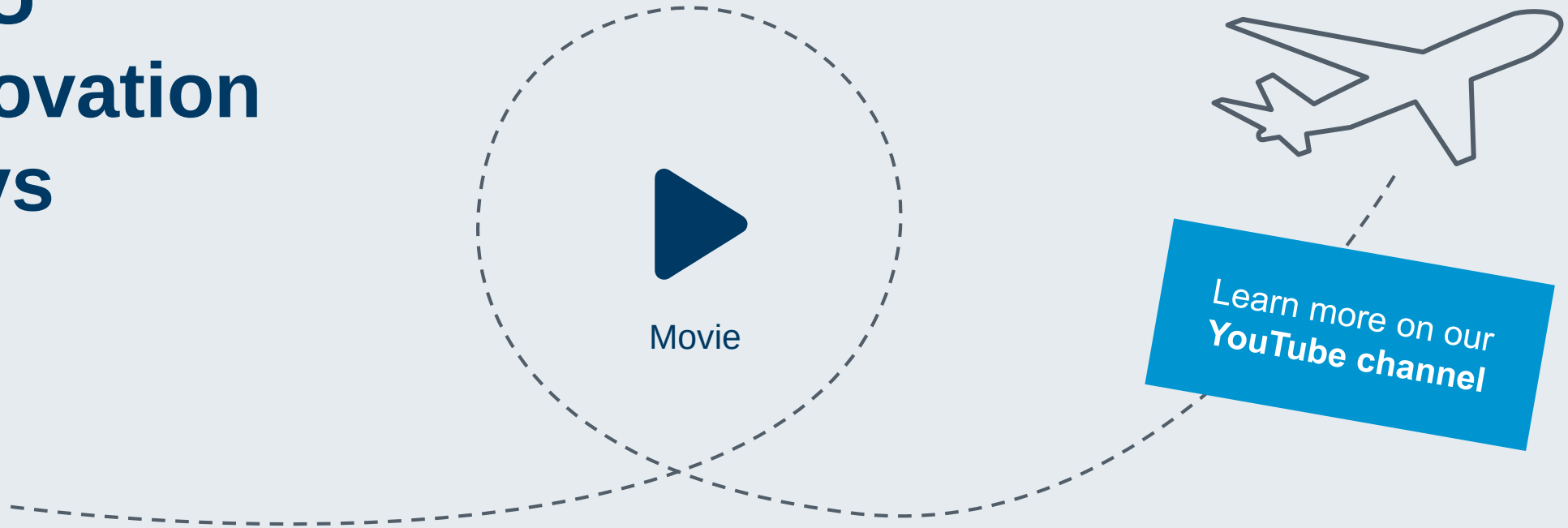
Investor & Analyst Day 2018

London, 30th November 2018 – MTU Aero Engines AG

MTU Innovation Days



Agenda – MTU Investor & Analyst Day 2018

Time	Event	Speaker
11:00 – 11:10	Welcome	**Michael Röger**, VP Investor Relations
11:10 – 11:30	MTU´s Market Environment	**Reiner Winkler**, Chief Executive Officer
11:30 – 12:30	Commercial OEM | Military OEM | Commercial MRO Q & A	**Michael Schreyögg**, Chief Program Officer
12:30 – 13:30	**Lunch**	
13:30 – 14:15	Status Execution | Smart Factory | Technology Roadmap Q & A	**Lars Wagner**, Chief Operating Officer
14:15 – 15:00	Future presentation OEM-MRO | Guidance 2019 | Long-term outlook Q & A	**Peter Kameritsch**, Chief Financial Officer
15:00 – 15:30	Outlook | Summary Q & A	**Reiner Winkler**, Chief Executive Officer

MTU´s market environment – Ongoing growth backed by normalizing market indicators

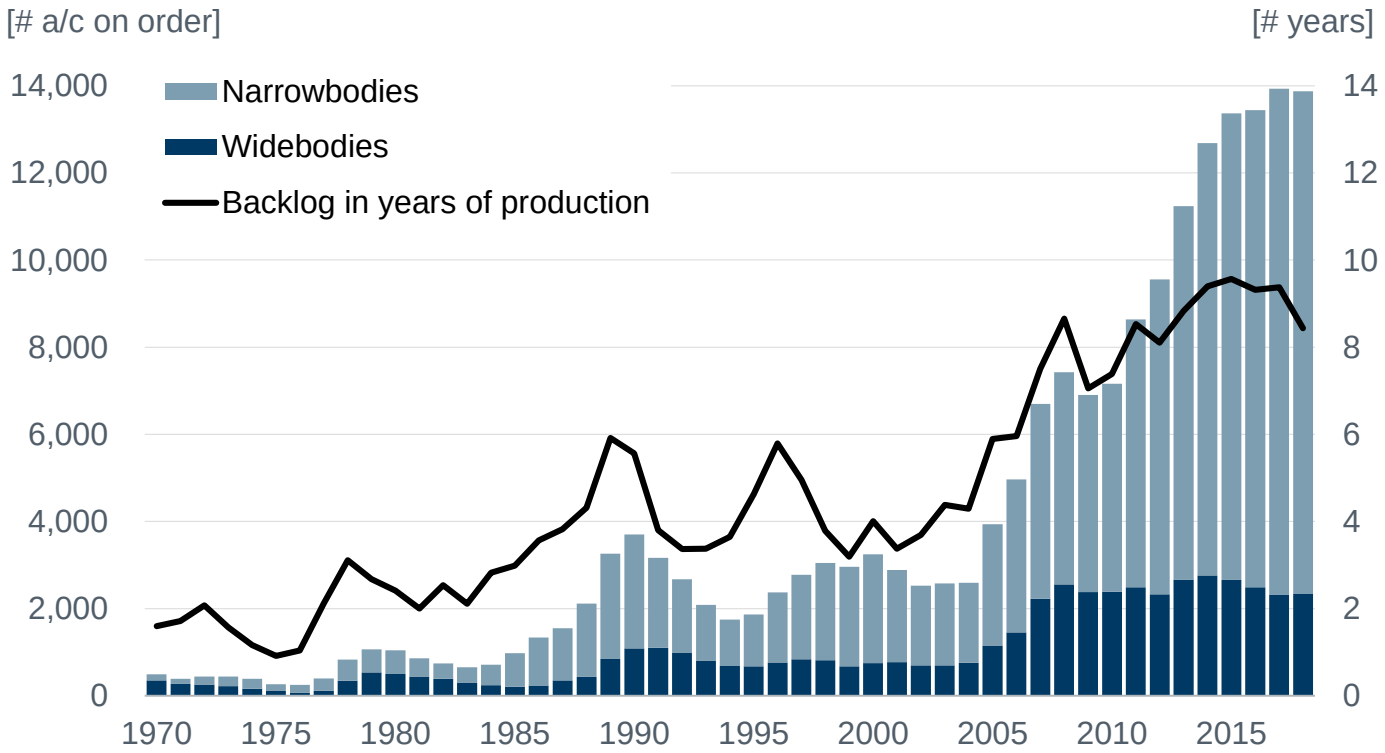
Reiner Winkler, Chief Executive Officer

Positive environment for aerospace despite rising oil price

	Demand indicators	~ 2000	~ 2010	Today	Influence on demand
1	**Backlog**	4 yrs	8 yrs	8 yrs	Backlog has stabilized at 13,900 a/c since 2017 Production growing
2	**Technology status**	'90s	'90s	'10s	Proven step change in efficiency achieved
3	**Cost of debt**	High	Mid	Low	Attractiveness of aircraft as investment remains intact
4	**Oil**	30 $/b	100 $/b	70 $/b	Increase driven by geopolitics/security but shale oil becomes competitive again

Backlog remains at historic high level, represents 8 years of production

Growing production is stabilizing backlog and turning it into deliveries

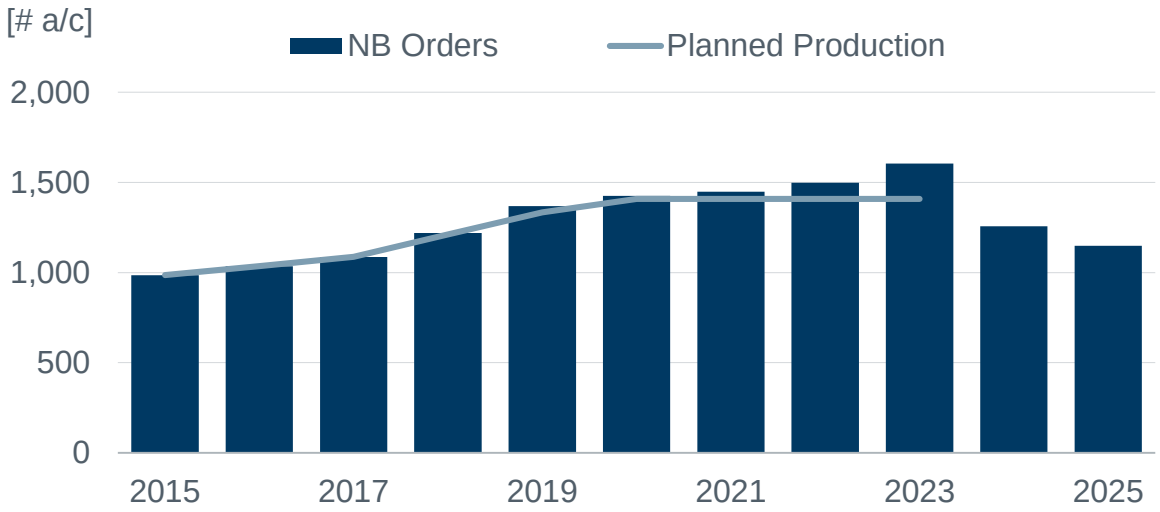


- Recent cancellation and deferral data remain negligible as a share of backlog
- **1,442** aircraft ordered in the first 9m 2018
- **+11%** production in 2018 y-o-y is stabilizing backlog and turning it into deliveries

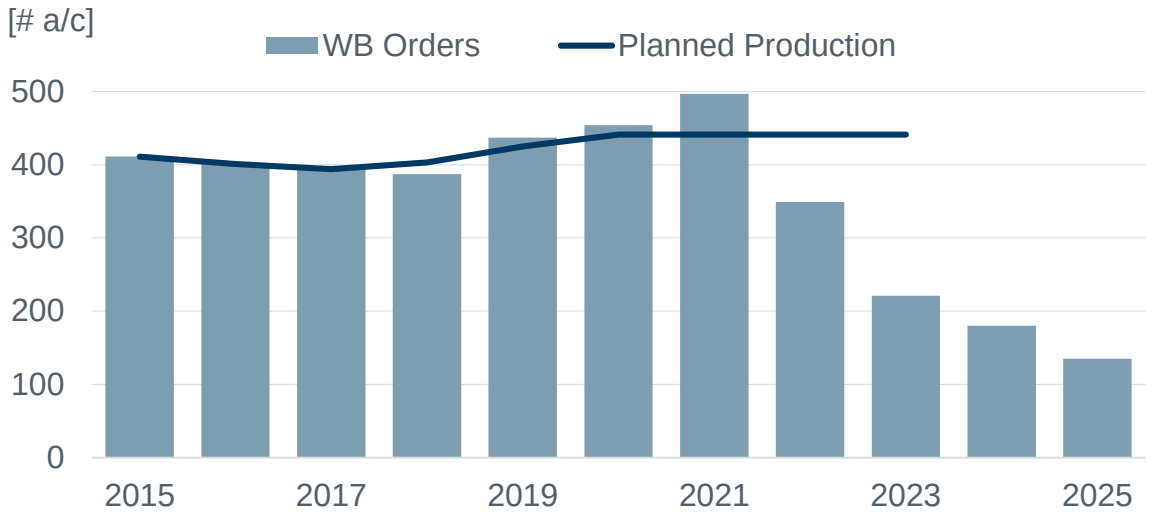
Source: Fleet Analyzer, western-built narrowbody and widebody airframes only (no RJ and TP), excludes LoIs, gross orders shown

Production plans under review for increase

Backlog distribution vs. production plans



- Narrowbody backlog equates to 10 years of production alone
- With currently planned rate 63, the A320neo is overbooked in 2020-25
- Airbus is examining rate 70, supply chain readiness is key



- Widebody backlog equates to 6 years in production
- Backlog justifies upcoming rate hikes in 2019-20
- Production of the 787 and 767 Freighter set to rise with 777X beginning ramp-up

Source: Ascend firm orders and LoIs as of 30.09.2018, OEM announced production rates, Airbus and Boeing aircraft only

GTF technology offering a step change in fuel efficiency

US$ 150 billion of kerosene to be saved alone by PW1100G-JM

Fuel savings GTF fleet to date

- 290+ GTF powered aircraft
- Airline operating costs lowered by US$ 140 million

260 million litres
of fuel saved

- 20,000 GTF deliveries expected in total
- 16% fuel burn advantage over V2500
- PW1100G-JM has the lowest fuel burn among single-aisle powerplants
- US$ 10 increase in Brent means US$ 100,000 savings per year over A320ceo

Total expected fuel savings PW1100G-JM fleet alone

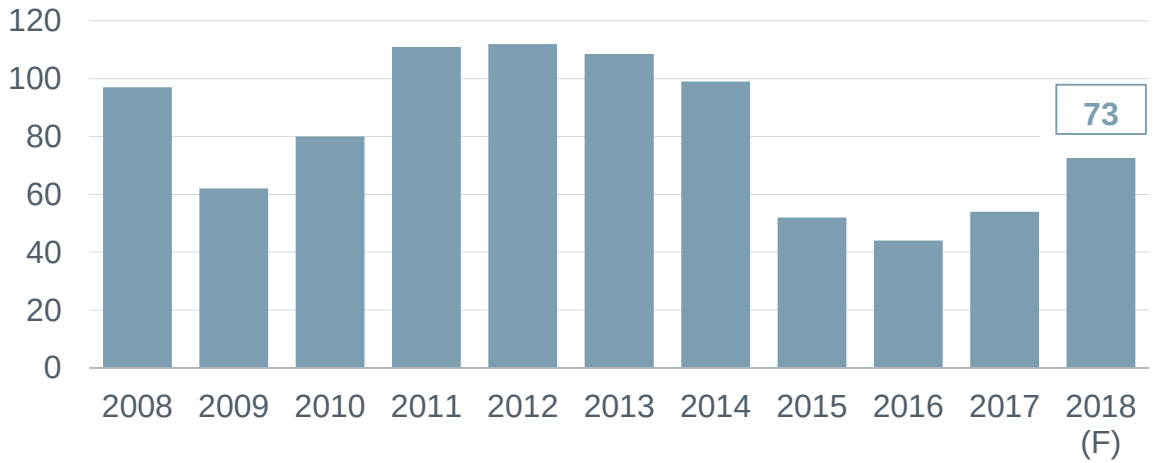
- Lower airline operating costs of US$ 150 billion expected

300 billion litres
less fuel expected

Latest rise in oil prices too recent to have a material impact on aftermarket

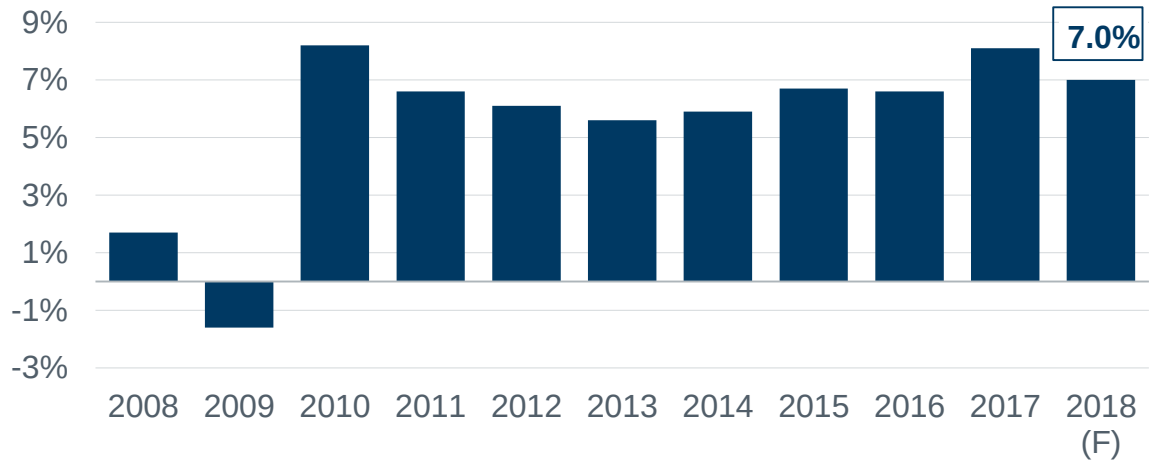
Strong traffic demand continues to stimulate usage of both mature and newer MTU engines

Crude oil price
[US Dollars per Barrel (Brent)]



- Recent increase driven by supply factors (geopolitics, OPEC/Russia efforts to limit production and re-instatement of sanctions against Iran)
- US shale oil and slowing global demand growth should help limit further price increases

Passenger traffic growth
[Growth rate in %]



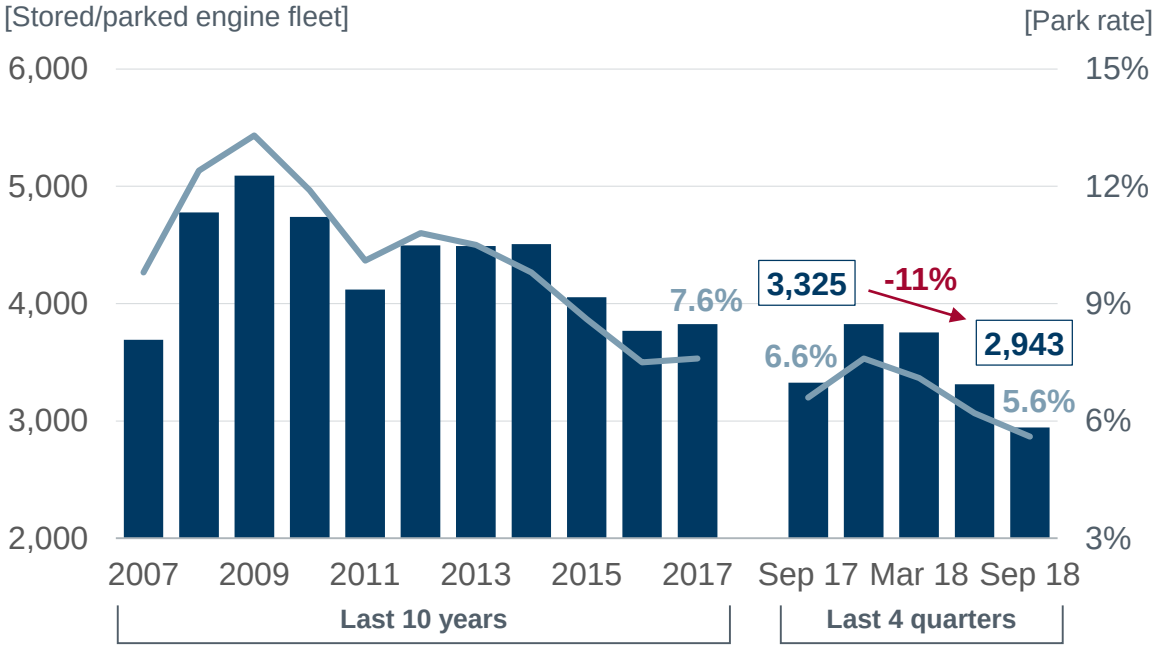
- Traffic demand continued to be supported by strong economic activity, Asia and low airfares

Source: IATA, Boeing, US Energy Information Administration (EIA)

Strong traffic growth has led to a continuing decline in parked and retired engines

Industry parked fleet

[Stored/parked engine fleet]

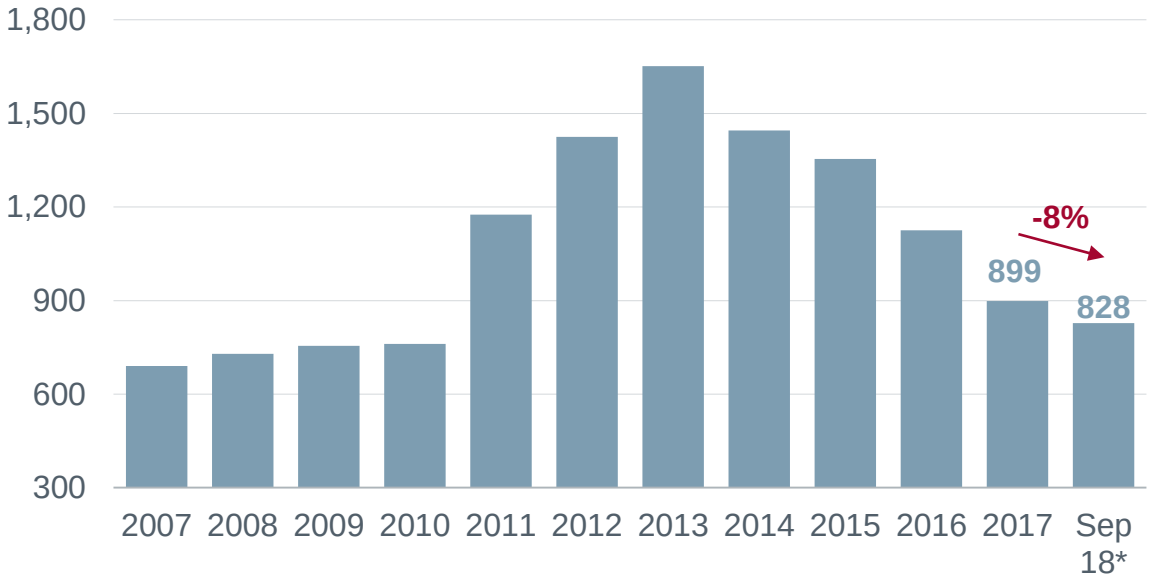


- Industry park rate at a record low level not seen since the 1990s

Source: Fleet Analyzer 1) % of total fleet (active+stored/parked)

Industry retirements

[Retired engines]



- MTU retirements on a similarly strong downward trend

Source: Fleet Analyzer, based on aircraft retirements (installed engines), does not cover spare engine retirements
* Last 12 months (Sep 17 to Sep 18)

Global geopolitics and imbalances in the global economy send some negative signals

Mitigation especially through MTU´s fleet and backlog

Trade barriers

IATA sees minimal impact from tariffs on the industry but warns against escalation

