CF6	Airbus A300, A310, A330, Boeing 747, 767, DC-10, MD-11, KC-10
GE90-110B/-115B*	Boeing 777-200LR, 777-200F, 777-300ER
GE9X	Boeing 777X
GEnx	Boeing 787, 747-8
GP7000	Airbus A380
PW4000Growth	Boeing 777

Short- and medium-haul aircraft

CF34*	Business and regional jets
CFM56*	Boeing 737, Airbus A318-A321
JT8D-200	Boeing MD-80
GTF engines	Airbus A320neo, A220, Mitsubishi SpaceJet, Embraer E-Jets Gen 2, Irkut MC-21
PW2000	Boeing 757, C-17
PW6000	Airbus A318
V2500	Airbus A319, A320, A321, Boeing MD-90, Embraer KC-390, C-390 Millennium

Business jets

PT6A*	Business and utility aircraft
PW100/150A**	ATR42, 72, Fokker 50, Bombardier Q400
JT15D**	Cessna Citation I/II/V/Ultra, Beechjet 400
PW300	Medium-weight business and regional jets
PW500	Light and medium-weight business jets
PW600**	Cessna Mustang, Eclipse 500, Embraer Phenom 100
PW800	Gulfstream G500, G600, Dassault Falcon 6X

Helicopters

PT6B/-C/-T**	AgustaWestland 119, 139, Airbus Helicopters H175
PW200/PW210*	Light- to medium-weight helicopters

* MRO only.

** MRO only; via Pratt & Whitney Canada Customer Service Centre Europe GmbH.

Military engines

Fighter jets

EJ200	Eurofighter
F110	Lockheed Martin F-16, Boeing F-15
F414	Boeing F/A-18E/F Super Hornet, Boeing EA-18G Growler, Saab Gripen Next Generation
Larzac 04	Dornier-Dassault Alpha Jet
RB199	Panavia Tornado

Helicopters

T408	Sikorsky CH-53K
MTR390/MTR390 Enhanced	Airbus Helicopters Tiger
T64	Sikorsky CH-53G, GS, GA, GE

Transporters

TP400-D6	Airbus A400M
Tyne	Transall C-160, Breguet Atlantic

Industrial gas turbines

ASE8/40/50, TF40/50, ETF40	Power generators, power systems for ships, mechanical power systems, generator sets
LM2500/LM2500+	Power generators, mechanical power systems, oil and gas industry, power systems for ships
LM5000	Power generators, mechanical power systems, oil and gas industry
LM6000/LM6000-PF+	Power generators

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Financial calendar

April 30, 2020	Quarterly Statement as of March 31, 2020 Conference calls with journalists, analysts and investors
July 30, 2020	Interim Report as of June 30, 2020 Conference calls with journalists, analysts and investors
October 29, 2020	Quarterly Statement as of September 30, 2020 Conference calls with journalists, analysts and investors
November 19, 2020	MTU Investor and Analyst Day

The date for the next Annual General Meeting had not yet been finalized at the time this report was printed in March 2020. It will be announced as soon as possible.

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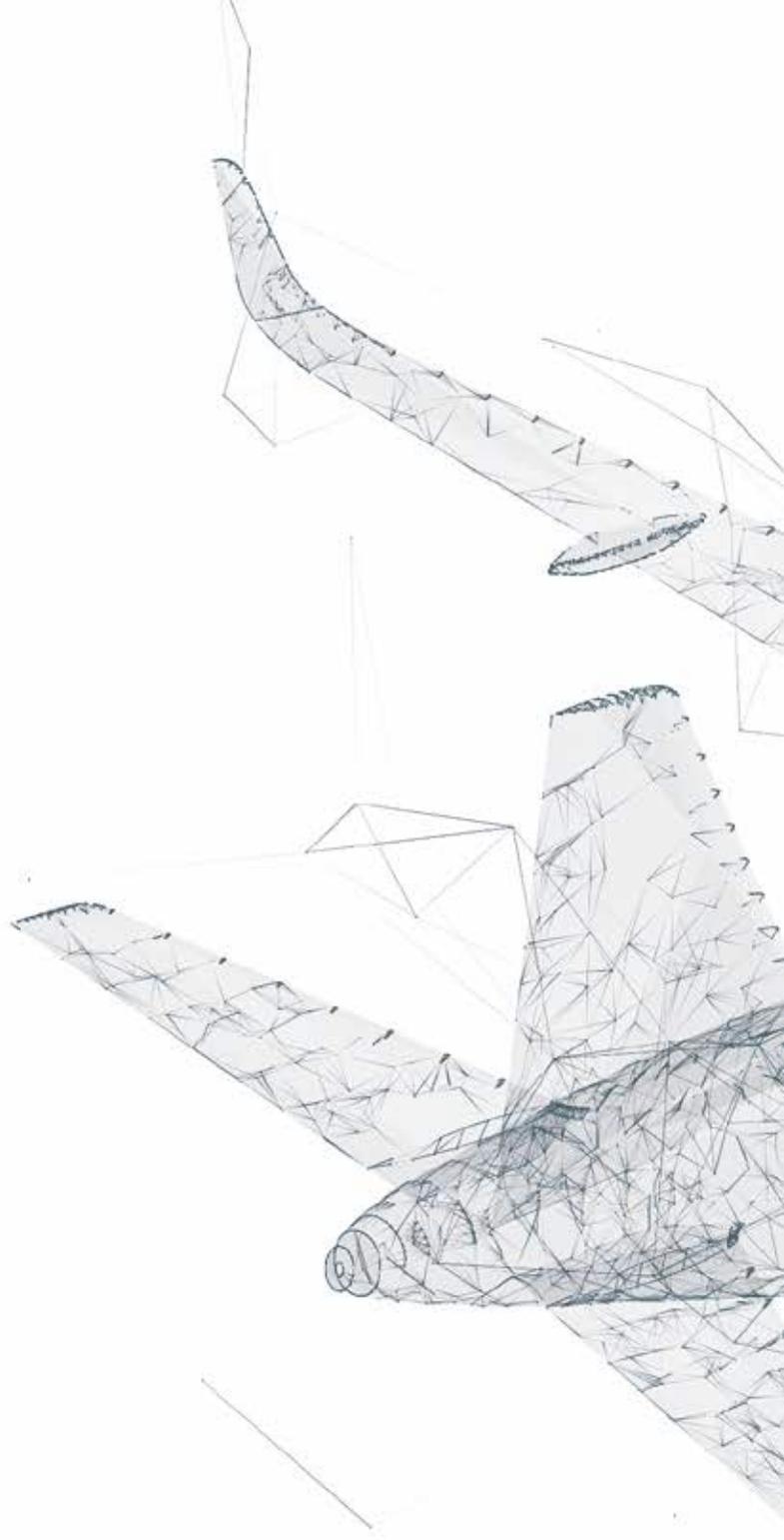
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