Brexit mitigation under way at MTU

US$ strength vs. emerging markets currencies

Diversified MTU fleet: affected countries representing 4% of MTU fleet and orders only

Traffic outlook into 2019 remains positive

Rising US interest rates

Historically interest rates still on a low level

Intact investors' appetite for financing new a/c

Higher oil price (US$ ~70)

Key MTU engines lead in fuel efficiency

Higher fuel prices support MTU backlog

Some programs show positive correlation (PW800)

Higher growth expectations in all business units

Michael Schreyögg, Chief Program Officer

Additional thrust for our business segments: Growth topics per business unit

Commercial Programs

Freight
Recovery
Growing spare parts business
V2500 CF6-80 PW2000
Rate70
C-Series
becomes
Falcon 6X
GEnx
Rising Market Share
A220
Gen2 GTF

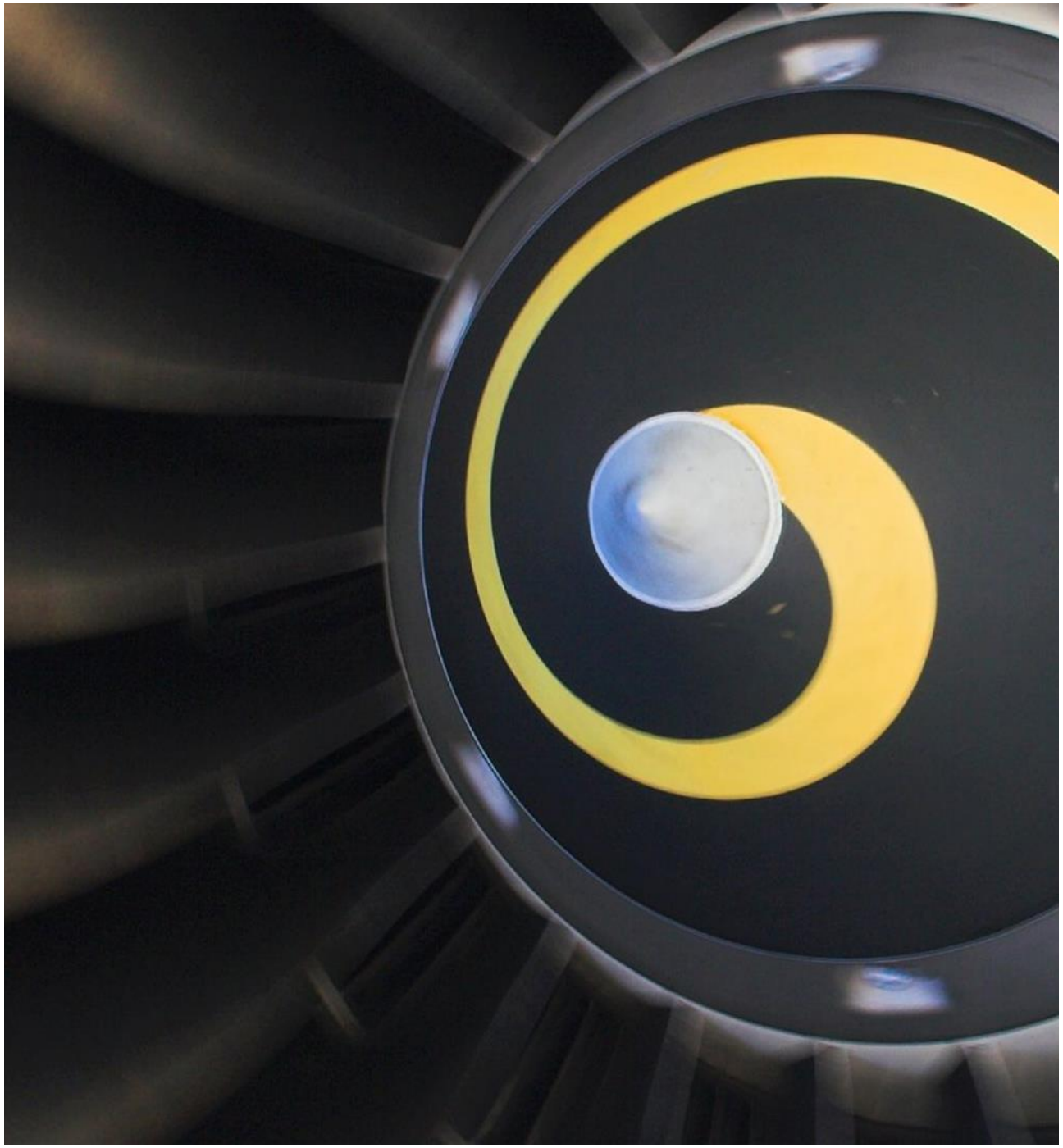
Military Programs

National & International Opportunities
Next European Fighter Engine
Technology
Tornado Replacement
Euro fighter
Fighter **Aircraft**

Commercial MRO

PW1100G-JM LEAP@TZ
Capacity Expansion
New Programs
Services
Lease
Business
strong demand meets consolidated market
Partnership development
Overproportional revenue growth
EME
AERO

Commercial OEM in the sweet-spot for organic growth



New Falcon 6X application strengthens MTU's position in the heavy business jet segment

New PW812D powers Falcon 6X

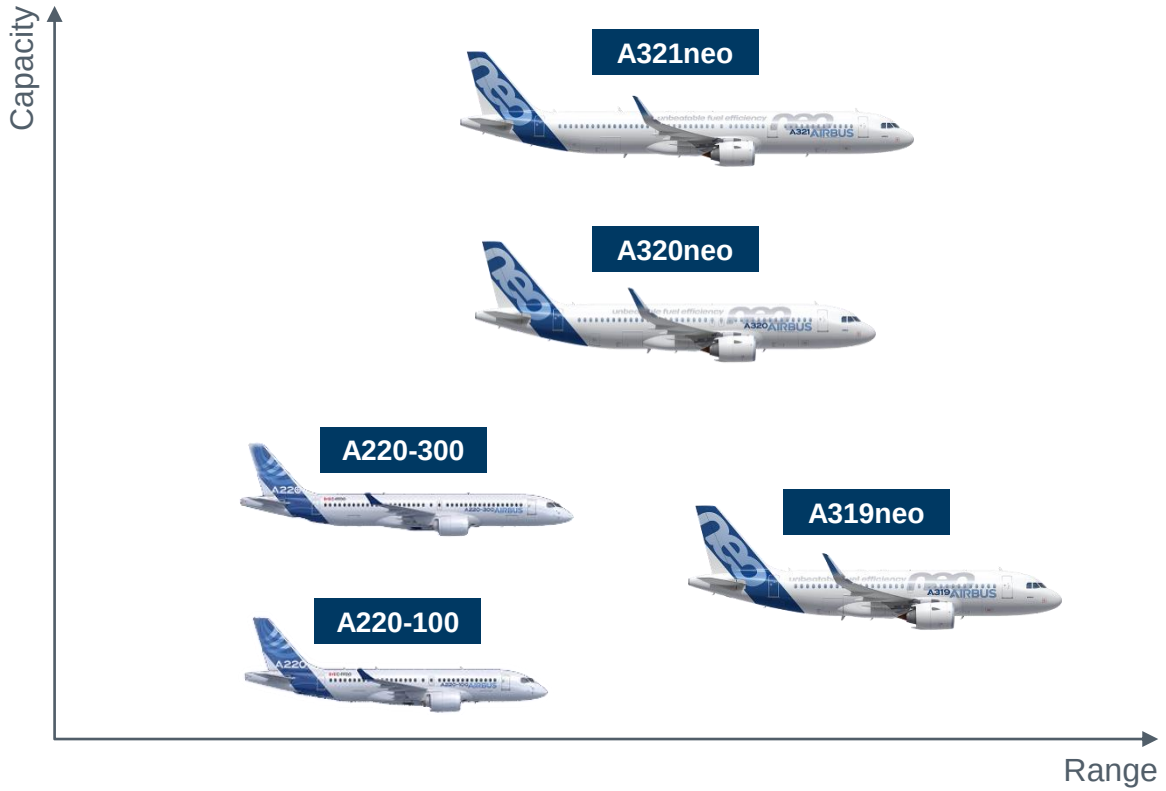
Maximum Operating Speed	Mach 0,90
Range	~ 5,500 nm
Number of passengers	Up to 16
EIS	2022

Business Jet engine outlook

- High value heavy business jet segment
- Positive EBIT contribution from series with full MRO participation for MTU
- New Falcon 6X complements PW800 position following G500 and G600
- Common core with regional GTF
- MTU secured 15% program share incl. MRO
- Revenues from MTU business jet programs roughly triple over 10 years (2015ff)

Airbus takeover of CSeries spurs the PW1500G program

A220 complementing Airbus single-aisle portfolio

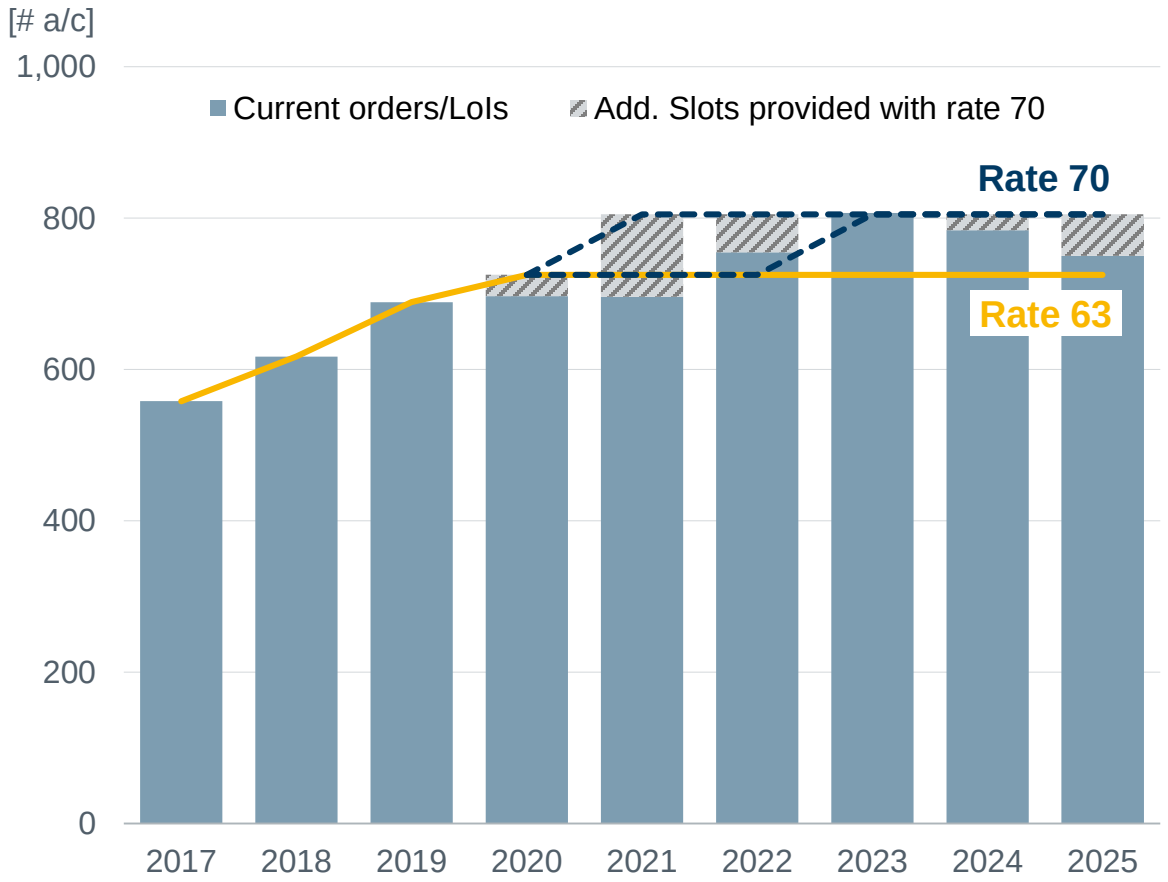


PW1500G outlook

- A220 brings superior economics and efficiency
- Delivery outlook clearly improves thanks to Airbus financial strength and global customer reach
- PW1500G exclusively powers the A220
- Anticipated future production capacity to increase by factor 5 compared to 2018
- A220 has growth potential beyond 130-seat

Rate 70 makes sense and requires a 10% production increase for large GTFs at MTU

A320 family orders vs. production scenarios



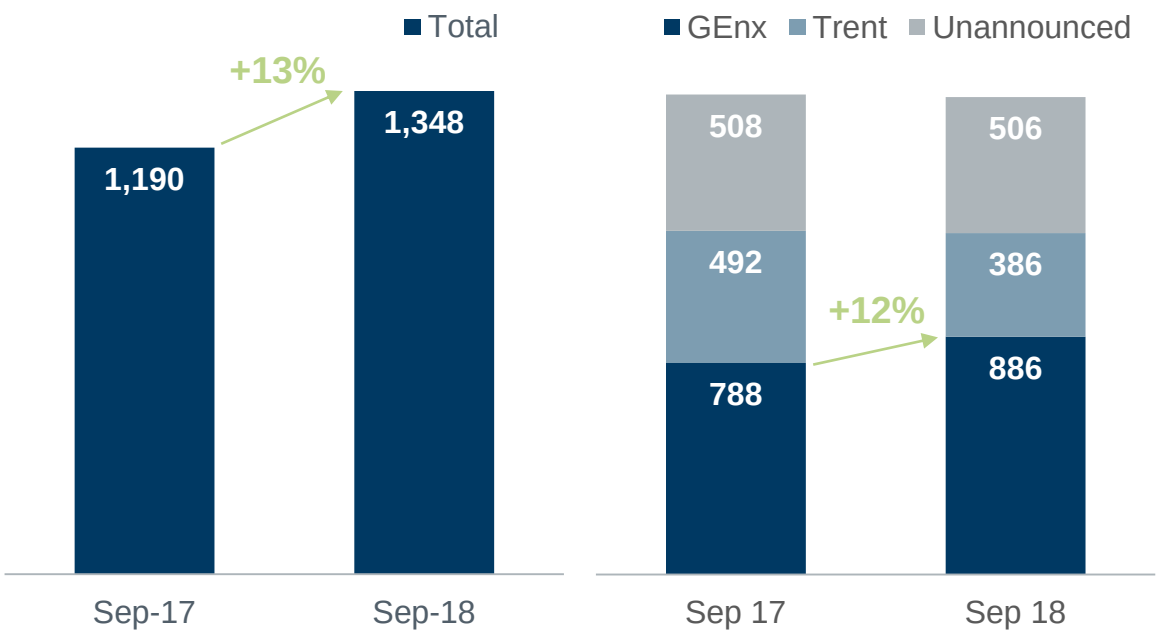
Source: Fleetanalyzer firm orders and LoIs as of Sept. 2018, announced Airbus production plans

PW1100G-JM outlook

- A320 family backlog stands at 6,600 firm orders & LoIs as of September (10 years of production)
- Rationale for Rate 70:
  - Today Airbus is overbooked for 2022-2025
  - A321neo LR and a possible future XLR have the potential to stimulate demand further
- Supply chain readiness is however a pre-requisite

Latest MTU widebody platform GEnx with growing market share

Growing GEnx installed base and orders



GEnx in-service fleet (787 and 747-8)

GEnx backlog (787)

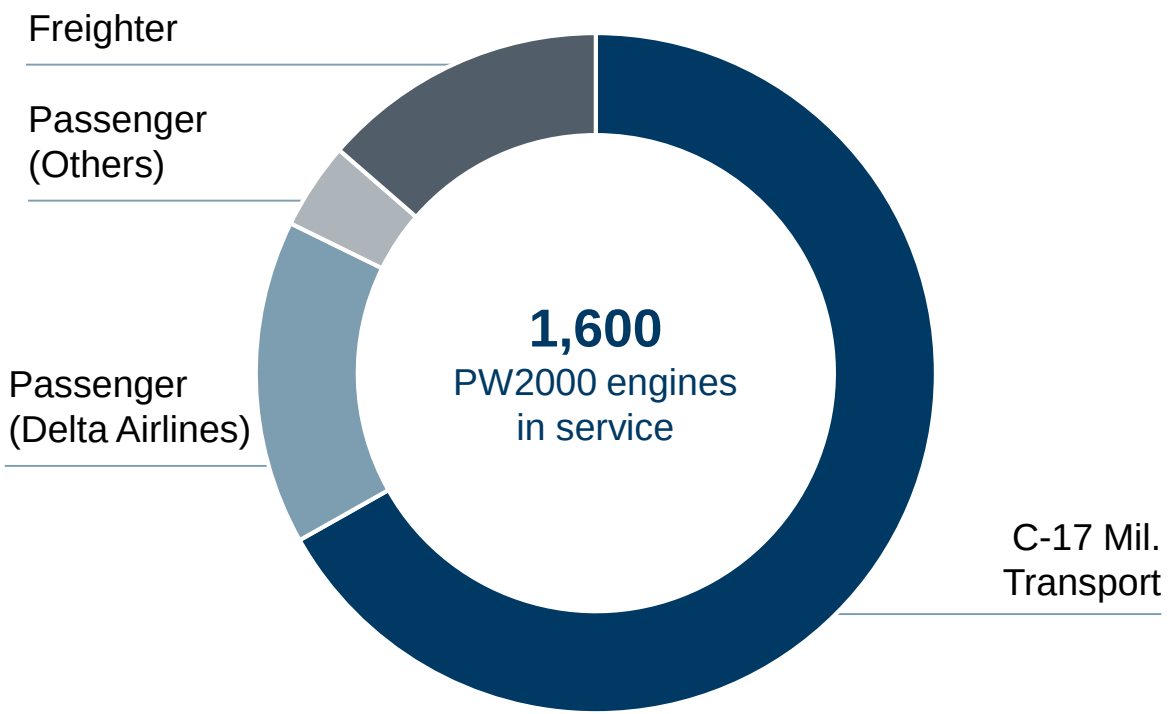
Source: Fleetanalyzer fleet, firm orders and LoIs as of Sept. 2018

GEnx outlook

- 4th largest MTU commercial fleet following V2500, CF6-80 and PW2000
- Fast-growing installed base reaching over 1,300 engines
- Stable 787 backlog representing 5 years of production
- LTM 85% order intake for 787 as of September 2018 resulting in 70% market share of backlog

High visibility of PW2000 aftermarket

PW2000 fleet by usage

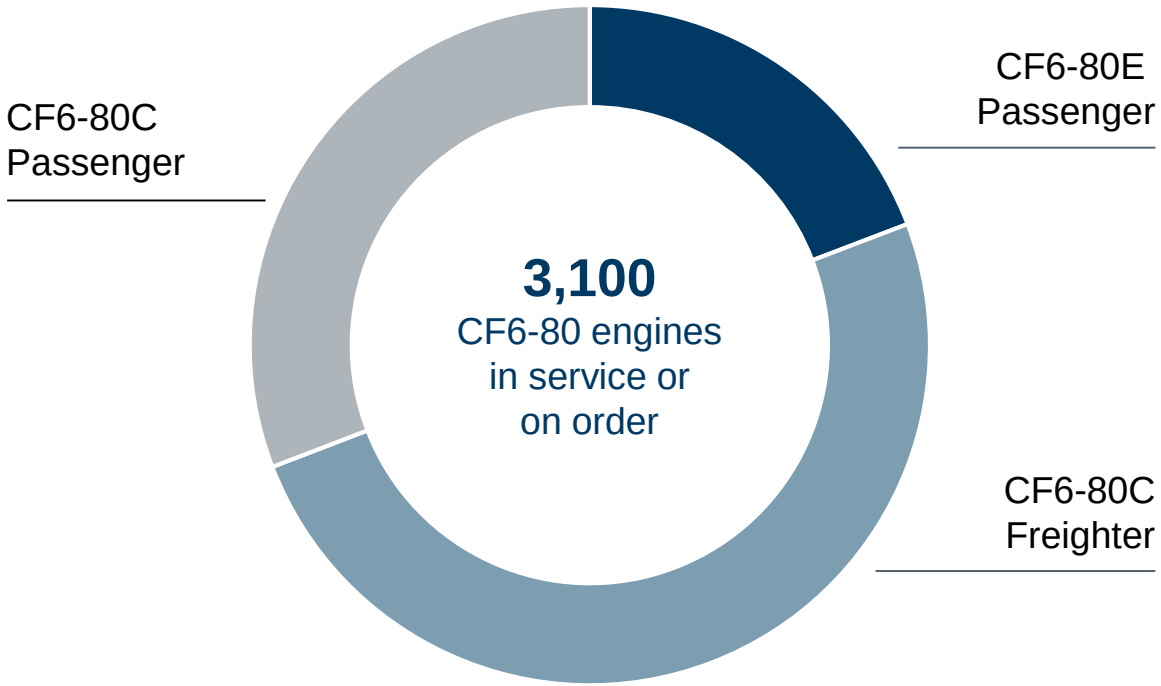


Highlights

- Younger C-17 application accounts for 2/3 of total fleet
- 200 engines are under the wing of the 757 freighter with FedEx and UPS.
- 300 engines continue to remain in 757 passenger service, the majority of which with Delta
- Delta´s interest in NMA indicates its readiness to keep the 757 flying well into the next decade

The last few years of strong passenger and freight traffic have led to a stabilization of the CF6-80 fleet, boosting spare parts demand

CF6-80C/E fleet by usage

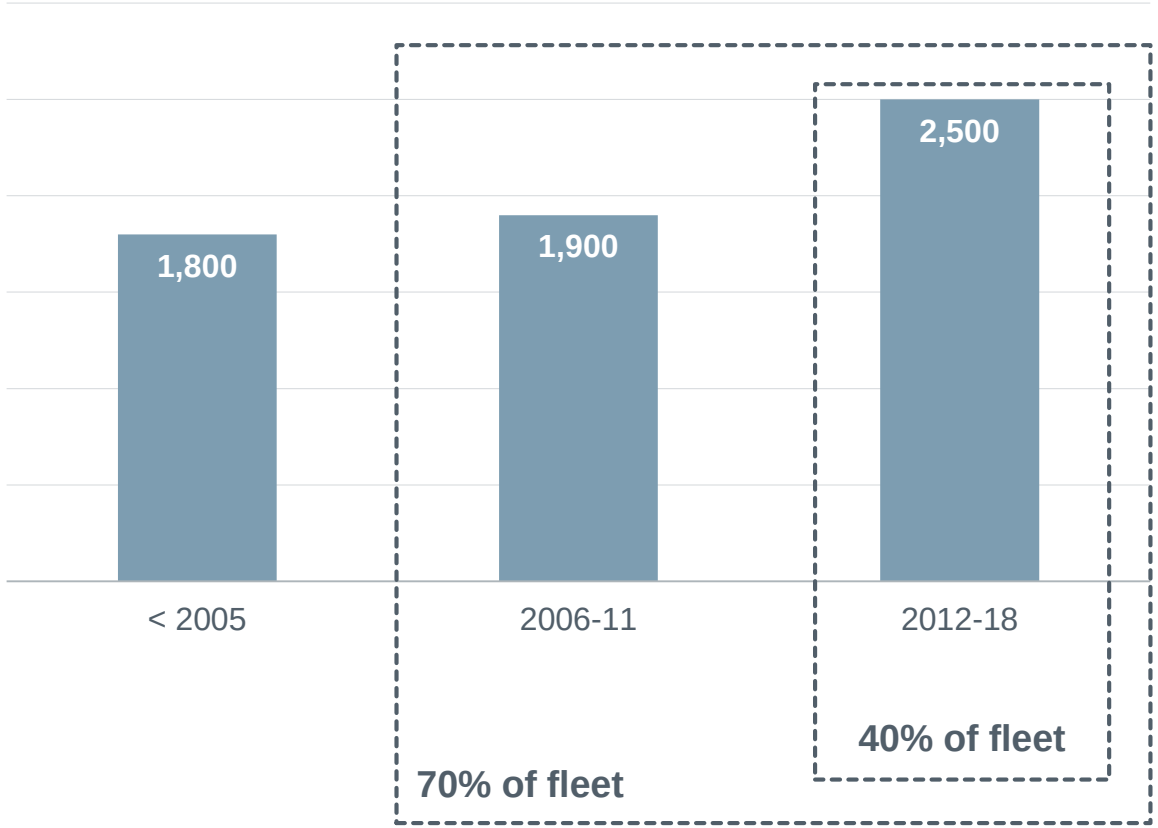


Highlights

- CF6-80 fleet has grown in spite of its maturity
- Used serviceable material is scarce, driving healthy demand for HPT blades and vanes at MTU
- Freighter aircraft remain in general 5 to 10 years longer in service than their passenger equivalent
- 1,600 CF6-80C engines in freighter, military or executive service
- 767-300 freighter version new production and conversions of passenger 767 are currently accelerating to meet the growth of e-commerce
- CF6-80E represents a young fleet

Rising maintenance events and growth in SV content drives V2500 aftermarket growth

V2500 fleet by year of delivery



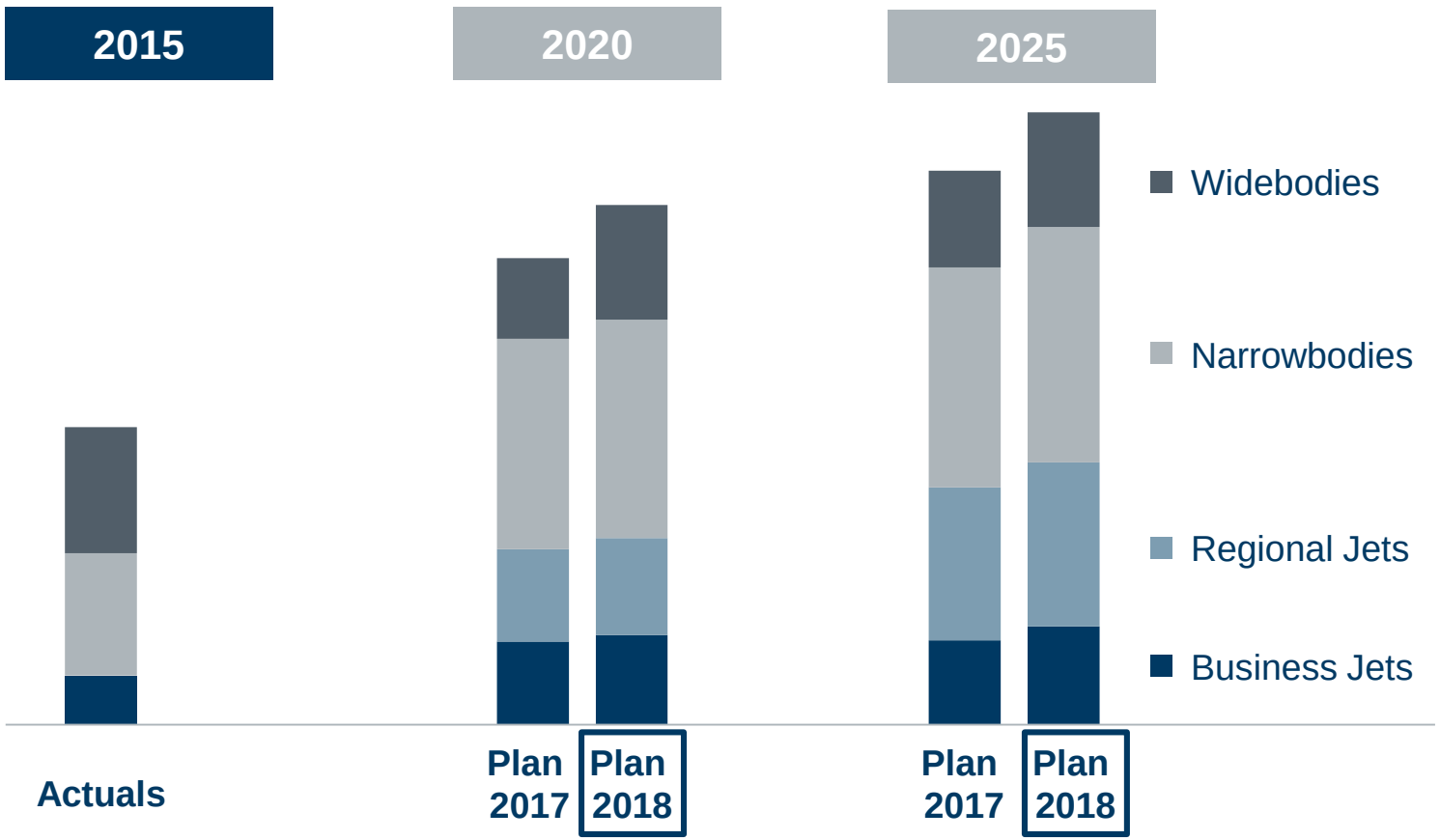
Source: Flightglobal, MTU

Growing share of heavy shop visits

- The gradual ageing of the V2500 fleet is pushing an ever increasing number of engines towards the 1st and 2nd shop visits
- 40% of the fleet have not had their first regular shop visit (performance restoration)
- 70% of the fleet have not had the first heavy shop visit requiring replacement of life limited parts
- On average, a heavy shop visit generates 2 to 3 times the spare parts revenue of a performance restoration

MTU is facing stronger growth in series than planned last year in all market segments

MTU engine delivery schedule



Comments

- PW800's position has strengthened with a new application
- Airbus majority stake in CSeries partnership is securing the future of the PW1500G program, with higher production rates likely
- MTU needs to get ready to produce around 900 large GTFs p.a. to meet Airbus rate 70
- 787 rate hike, improved GEnx market share and the upcoming GE9X ramp-up will lead to fast growing TCF deliveries

Military Business with Attractive Growth Opportunities

Over 11,500 military engines with MTU components are flown worldwide

MTU‘s worldwide footprint in Military Business

Fighter:
~ 8,170 engines

Transport:
~ 2,170 engines

Helicopter:
~ 1,200 engines

North America / Canada
Fighter: ~3,500
Transport: ~910
Helicopter: ~630

Europe
Fighter: ~2,190
Transport: ~920
Helicopter: ~520

Middle East
Fighter: ~1,360
Transport: ~ 140

Asia Pacific
Fighter: ~760
Transport: ~90
Helicopter: ~40

Latin America
Fighter: ~50
Transport: ~100

Africa
Fighter: ~330

MTU is well positioned in the international military aircraft market

Fighter

- 140 Eurofighters and 85 Tornados in service in Germany
- Eurofighter with attractive export potential
- Increasing aftermarket for EJ200
- Germany phase out of Tornado from 2025 onwards

Transport

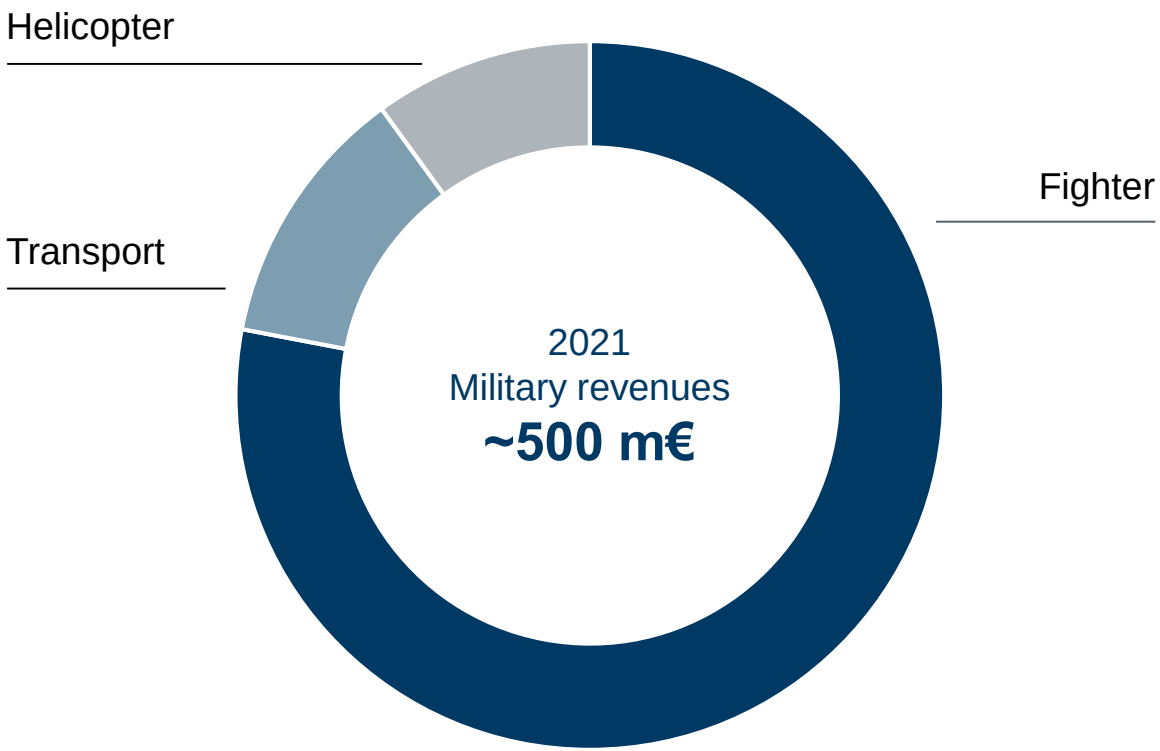
- 170 A400M ordered, thereof 67 delivered
- A400M well positioned for export
- Potential cooperation between Boeing and Embraer on KC-390 (equipped with V2500) could strengthen order activity

Helicopter

- 181 Eurocopter Tiger delivered
- CH53-K entry into service on track for 2019 and excellent positioned for export

Revenue contribution from Fighters by far most important

MTU Military revenue split (2021)



Highlights

- Revenue share increase from ~70% today to ~80% by 2021
- Growing customer base secures Eurofighter aftermarket business
- Fighter export campaigns with high potential
- Eurofighter with high potential to replace Eurofighter Tranche 1 and later Germany's Tornado fleet
- Future German/French combat aircraft enables access to customer funded technology development

MTU wants to participate in the New European Fighter Aircraft

Highlights

- Successor for Eurofighter / Rafale
- Airbus and Dassault collaborate as Airframe OEM
- First prototype expected by ~2031
- Entry into service expected by ~2040
- Roughly 1,100 engines (incl. spares) expected

MTU and Safran target joint development for the Next European Fighter Engine (NEFE)

Cooperation with Safran could secure strong MTU role within NEFE project

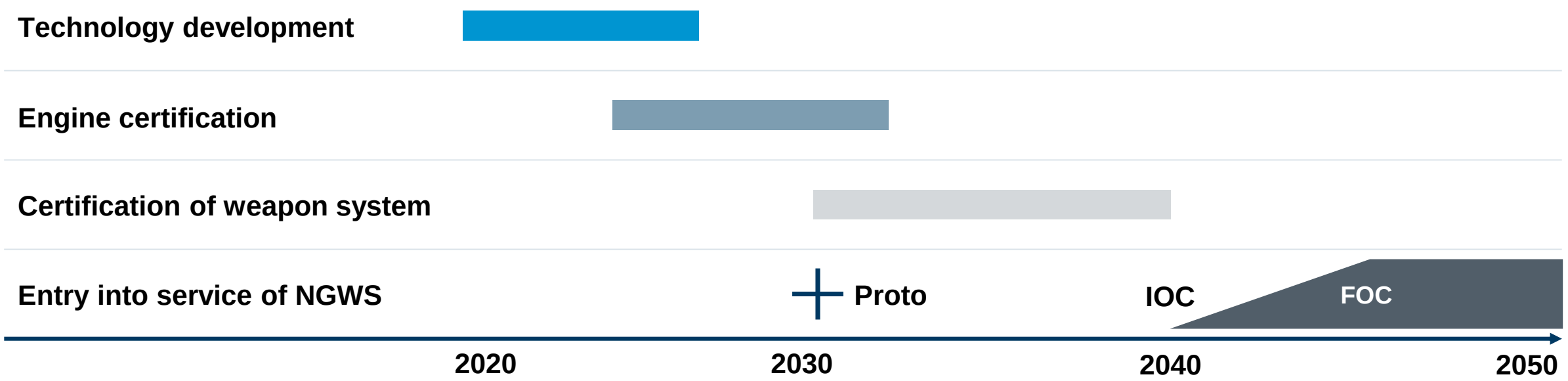
From left to right: Florence Parly (French MoD), Michael Schreyögg (Chief Progam Officer MTU), Olivier Andriès (CEO Safran Aircraft Engines), Reiner Winkler (CEO MTU), Ursula von der Leyen (German MoD)

MTU objectives

- MTU as German engine partner
- Clear division of responsibilities and a partnership at eye level
- Achievement of 50% workshare with focus on MTU key competencies
- Customer financed development

Early start of technology development secures entry into service of New European Fighter Aircraft by 2040

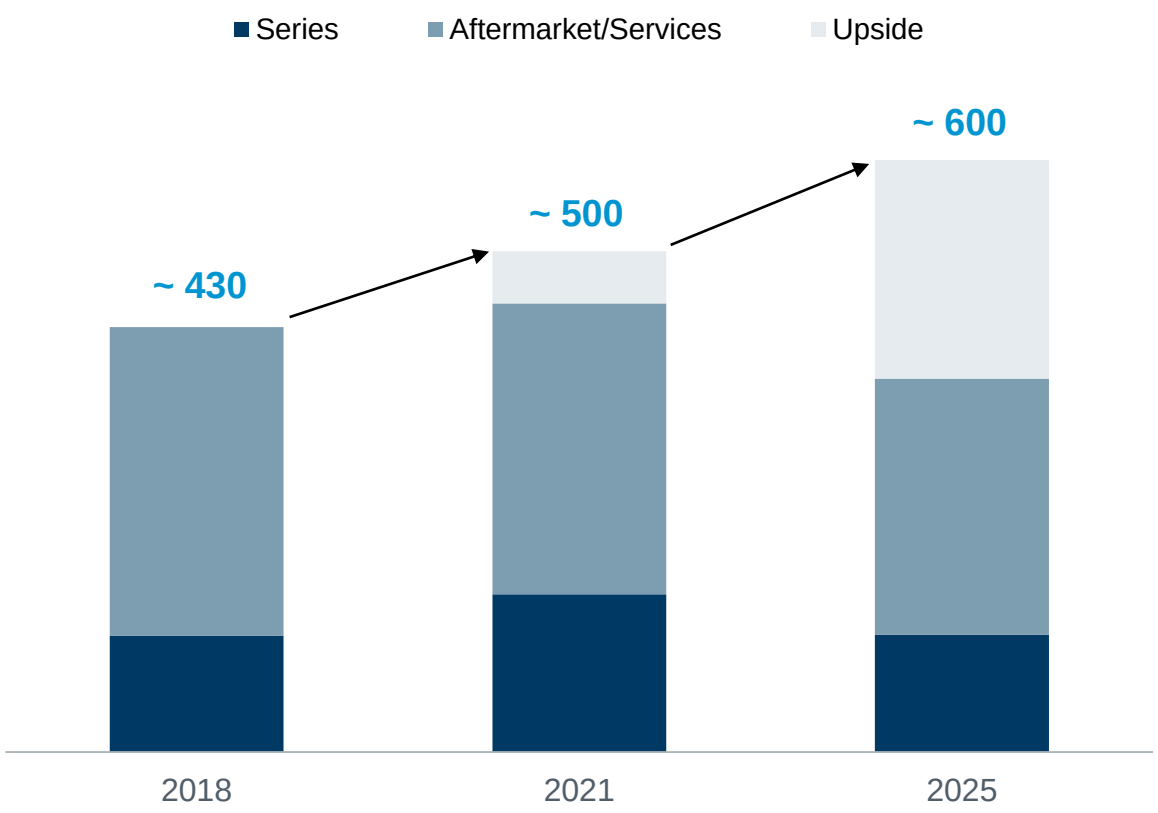
Timetable of the New European Fighter Aircraft project



IOC: Initial Operational Clearance
FOC: Full Operational Clearance

Improved sentiment in the military business leads to an annual expected growth rate of ~ mid single digit

MTU Military revenue outlook 2018 to 2025 (in m€)

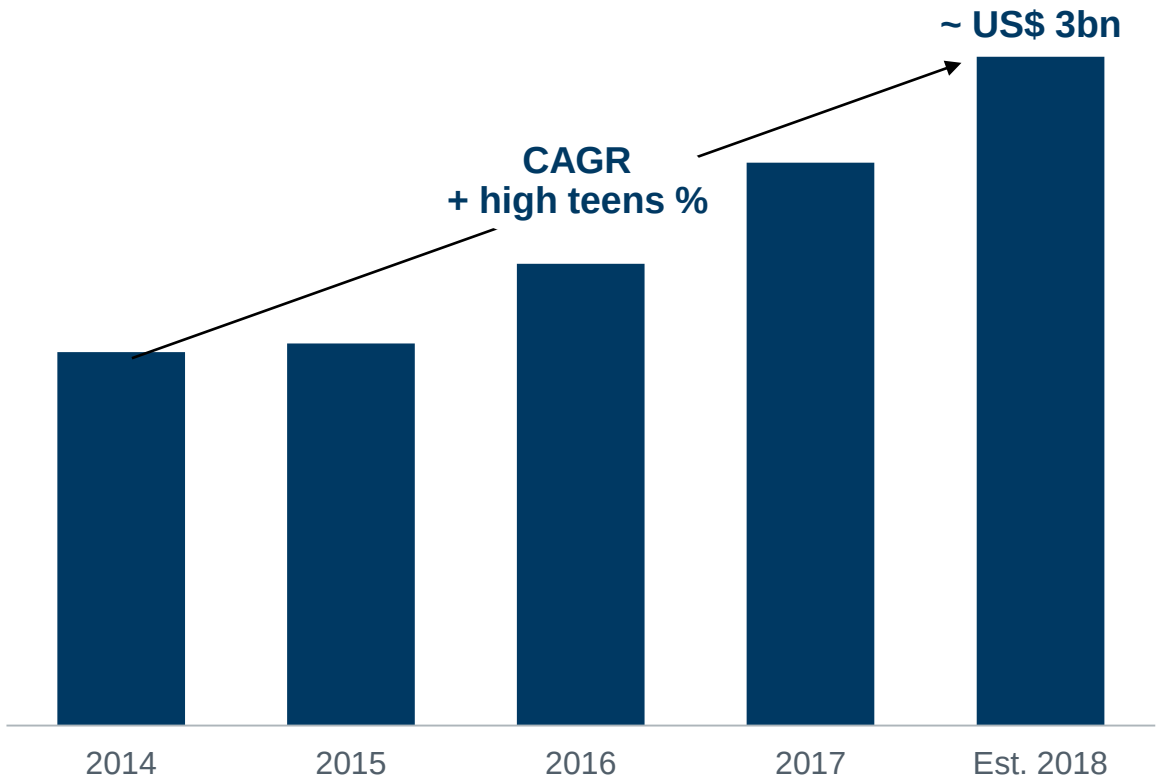


Highlights

- Fighter engines remain key revenue drivers
- Upside potential driven by ongoing national and international campaigns
- Development of Next European Fighter engine could lead to additional revenue contribution 2020 onwards
- Most likely scenario foresees increased revenue expectation for the mid 2020s
- German Defense Budget increase in sight

MRO Roadmap

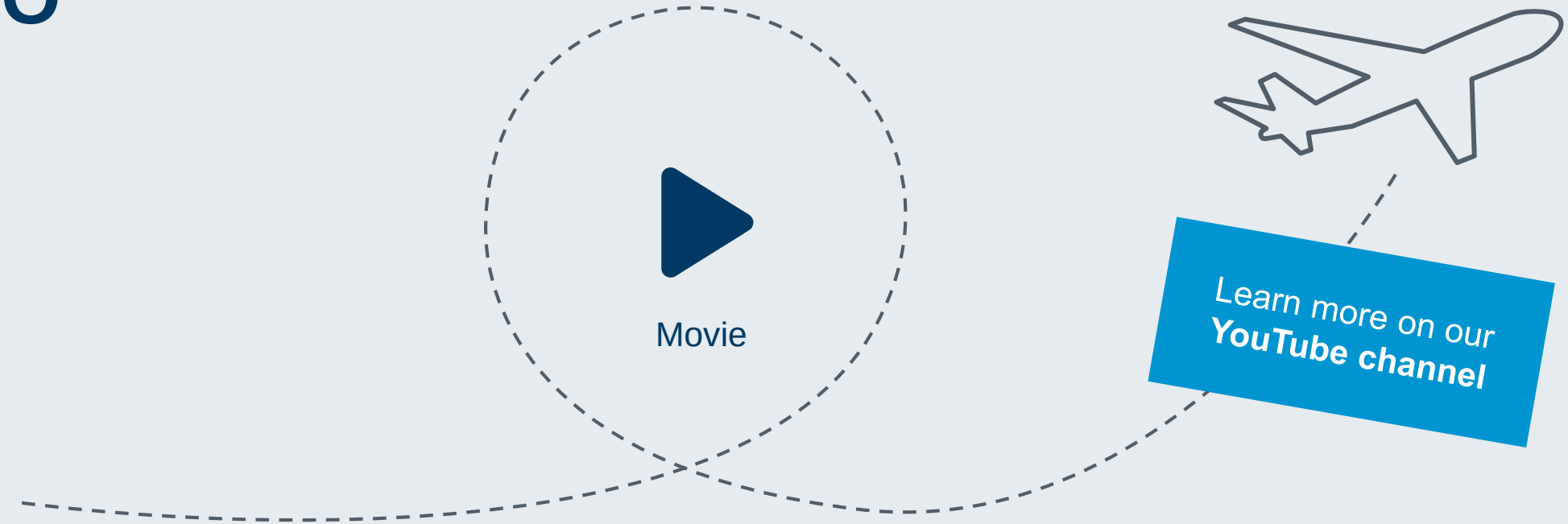
MRO revenues significantly outperformed the market



Highlights

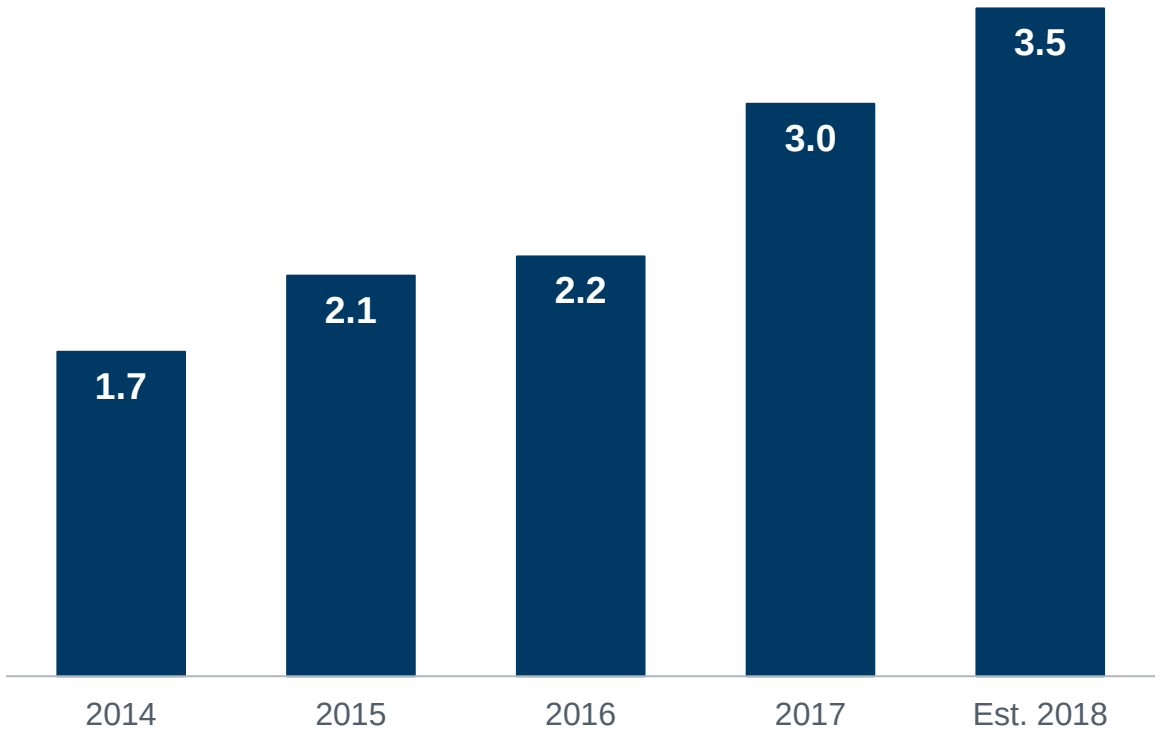
- Key drivers are the V2500 and PW1100G-JM
- Higher material content
- Mature engine types perform better than expected
- Increase in share of OEM flighthour agreements
- Increasing customer demand for engine lease and asset management

MRO



Independent MRO continues its success story

Independent MRO campaign wins 2014 – 2018 in US$ billion

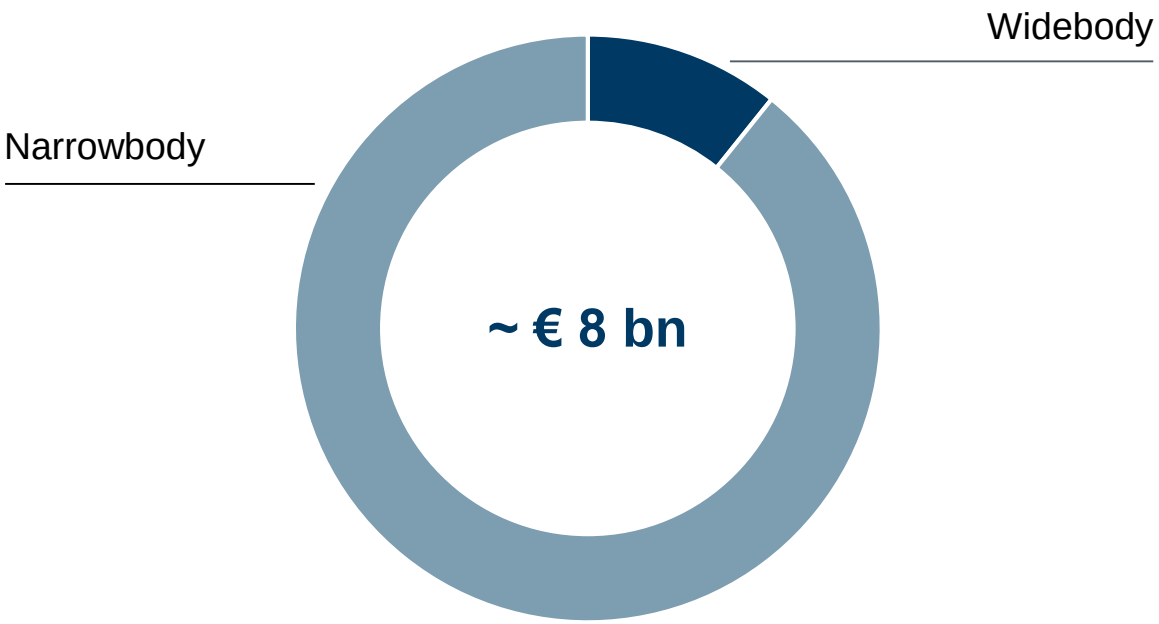


Highlights

- Ongoing strong campaign wins
- Key programs are V2500, CF34, CFM56, GE90G
- Basis for future revenue growth

Increase in market shares by OEMs secures workload for decades

OEM-MRO cooperation order book as of 30th September 2018

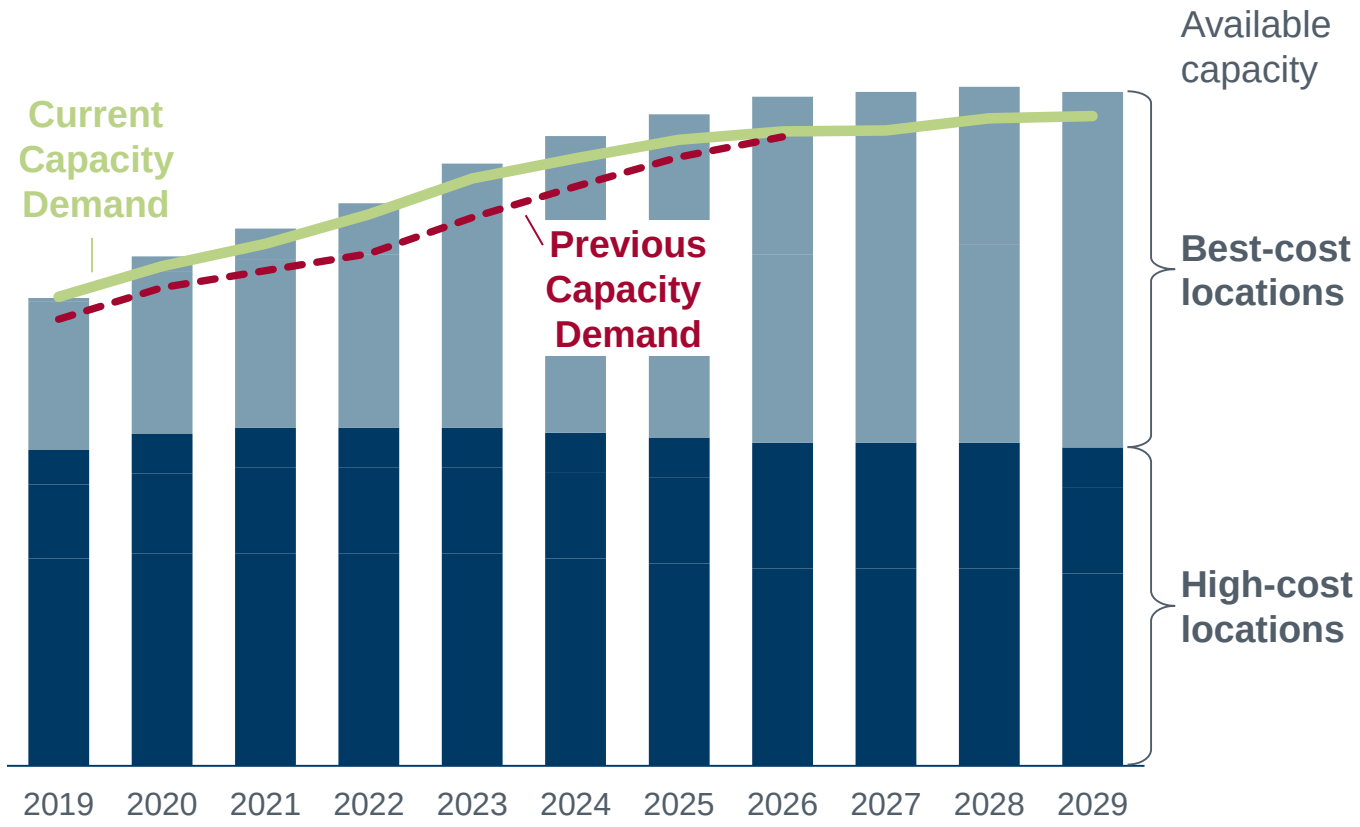


Highlights

- V2500 ~60% under FHA agreement
- FHA-share on new programs increase
- GTF ~70-80% under FHA agreement
- Access to OEM-MRO cooperation secured by Risk and revenue sharing partnership (RRSP)

Higher than expected volumes drive capacity increase primarily at best-cost locations

Capacity demand vs. available capacity

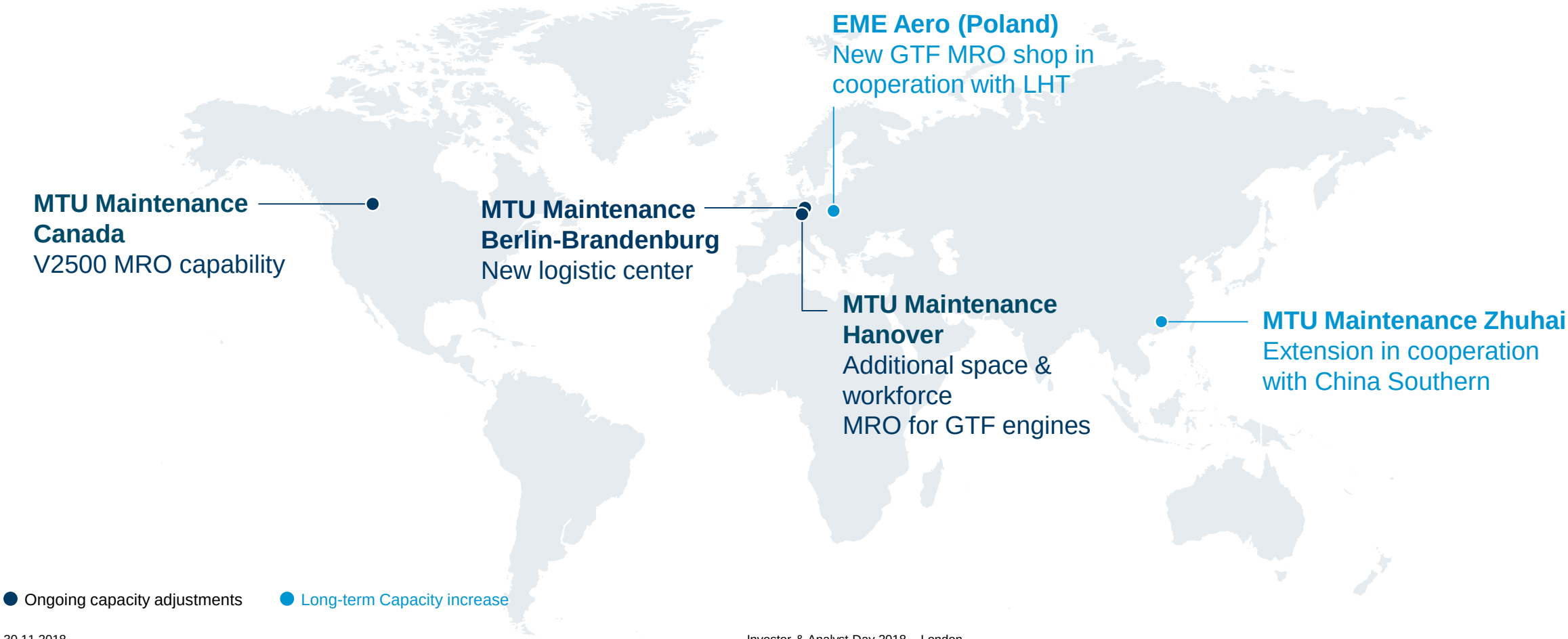


Highlights

- Rising demand for mature and new engine programs
- Short term: Full capacity utilization at existing locations
- Mid to long term: Increase capacity at best cost locations
- Strengthen partnerships with China Southern, LHT
- Best cost share will raise from 30% to 50%

Expansion of MRO Network by short term measurements and structural adjustments

Disassembly Assembly Test Facilities

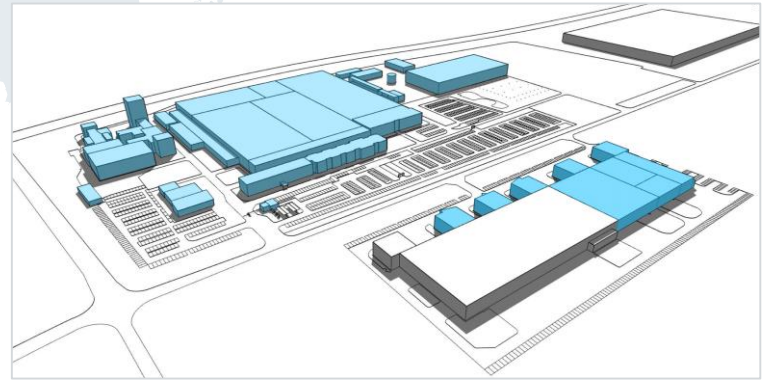


Site extension of MTU Maintenance Hanover and MTU Maintenance Berlin-Brandenburg

Site extension Berlin

MTU Maintenance Berlin
New logistic center

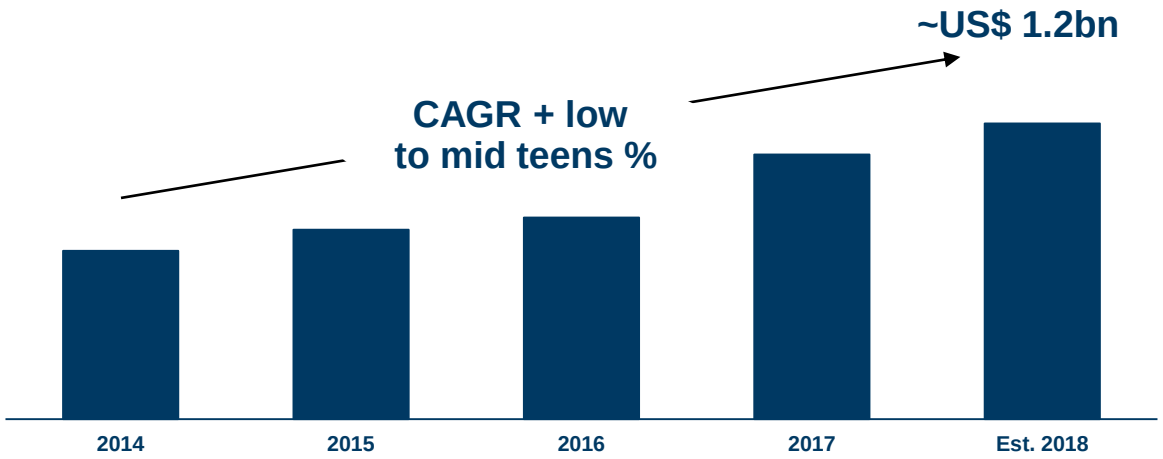
MTU Maintenance Hanover
Additional space & workforce
MRO for GTF engines



Site extension Hanover

JV with China Southern secures future growth in the strong growing Asian market

MTU Maintenance Zhuhai No.1 MRO shop in China with strong revenue growth



Highlights

- 50:50 JV with China Southern
- Prolongation of JV with China Southern until 2051
- JV partner China Southern intends to double its aircraft fleet until 2035
- Target to expand to new engine platforms
- Increase capacity at MTU Zhuhai by another 50%
- Long term expansion concept in China under development

Lufthansa Technik – a strong partner for our new GTF MRO shop in Poland

EME Aero will become the most efficient GTF MRO shop worldwide

Highlights

- 50:50 JV with Lufthansa Technik
- Total investment of € 150m from both shareholders
- Start of operations in 2020
- Workforce ~ 800 employees
- Capacity ~ 450 Shop visits

Further increase in added value business will enable further profitable growth

Repair & Service locations with strong growth potential

● MRO service adjustments

Together with Lufthansa Technik we intend to expand our repair shop in Malaysia

ASSB – a competitive repair shop

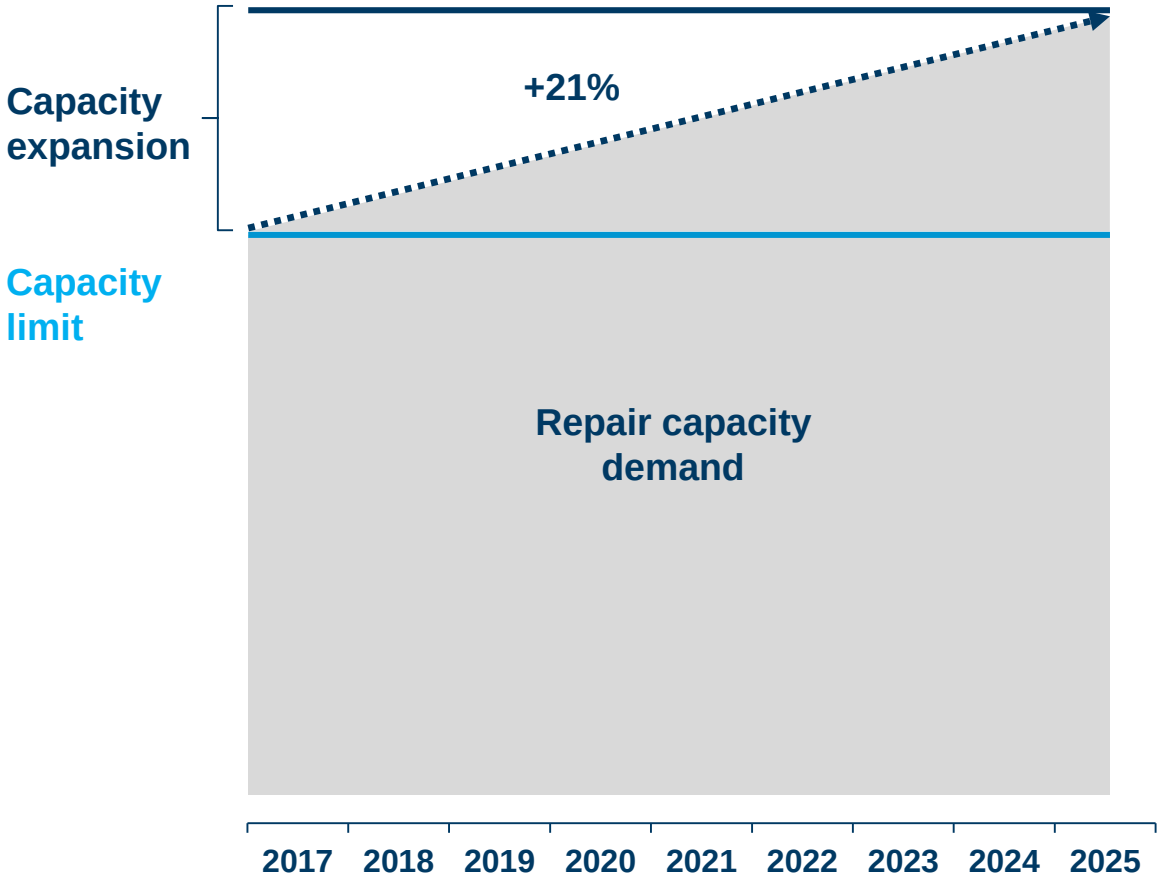
ASSB – Airfoil services in Malaysia

Highlights

- Successful JV with LHT since 2003
- Focus on repair of LPT and HPC airfoils
- Future growth in repair hours driven by new engine programs
- Capacity increase by 60% at ASSB

Rising demand for repairs requires additional capacity increase

New best cost repair shop under examination

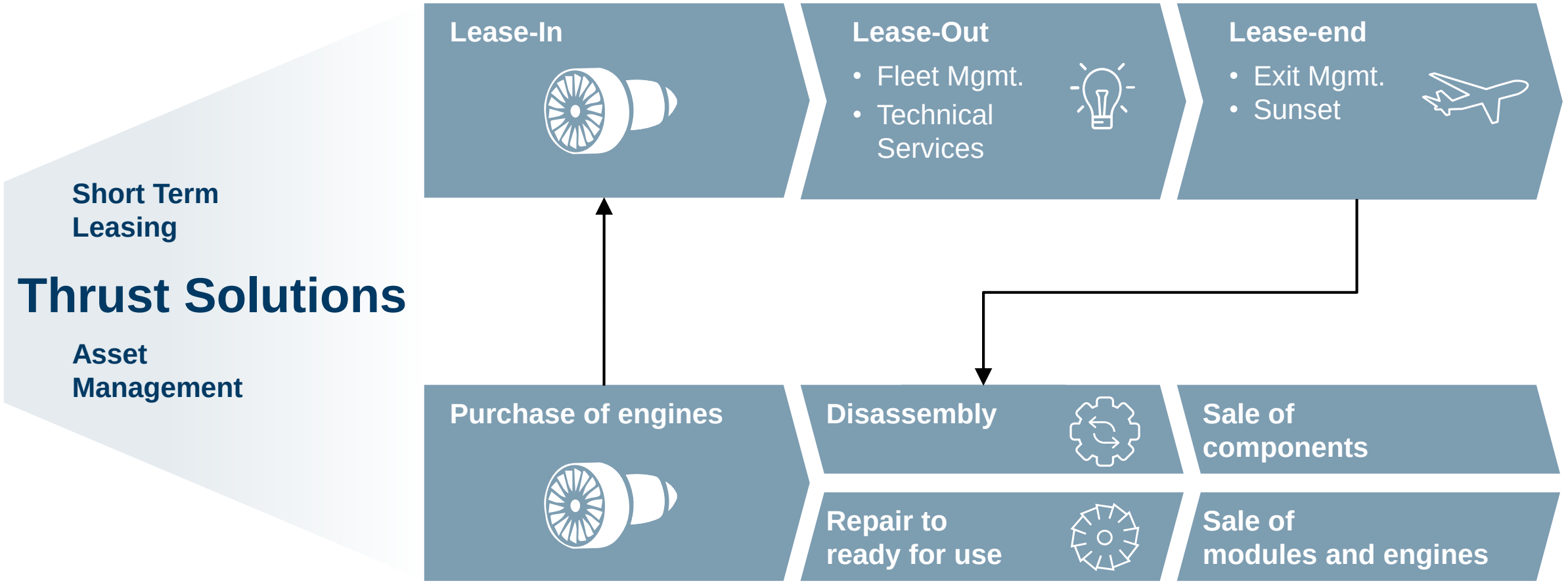


Motivation for a new best cost repair shop

- Growth especially through new programs
- Currently full utilization in existing locations
- New repair shop being established in a best cost country
- Competitive production costs support EBIT adj. margin in MRO

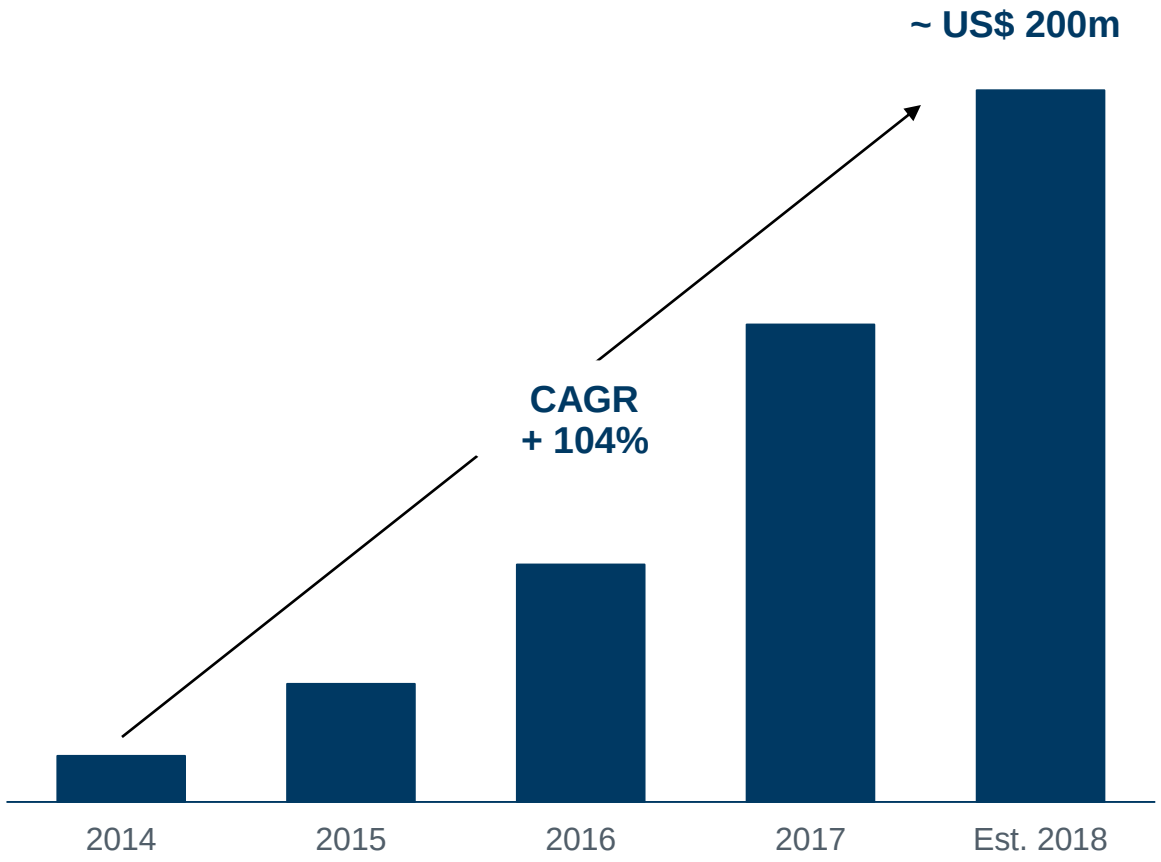
MRO service portfolio is complemented by engine lease and asset management

Business model of MTU Maintenance Lease Services in Amsterdam



MTU Maintenance Lease Service (MLS) is a successful Joint Venture with Sumitomo

Strong growth performance of MLS since foundation



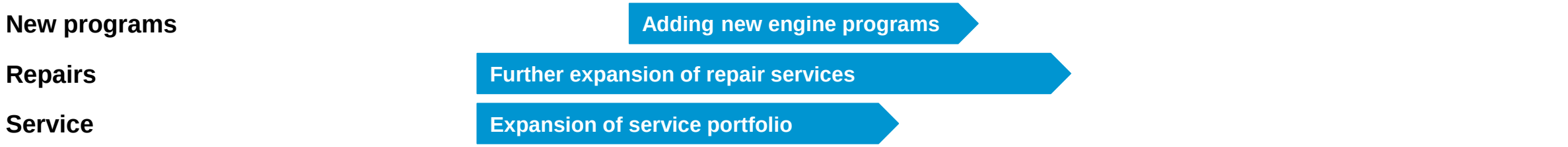
Highlights

- Focus on engine leasing and asset & material management
- Revenue growth exceeded expectations since founding year
- Lease pool of +100 engines by 2022
- More than 600 engines are assessed annually

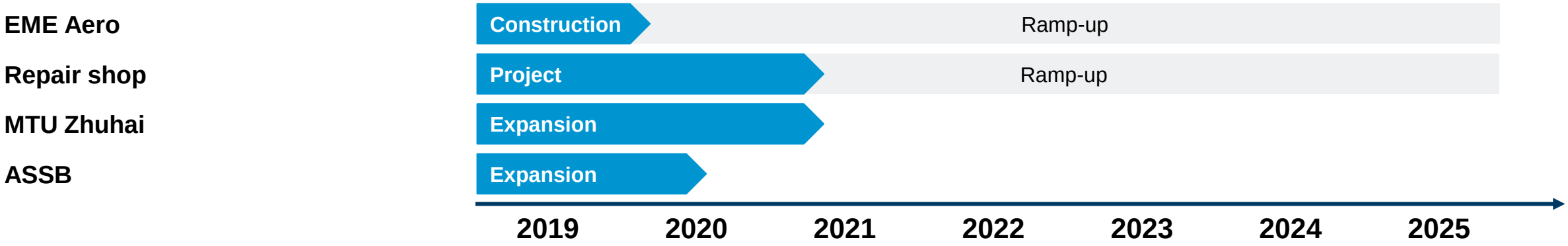
Clear strategy to increase MRO service portfolio and capacity

Overview about expansion roadmap

MRO Service Portfolio



MRO Network Structure



All business segments to grow stronger than previously expected

Commercial OEM business

- New application for PW800
- A220 secures PW1500G program with likely higher production rates
- Airbus rate 70 would further increase GTF production
- 787 rate hike – improved GEnx market share – upcoming GE9X ramp-up

Military OEM business

- Positive sentiment from national and international campaigns
- Next European Fighter Engine key for future growth

Commercial MRO business

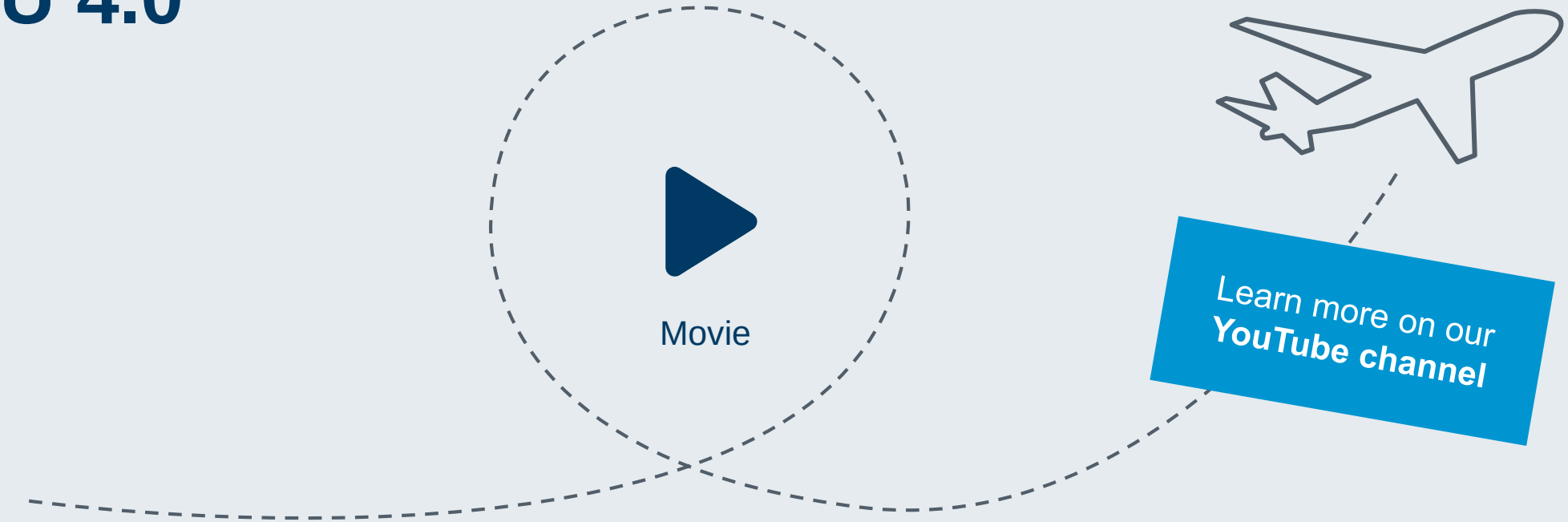
- New engine programs and further expansion of MRO services
- Expansion of MRO network structure with clear focus on best cost

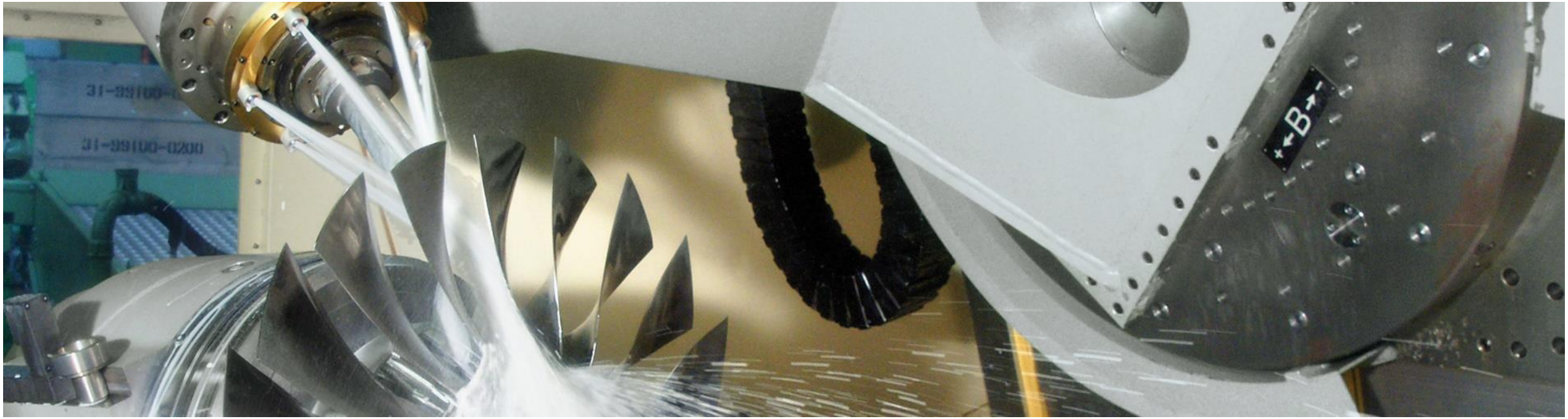
Higher growth expectations in all business units

Q&A

Lunch

MTU 4.0





Successful execution and a prosperous technology roadmap

Lars Wagner, Chief Operating Officer

Status Execution

With PW1900G and PW800 two more engine programs entered service in 2018

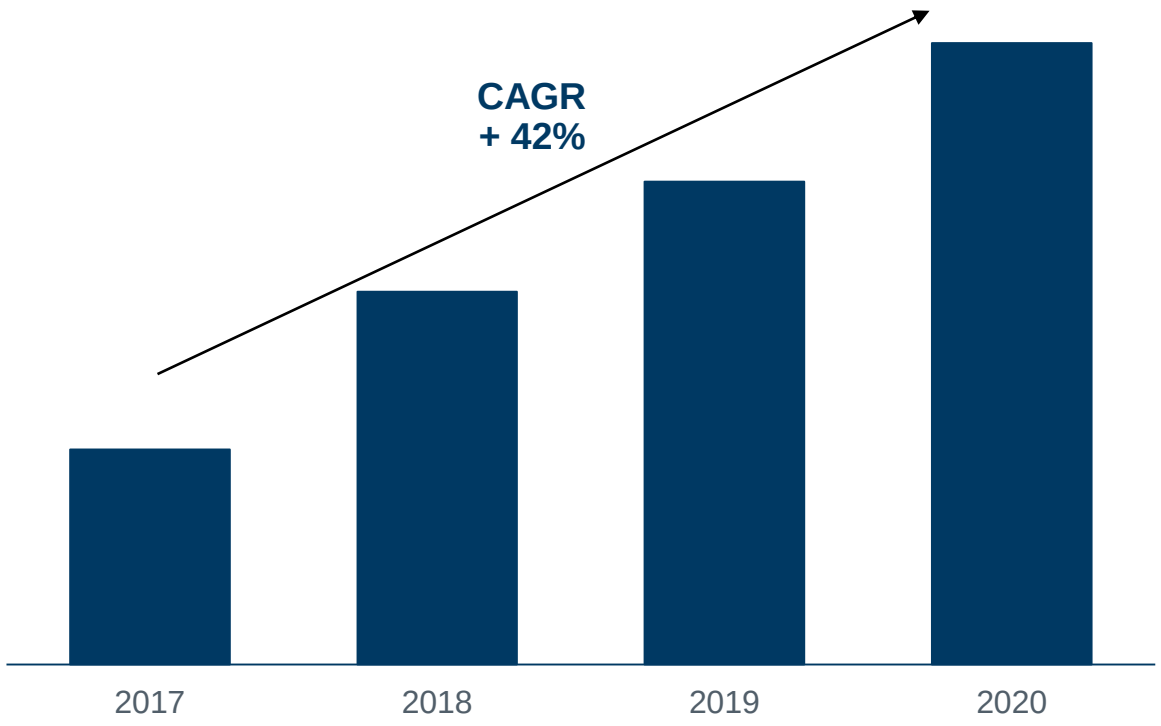
Development milestones of new engine programs

	PW1500G A220	PW1100G-JM A320neo	PW1200G MRJ	PW1400G-JM MS-21	PW1900G E-Jets 2. Gen	PW800 G500 / G600	GE9X B 777X	T408 CH-53K
First engine to test	✓	✓	✓	✓	✓	✓	✓	✓
Tested in flying test-bed	✓	✓	✓	N/A	✓	✓	✓	N/A
Engine certification	✓	✓	✓	✓	✓	✓	2019	2018*
First flight	✓	✓	✓	✓	✓	✓	2019	✓
Entry into service	✓	✓	2020	2020	✓	✓	2020	2019

* T408: Certification of whole aircraft system after flight testing

GTF engine programs continue to be a main driver for company growth

Strong ramp-up in GTF engine deliveries



Aircraft applications

A320neo

MS-21

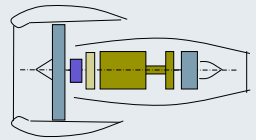
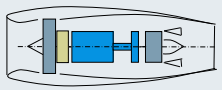
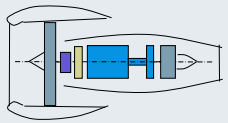
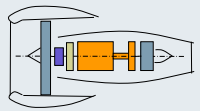
A220

MRJ

E-Jets

GTF product family powers eleven different aircraft and provides a wide range of thrust

Classification according to core engine size

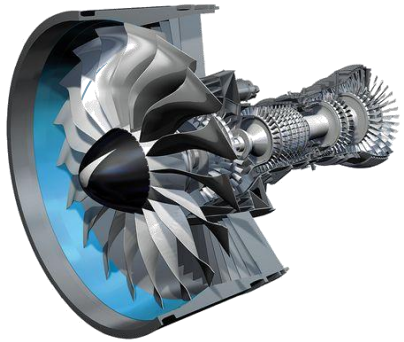
	Medium by-pass direct drive turbofan	High by-pass geared turbofan
Large core		**PW1100G-JM:** Airbus A320neo family **PW1400G-JM:** Irkut MS-21  ~81” Fan
Medium core	**PW814:** Gulfstream G500 **PW815:** Gulfstream G600  ~50” Fan	**PW1500G:** Airbus A220 family (ex C Series) **PW1900G:** Embraer E190-E2  ~73” Fan
Small core		**PW1200G:** Mitsubishi Regional Jet **PW1700G:** Embraer E175-E2  ~56” Fan

GTF in-service fleet is growing and meets all specifications of economical performance

Deliveries and in-service experience

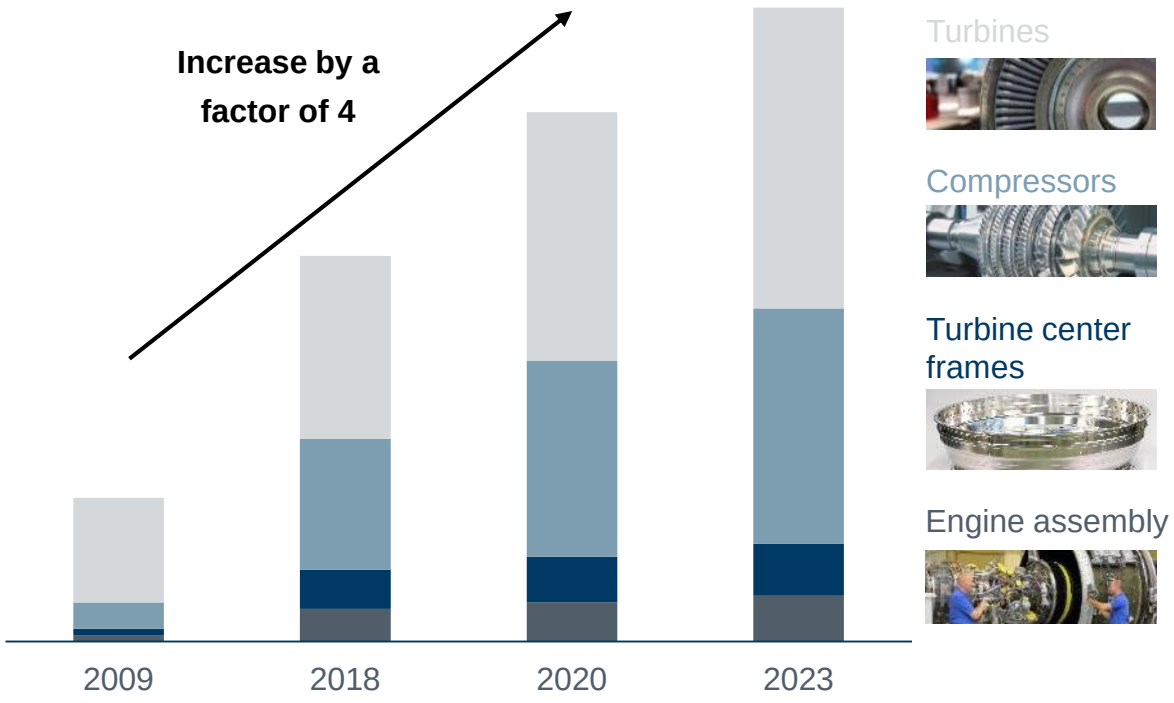
- More than **290 GTF-powered** aircraft delivered to 31 **operators**, flying to ~ 570+ destinations on 5 continents
- More than 550,000 flights accomplished, **260 million litre** of fuel saved for customers
- Engine deliveries are on track to meet production commitments in 2018

- Focus is still on
  - Ramp-up of the supply chain and delivery performance
  - Availability of lease engines to ensure any disruption is minimized
  - Progress on technical improvements



OEM production is continuously ramping-up with additional demands in various programs

Deliveries per year of all OEM programs



Turbines

Compressors

Turbine center frames

Engine assembly

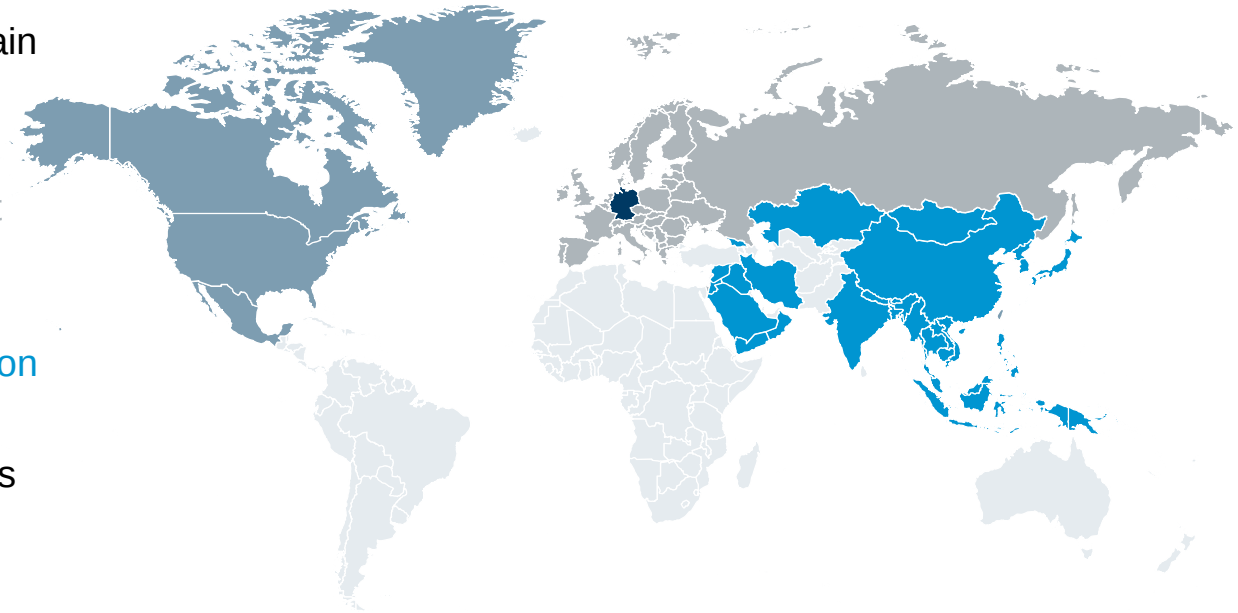
Production status

- Quality is on a high level
- Program demands further increased in 2018
  - Commercial: additional 12% increase for 2019
  - Military: additional 8% increase for 2019
- Efficient capacity use and increase of capacity
- Extension of best-cost site Rzeszów (Poland)
- Further automation efforts in Munich
  - Extension of blisk and disk manufacturing

External supply chain management is a key factor to ensure company growth

OEM and MRO purchasing figures in 2017

- € 2.5 billion purchasing volume for OEM and MRO
- Broadly based OEM supply chain
  - # 197 in Germany
  - # 154 in Europe, Middle East and Africa
  - # 195 in America
  - # 36 in Asia and Pacific Region
- 80% OEM purchasing volume is at # 50 suppliers



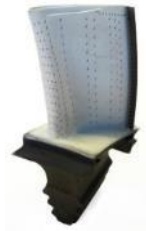
- Utilization levels are very high
- Ramp-up weaknesses identified
- Actions to mitigate risks
  - Double or triple sourcing where necessary
  - Improvement teams at critical suppliers
  - Digitalization efforts: end-to-end transparency
- Goal is to reduce inventory with simultaneously increasing on-time deliveries

Smart Factory

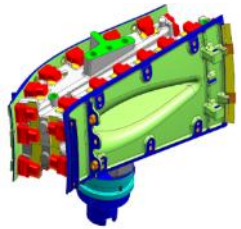
Production ramp-up triggers extensive automation with state-of-the-art production technology (1 / 2)

Blisks
(compressor)

Disks
(turbine)



Blades
(turbine)



Flow path hardware
(turbine center frame)

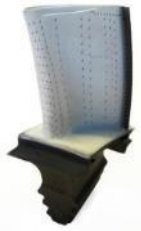
Production ramp-up triggers extensive automation with state-of-the-art production technology (2 / 2)

Blisks
(compressor)

- State of the art production capabilities established
- Further extension of automated production decided
- 30% lower production cost and 50% lower labor utilization rate already achieved

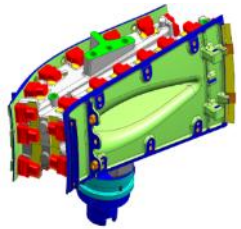
Disks
(turbine)

- New disk machining shop in Munich decided
- Fully automated with latest production technology
- Target is comparable efficiency as blisk machining



Blades
(turbine)

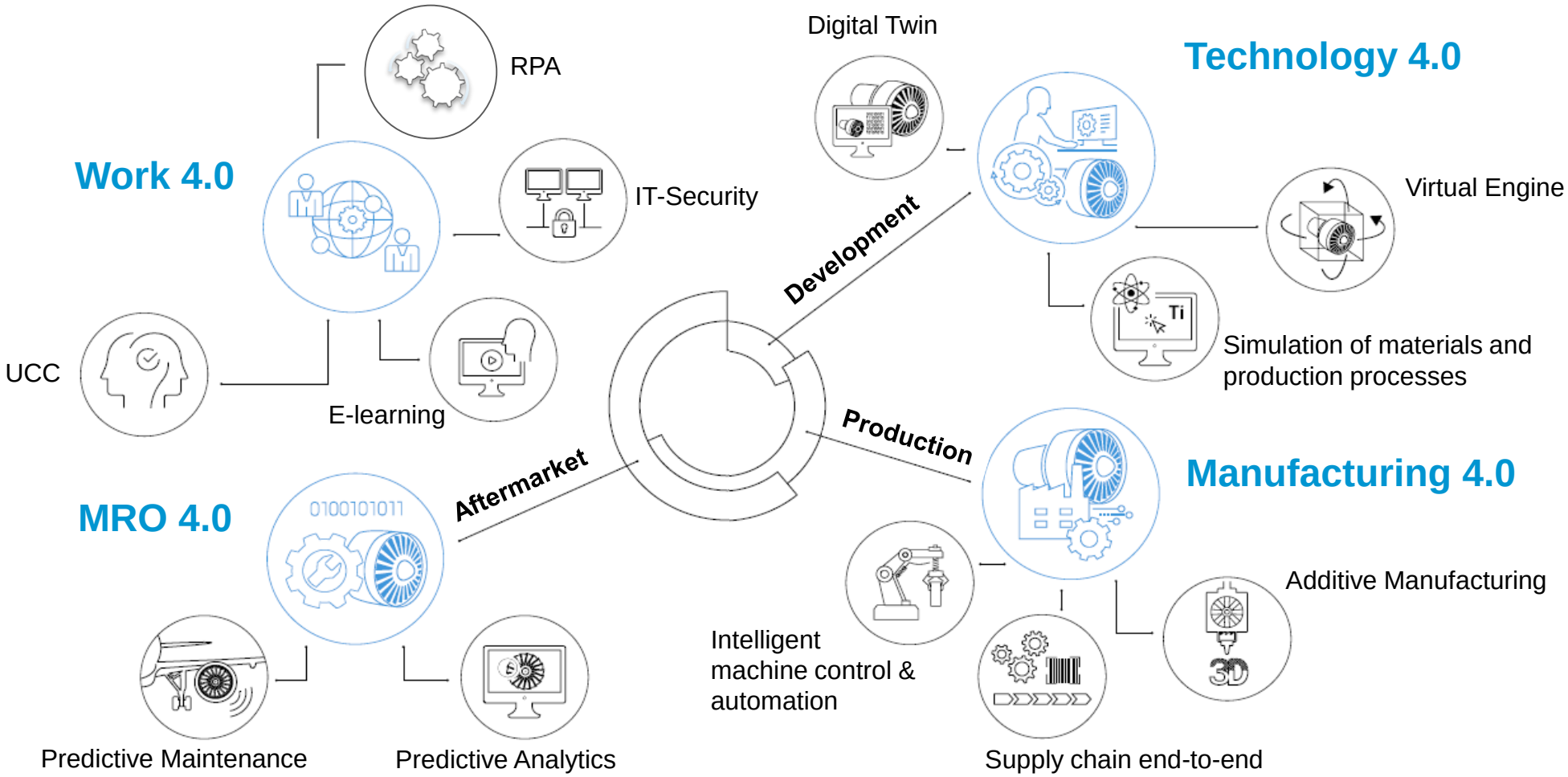
- Flexible manufacturing system in realization: trial machining started
- 4 robotized units replacing 20 conventional machines
- Target is unmanned production with ~ 7,000 machining hours per year and 24/7 capabilities



Flow path hardware
(turbine center frame)

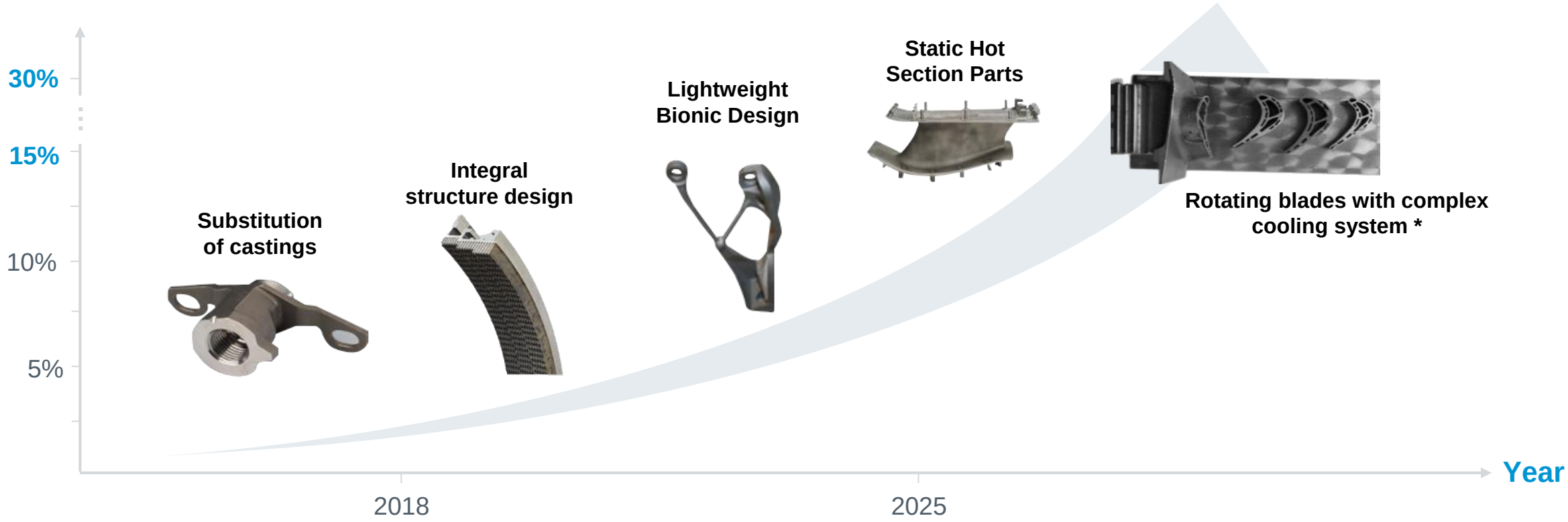
- State of the art production capabilities established: finish-cutting and complex fixture construction
- New production line with robotized part and tooling transfer in preparation
- Target is 60 to 70% lower labor utilization rate with 24/7 capability

A broad digitization strategy enables automation and supports efficient company growth



Manufacturing 4.0: Additive manufacturing to create new (bionic) design possibilities

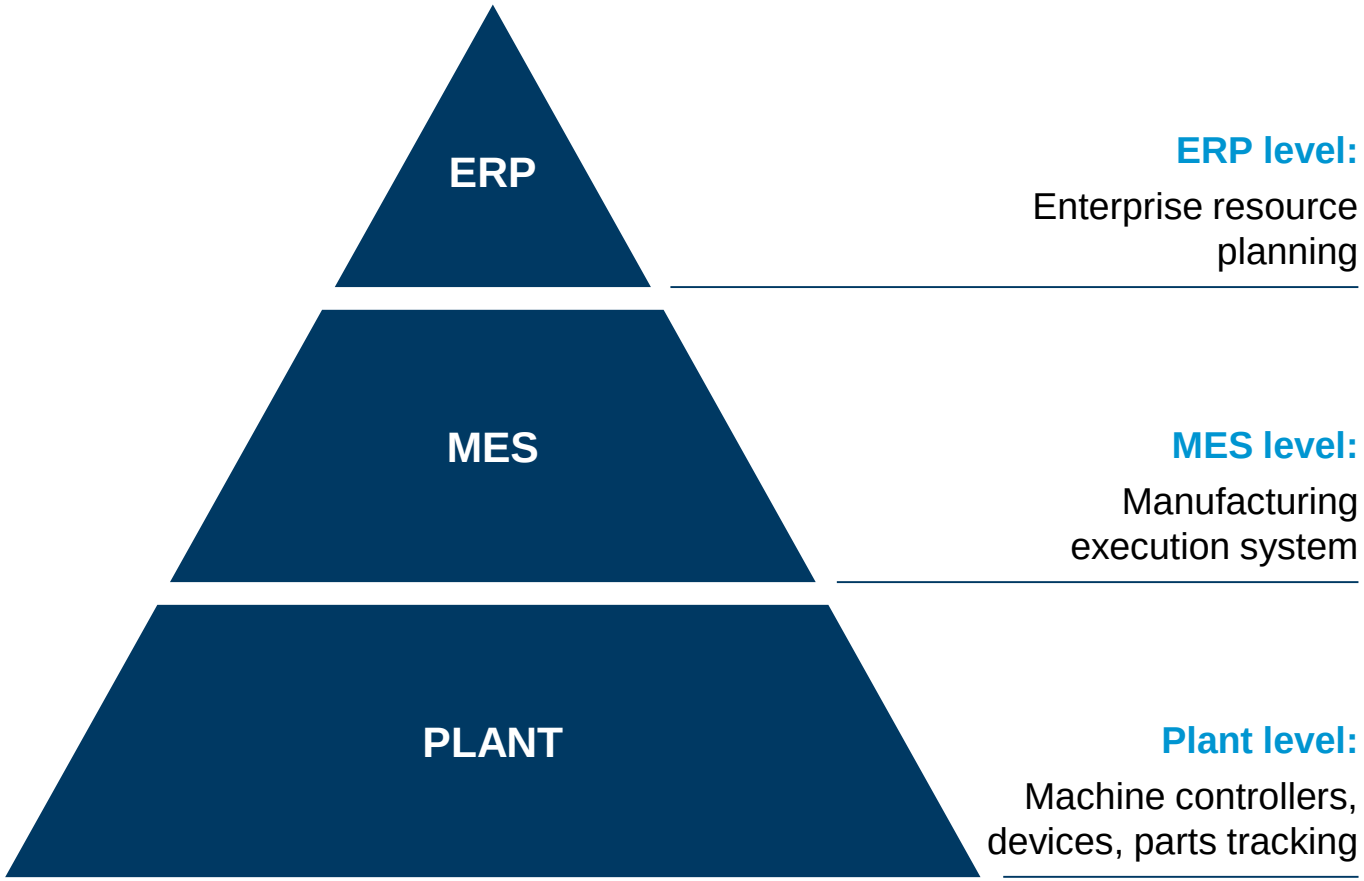
Estimated amount of AM parts in aero engines



* Picture source: Central Institute of Aviation Motors

Manufacturing 4.0: Manufacturing Execution System (MES) to optimize in-house production flow and capacity utilization

Basic structure of production planning and control



ERP level:
Enterprise resource planning

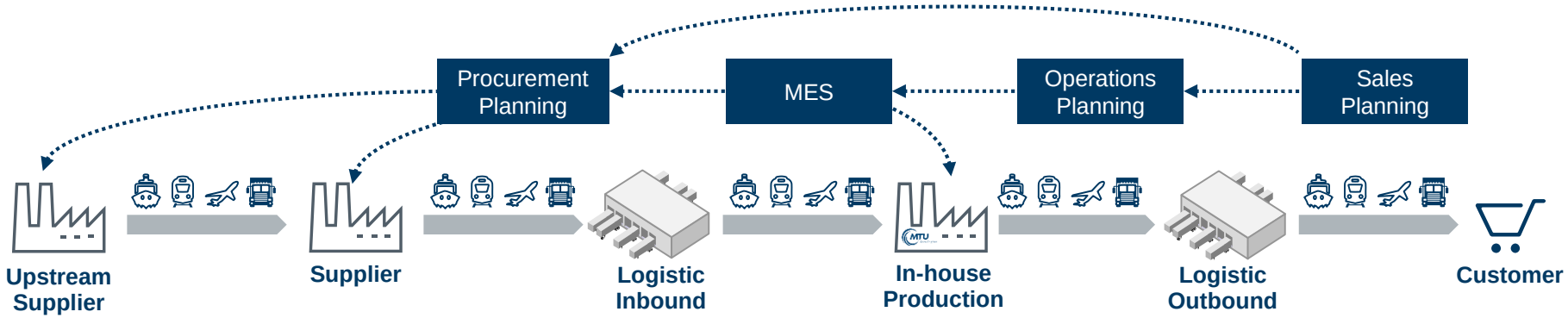
MES level:
Manufacturing execution system

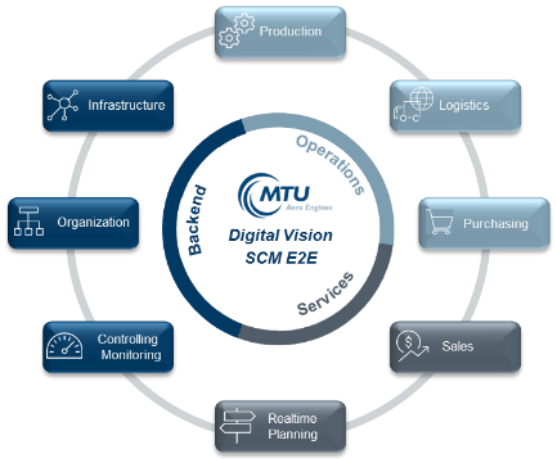
Plant level:
Machine controllers, devices, parts tracking

- Real-time network to connect, monitor and control entire manufacturing process
- Monitors all available resources for optimized material flow
- Enables autonomous decision making

Manufacturing 4.0: Supply chain end-to-end connection to create a highly efficient value stream

E2E connection of all tiers





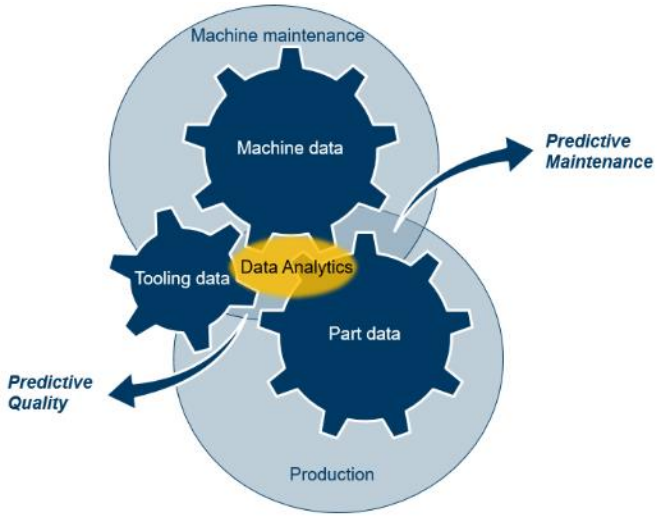
Transparency of data along the entire value chain E2E

Integrated sales and operations planning process

Based on integrated data and system landscape SAP S/4 HANA

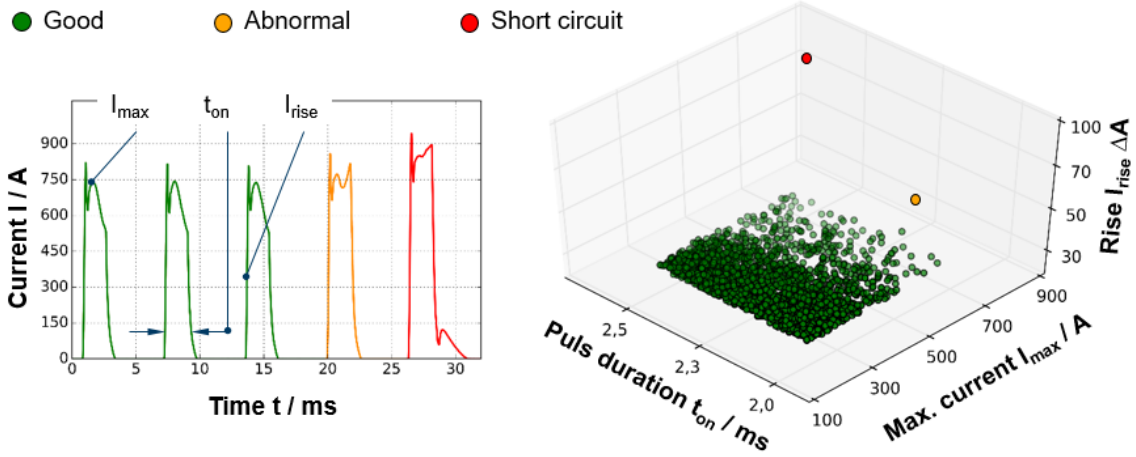
Technology 4.0: Process data management to utilize available (big) data for enhancement of automated processes

Basic scheme



- Real-time processing and usage of big data out of production processes
- Basis are machine data, data from production resources/ tools and produced parts

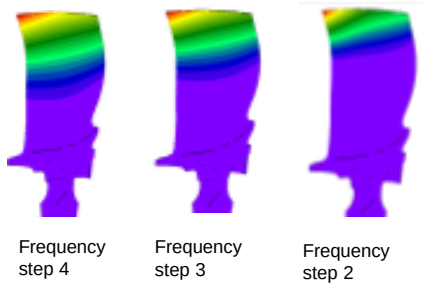
Example of a trend analysis

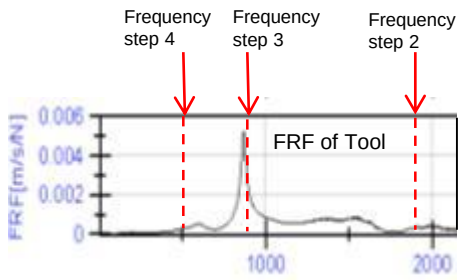


- Enabling predictive part quality – with high impact on quality management
- Enabling predictive machine maintenance – with high impact on machine availability

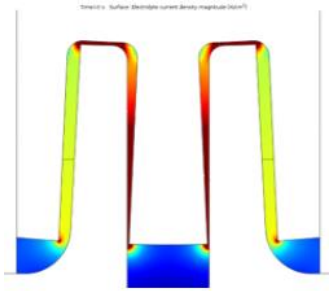
Technology 4.0: Cutting edge simulation methods to improve materials and production processes

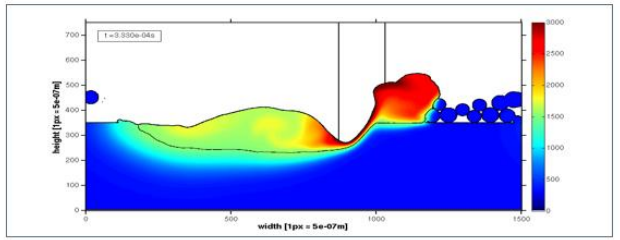
Vibration analysis (for machining processes)





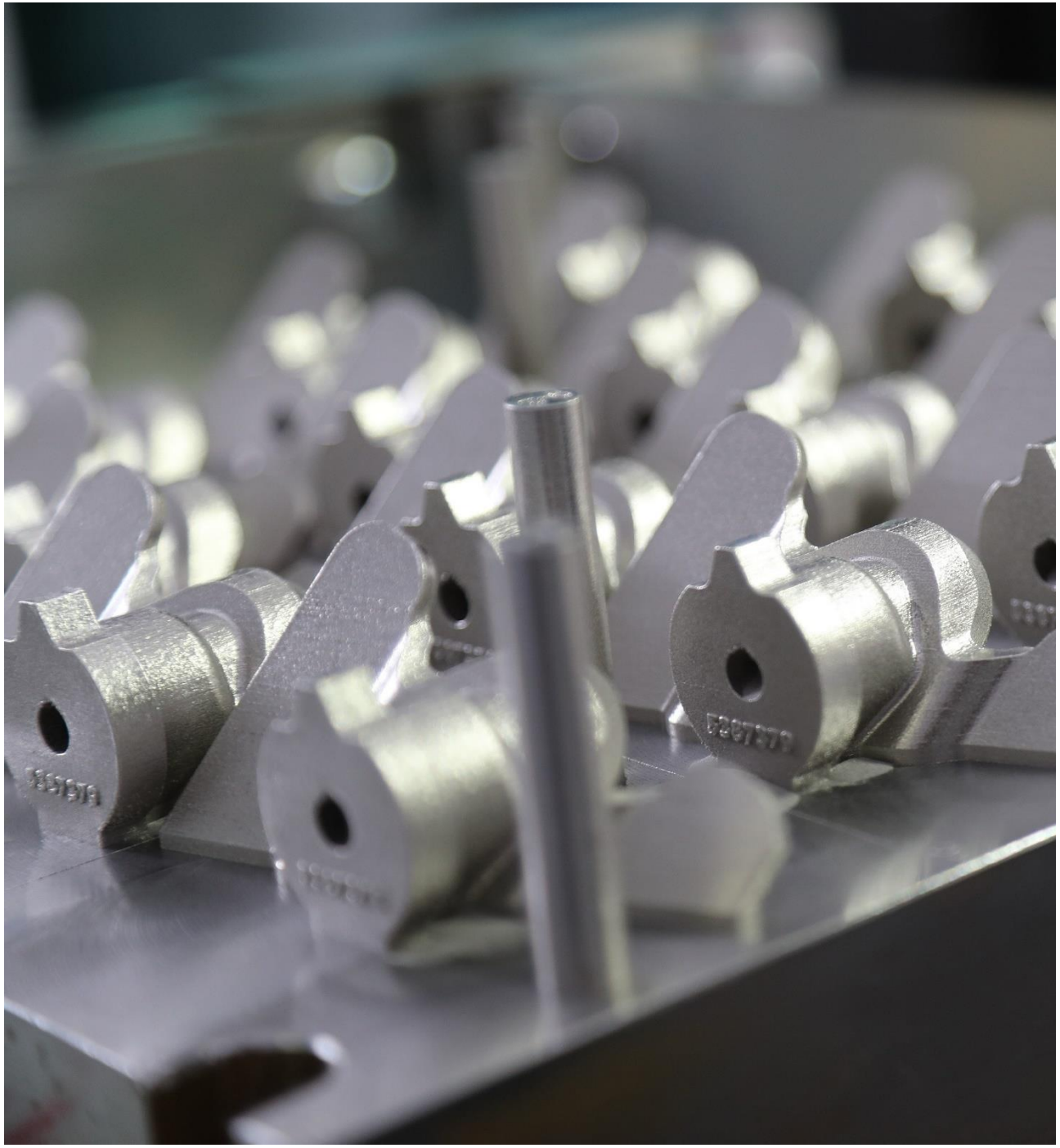
Material treatment analysis





- Simulation of physical interaction between part, tool and machine
- Reduction of iteration loops on the machine
- Reduction of time to market
- Integration of manufacturing simulation in early part design process

Technology Roadmap



Updated technology roadmap is based on three time horizons

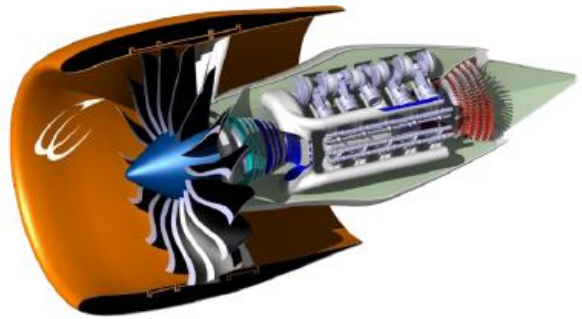
Scopes of 10 / 20 / 30 years plus

Commercial engines:
Entry-into-service of 2. Geared Turbofan (GTF) engine generation

10 years +

Military engines:
Entry-into-service of Next European Fighter Engine (NEFE)

20 years +



Source: Bauhaus Luftfahrt

New propulsion concepts:
Entry-into-service of new design

30 years +

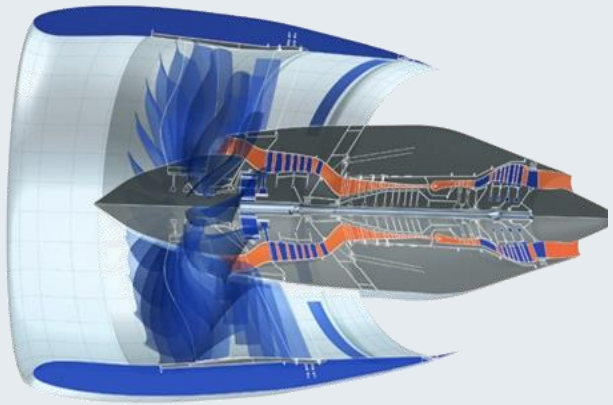
GTF engine concept has a high enhancement potential for further applications

Commercial technology development for 2. GTF engine generation

Targets
relative to 1. GTF generation

- - 10% fuel burn at least
- - 10% dB noise
- Up to 2x more life

- Technology ready 2027+
- Entry-into-service 2033+



Key enabler

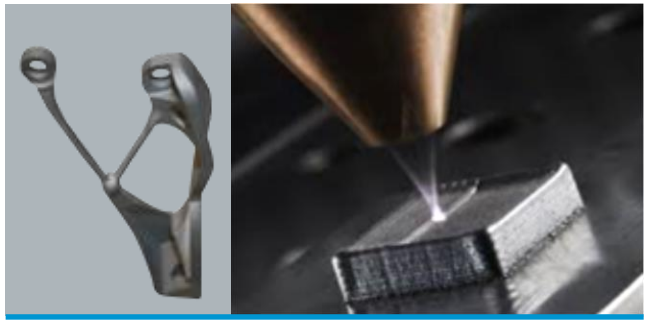
- Higher By-Pass-Ratio (BPR): bigger fan and slim nacelle
- Higher Overall-Pressure-Ratio (OPR): small core engine with higher temperatures
- Very efficient components
- New materials
- Robust and reliable design – easy to access
- Improved aircraft/engine integration

Various key technologies will enable entry-into-service of the 2. GTF engine generation

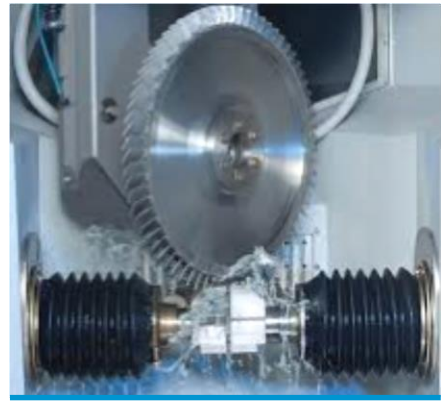
CMC materials

On-wing repairs

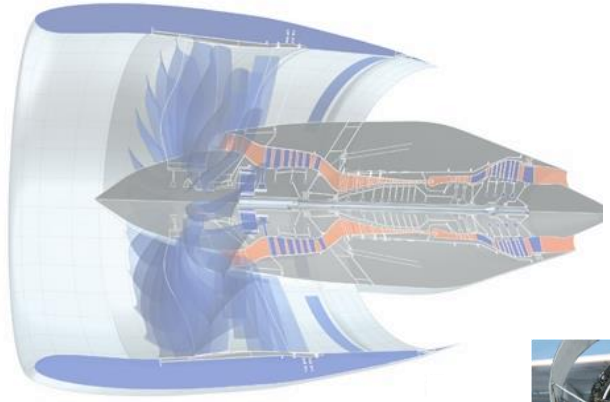
Digitalization and industry 4.0

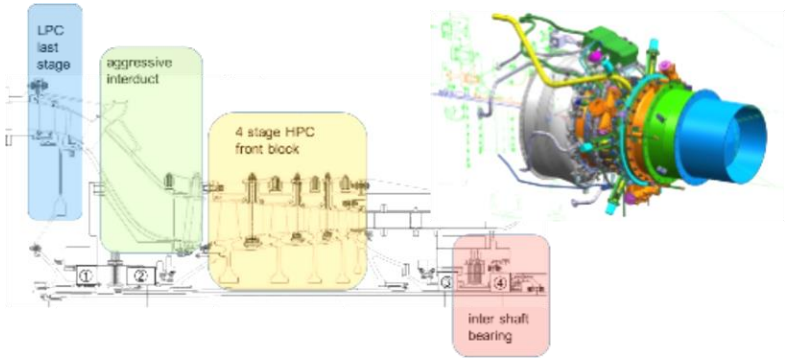


Additive manufacturing



New production technologies





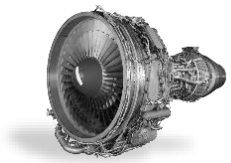
“World class” testing and validation

Engine trend monitoring

Simulation

GTF engine concept results from a straight roadmap since decades

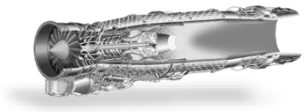
Commercial and military technology development in the past



PW2000

First MTU-designed **commercial LPT**

1980



EJ200

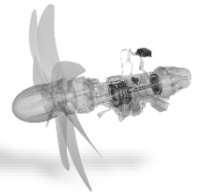
First MTU-designed **military LPC** (all-blisk) **& HPC**

1990

PW6000

First MTU-designed **commercial HPC** winning **Innovation Award**

2000



TP400-D6

New **military IPC & IPT**

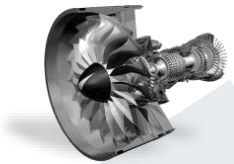
GP7000

Commercial LPT that sets new standards

2010

GE9X

First MTU-designed **commercial TCF**



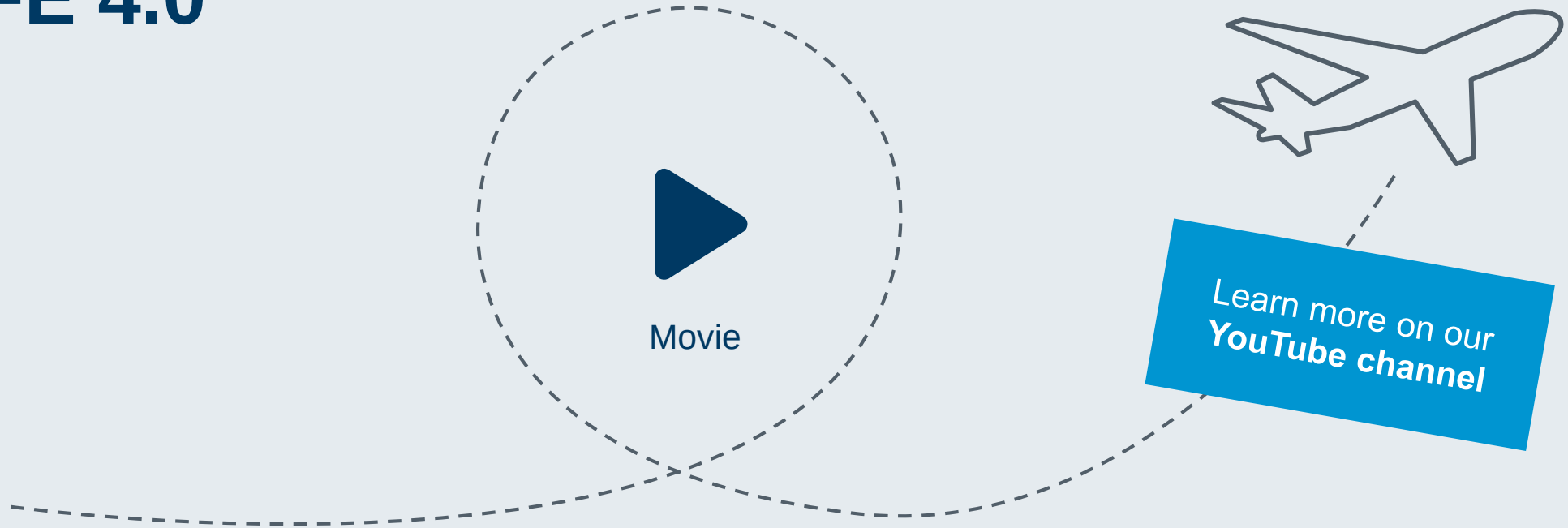
GTF family

New **commercial HPC & LPT** winning **Innovation Award**

2015

LPT: Low-pressure turbine
LPC: Low-pressure compressor
HPC: High-pressure compressor
IPC: Intermediate-pressure compressor
IPT: Intermediate-pressure turbine
TCF: Turbine center frame

NEFE 4.0



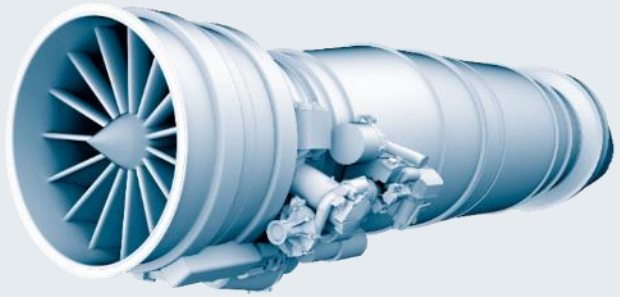
Next European Fighter Engine (NEFE) – a new impulse at the military market

Military technology development for NEFE

Targets

- Long range
- High mission flexibility
- High availability
- Low observability
- Low operating costs

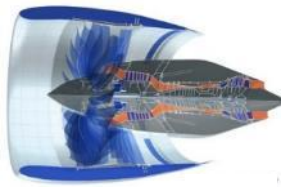
- First prototype 2031+
- Entry-into-service 2040+



Key enabler

- Variable cycle engine technology
- Very efficient components
- High temperature, low weight materials
- Integrated aircraft / engine heat management
- Full digitalized design and aftermarket process

Significant synergies between commercial and military development are achievable

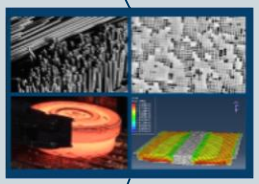


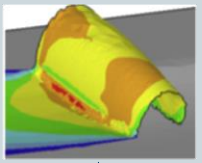
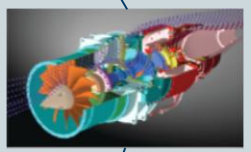
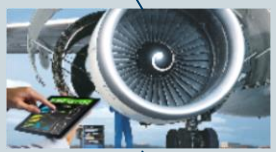
GTF 2. Generation:
Technology ready 2027+

GTF 2. Generation:
Entry-into-service 2033+

Commercial






HPC
LPT
Materials
Additive manufact.
Simulation
Virtual engine
Life cycle managem.
Testing and validation

Military

NEFE prototype:
Technology ready 2025+

NEFE prototype:
Entry-into-service 2031+

Electrification of jet engines will play a role in the future

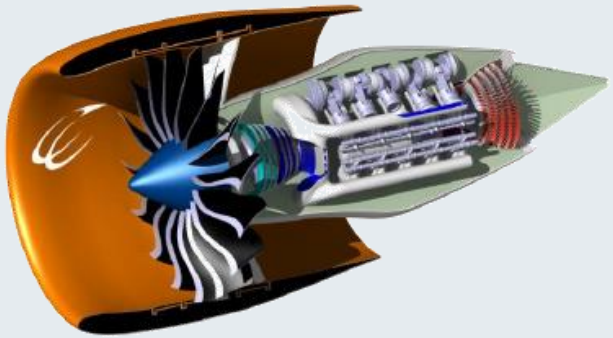
Evaluation and actions for hybrid and turbo-electric propulsion

- Turbo-electric (hybrid) concepts are technology-wise necessary for aircraft with more than 4 passengers
  - Gas turbine to generate electric power to run an electric motor boosted by batteries
- For these applications a highly efficient gas turbine will be necessary
- MTU is assessing the feasibility by collaborating in a short-term regional pilot aircraft

Revolutionary new propulsion concepts are necessary for Flightpath 2050 targets

Targets and fields of research

- **Targets relevant to 1. GTF engine generation**
  - -25% fuel burn
  - -25% dB noise
  - Low emissions
- **Strategic concepts**
  - Gas turbine including piston engine
  - Gas turbine with water steam injection

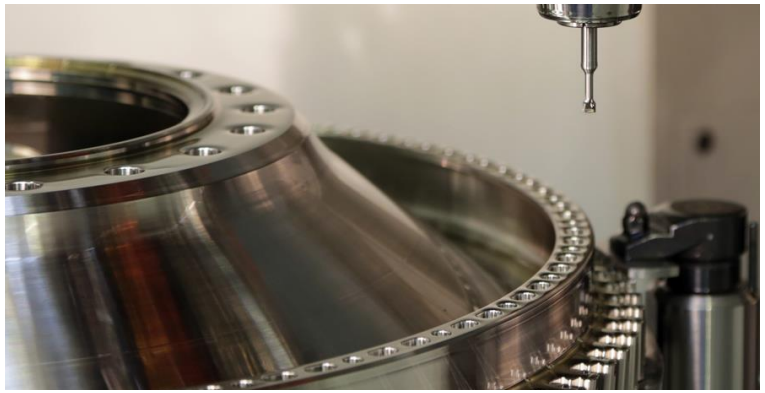


Source: Bauhaus Luftfahrt

Conclusion

Status Execution

- Engine programs are successively entering into service and accumulating flight hours
- Ramp-up continues with high growth rates and focus on supply chain performance



Smart Factory

- Cutting-edge production capabilities are installed or planned for every part commodity
- Digitalization and industry 4.0 activities increase the level of automation / efficiency

Technology Roadmap

- Technology roadmap is in place to align next generation commercial and military engines
- Revolutionary engine concepts will power turbo-electric propulsion in the future

Successful execution and a prosperous technology roadmap

Q&A

MTU Financials & Outlook: Ramp-up of cash conversion continues

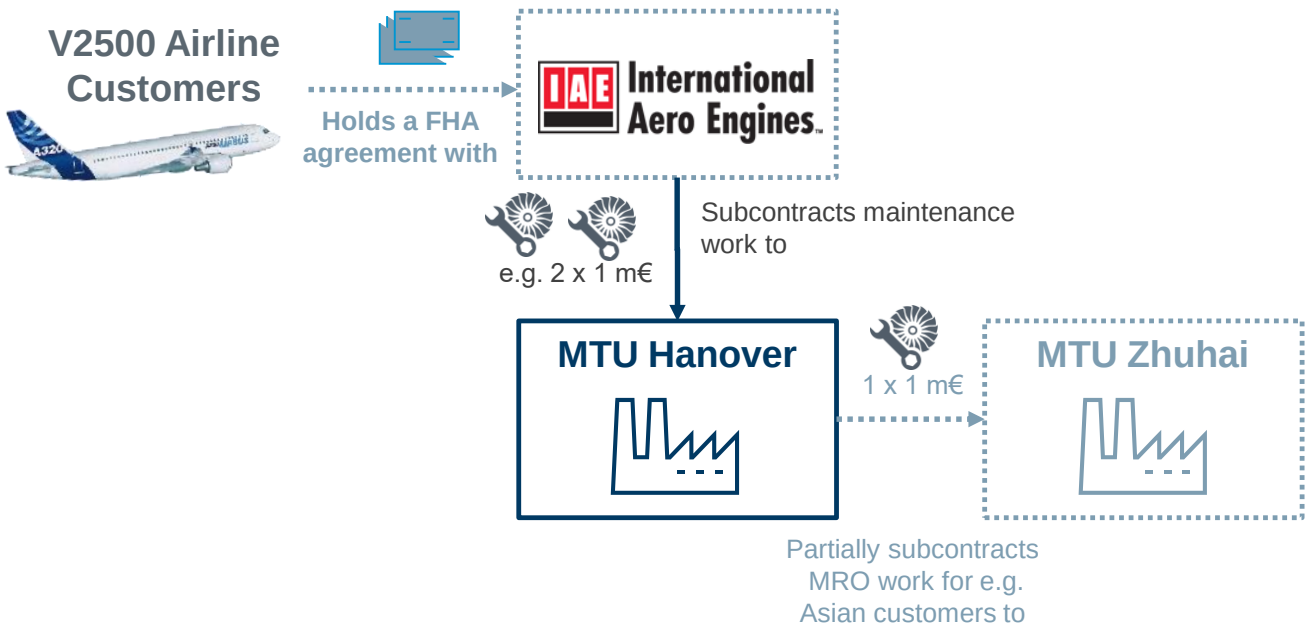
Peter Kameritsch, Chief Financial Officer

Future presentation OEM-MRO cooperation shopvisits

Today MTU Hanover is sole contract partner to IAE for V2500 FHA shopvisits

All Revenues for MRO services are fully consolidated even work is carried out by MTU Zhuhai

Contracting streams V2500 FHA OEM-MRO shopvisits



● Fully consolidated ● Consolidated at equity

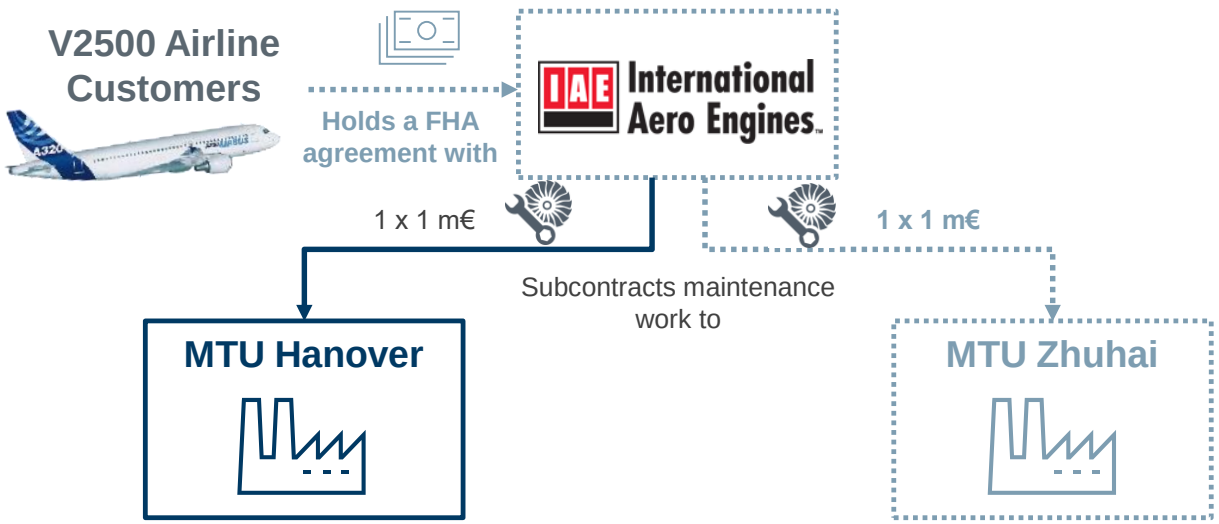
IFRS consolidated revenue

OEM Segment		
MRO Segment	Invoice MTU-H→IAE	**2 m€**
	Invoice MTU-Z→MTU-H	-
Group	MTU Group Revenue	**2 m€**

Starting 2019 MTU Zhuhai will be contracted for V2500 MRO work directly from IAE

Revenue of MRO segment will be lowered leading to higher margin and less complexity

Contracting streams V2500 FHA OEM-MRO shopvisits



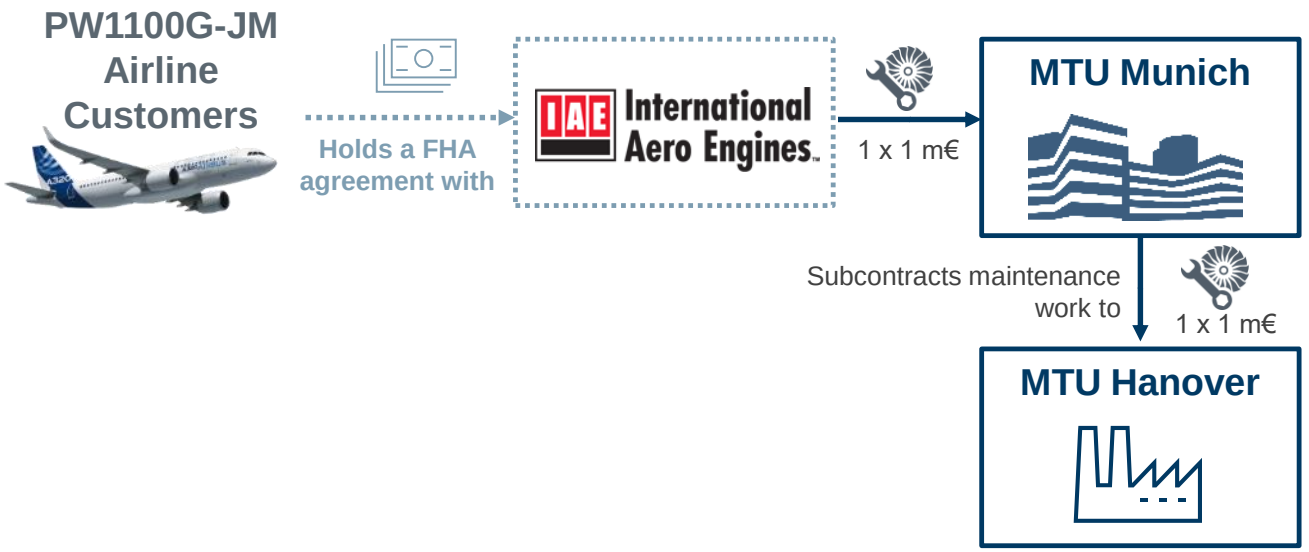
IFRS consolidated revenue		
OEM Segment		
MRO Segment	Invoice MTU-H→IAE	**1 m€**
	Invoice MTU-Z→IAE	-
Group		
	MTU Group Revenue	**1 m€**

● Fully consolidated ● Consolidated at equity

In newer engine programs such as PW1100G-JM the OEM segment is <u>today</u> prime contractor

MRO services are recognized in both segments and 1x eliminated for group consolidation

Contracting streams PW1100G-JM FHA OEM-MRO shopvisits



IFRS consolidated revenue

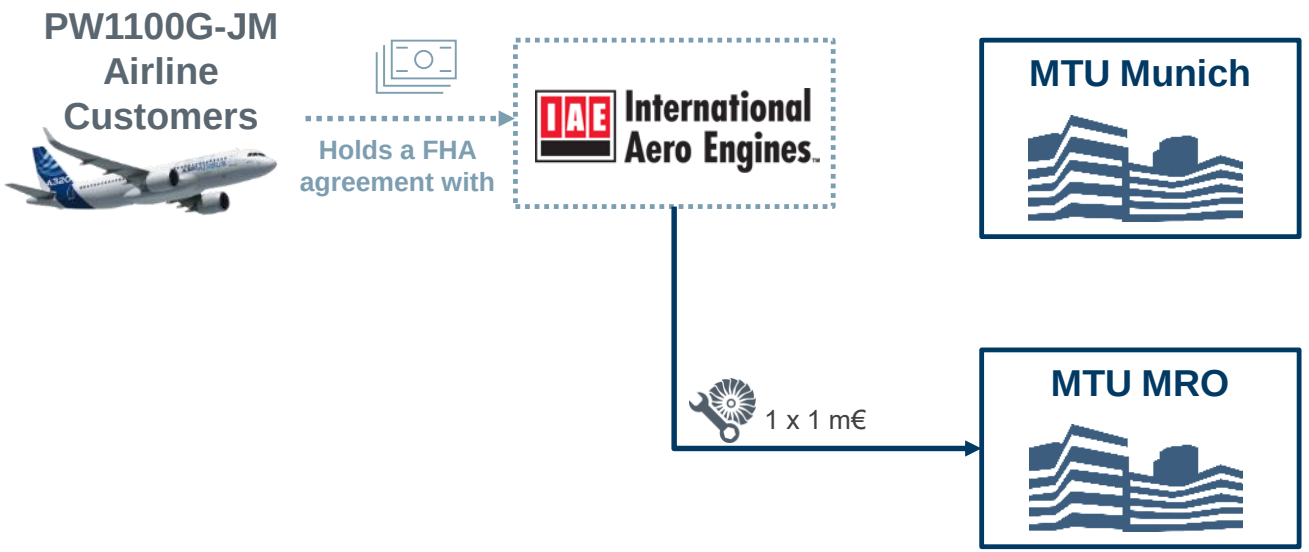
OEM Segment	Invoice MTU-M→IAE	**1 m€**
MRO Segment	Invoice MTU-H→MTU-M	**1 m€**
Group	Consolidation	**-1 m€**
	MTU Group Revenue	**1 m€**

● Fully consolidated ● Consolidated at equity

Starting 2019 OEM-MRO co-operation revenues will be presented in MRO segment only

Segmentation by content instead by legal entity will avoid increase in elimination line

Contracting streams PW1100G-JM FHA OEM-MRO shopvisits



IFRS consolidated revenue		
OEM Segment		
MRO Segment	Invoice MTU-M→IAE	**1 m€**
Group	MTU Group Revenue	**1 m€**

● Fully consolidated ● Consolidated at equity

Presentation of OEM-MRO cooperation shopvisits equalized and simplified from 2019

Summary

V2500

- MTU Zhuhai will directly invoice OEM-MRO shopvisits to IAE
- Implementation in 2018 would have lead to ~200 m€ less revenues, EBIT unchanged. Group and MRO margin up

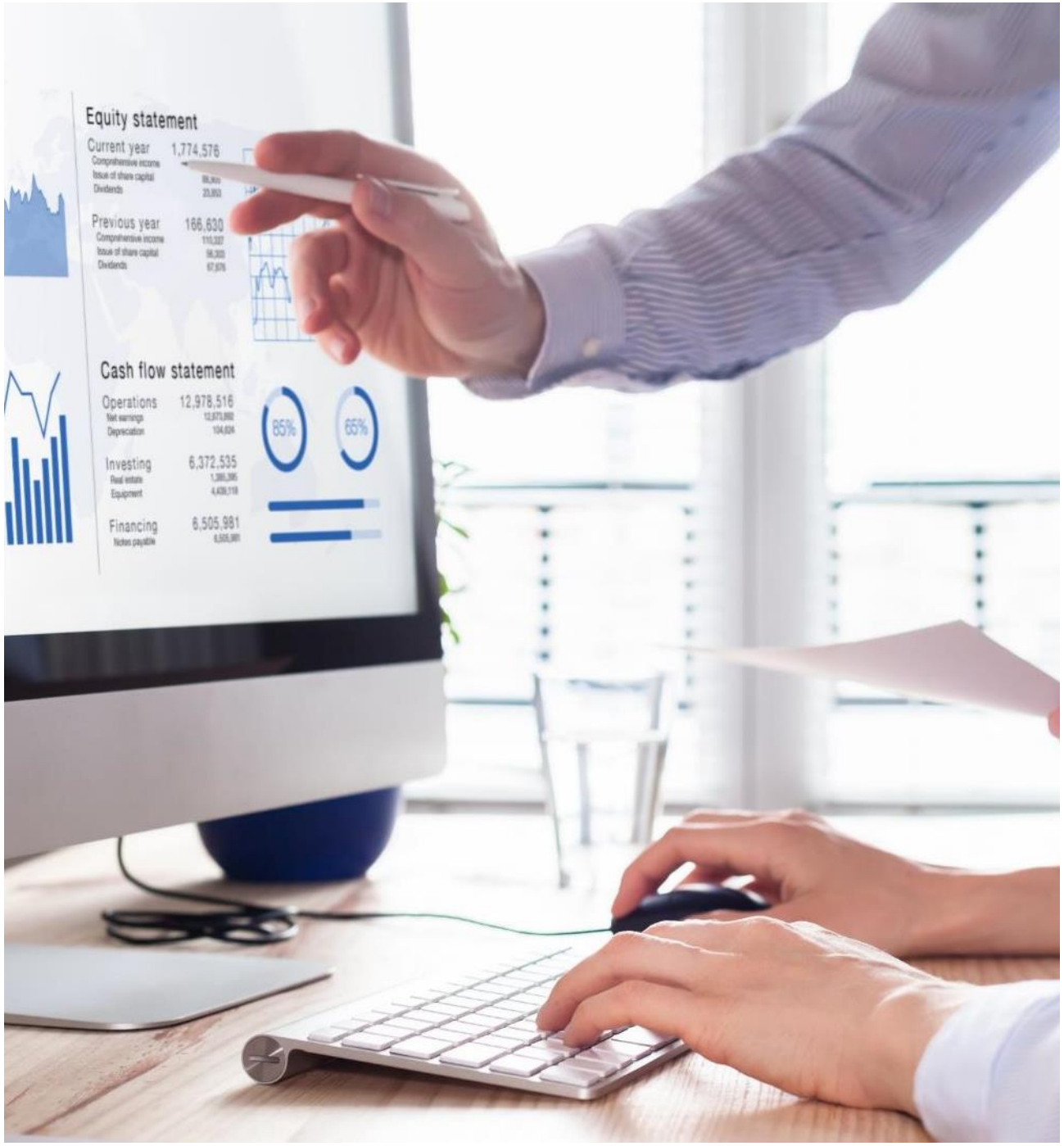
GTF, GEnx, GP7000

- OEM-MRO shopvisits will be presented in MRO segment only
- Revenues in OEM business and elimination line will be reduced
- Group revenues unchanged
- Restatement for 2018 with release of Q1 2019 results

Guidance 2018: Thereotical restatement would lead to less revenues, hence higher margin

	As reported	Assuming direct invoicing MTU-Z → IAE
Total Group Sales	**~ 4.4 bn€**	**~ 4.2 bn€**
Military	Stable	Stable
Commercial OE	Up ~ 30%	Up ~ 30%
Commercial Spares	Up low teens	Up low teens
Commercial MRO	Up mid twenties	Up mid twenties
EBIT adj.	**~ 660 m€**	**~ 660 m€**
EBIT adj. Margin	**~ 15%**	**~ 15.7%**

Guidance 2019



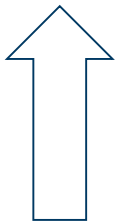
The year 2019:

Tailwinds will overcompensate headwinds from GTF growth

Ongoing strong growth of aftermarket (Com. Spares & MRO)

Military Business‘ growth re-initiated

Working Capital to grow less than revenues



Total OE losses to stabilize in 2019 despite continuous ramp-up

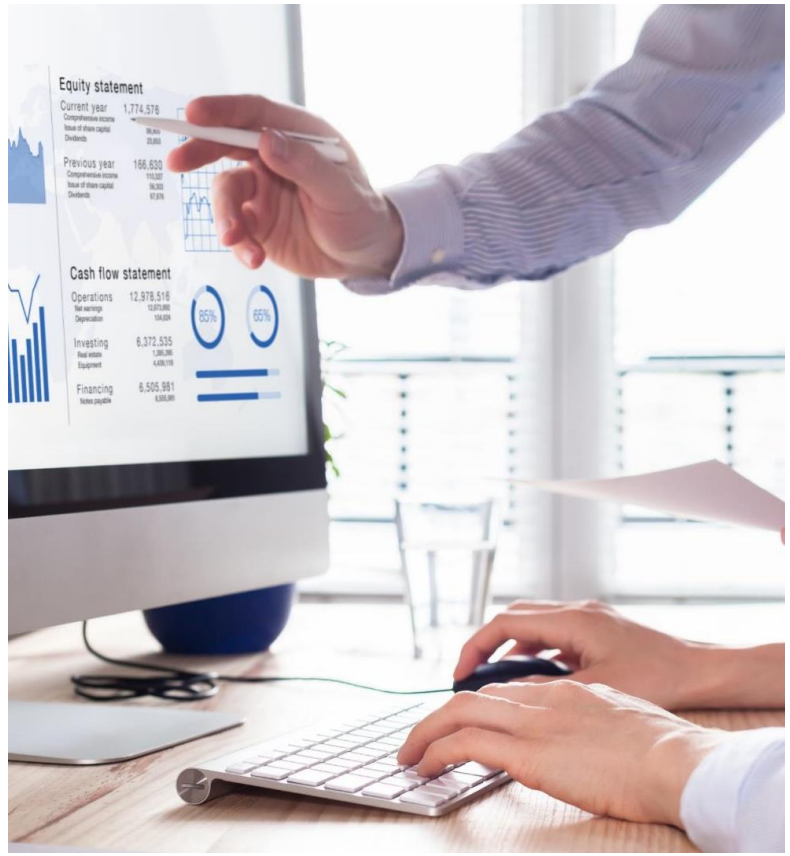
OEM-MRO cooperation business continues to grow in 2019 with limited profit contribution

Capacity ramp-up in both segments requires an increase in PPE

The year 2019: Further growth of EBIT adj. and Free Cashflow

2019 Main Drivers

Military	**+10%**
Commercial OE	**Low teens**
Commercial Spares	**Up mid to high single digit**
Commercial MRO	**Stable (Organically high single digit)***
EBIT adj.	**Stable Margin***
CCR**	**~ 50–60%**

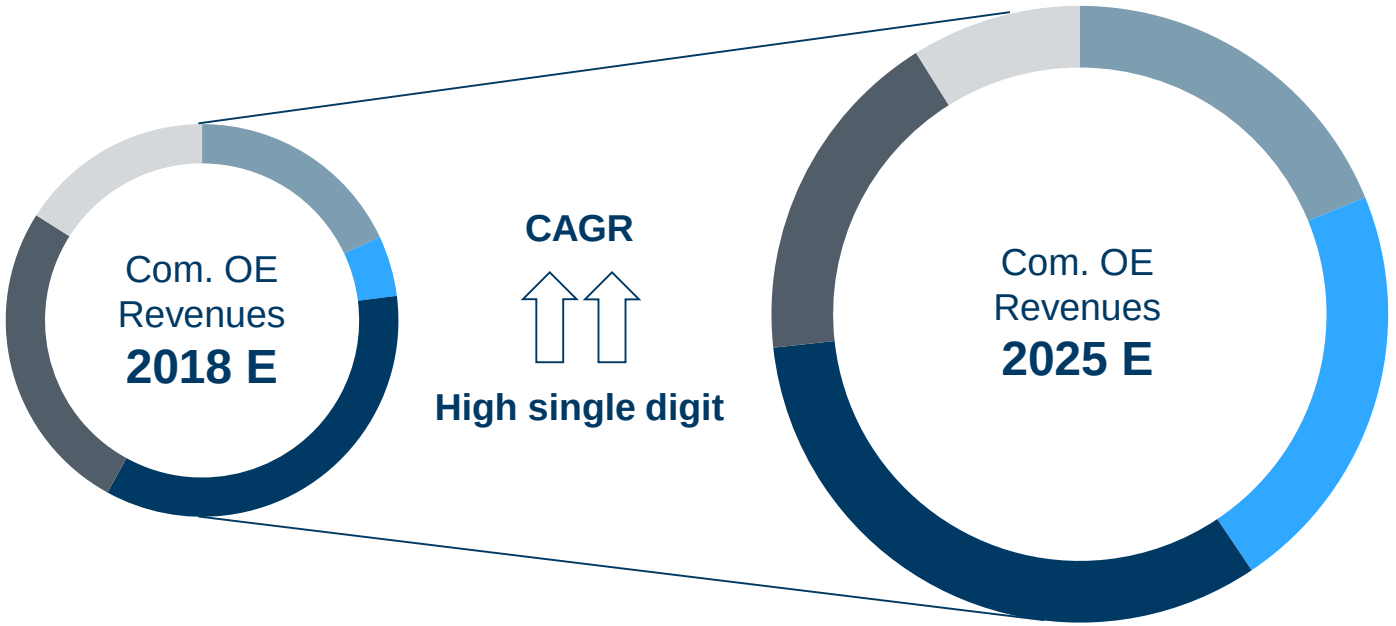


*) based on equal assumptions with IAE OEM-MRO shopvisits consolidated, see page 87
**) Cash Conversion Rate = Free Cashflow/Net Income adj.

Long term outlook

Increase in production rates continue to drive strong growth backed by order book

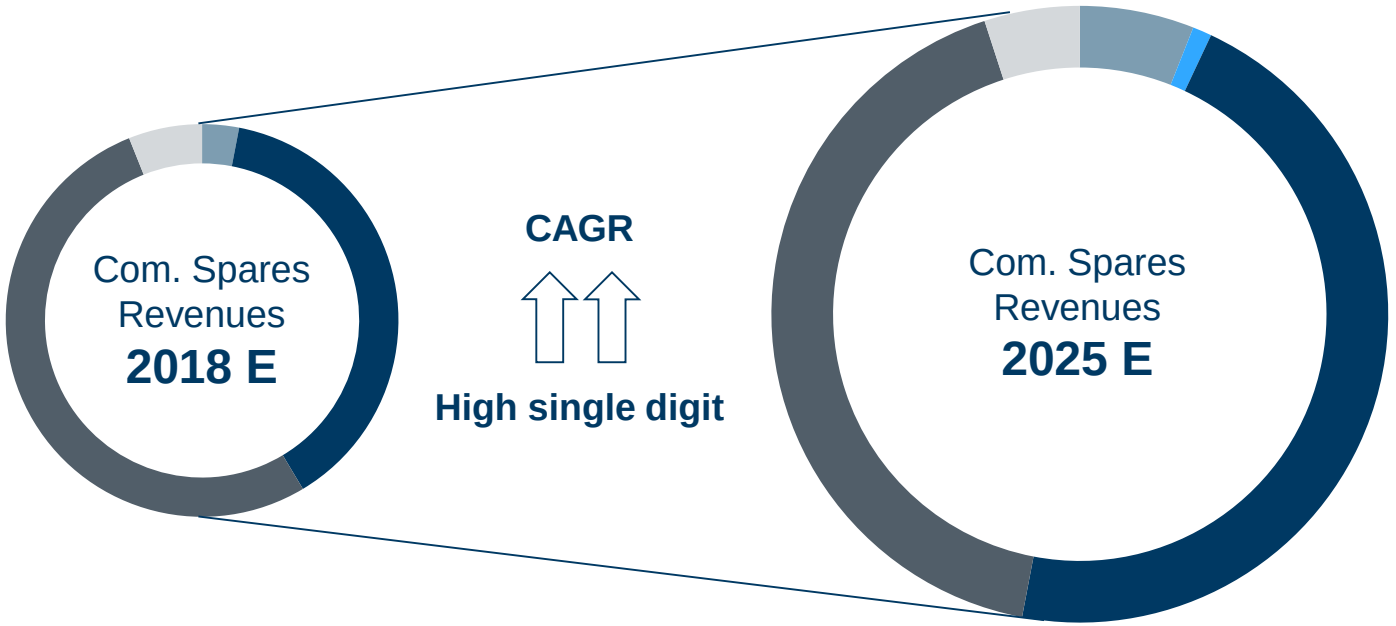
MTU Commercial OE Revenue Breakdown



- Business Jet shows a higher revenue share with IFRS15 implementation
- Regional Jet revenue contribution will gain importance
- Assuming rate 70 Narrowbody doubles & will remain most important
- GE9X will start to contribute to Widebody revenue early 2020s

Spare parts revenues growth driven by narrowbody engines

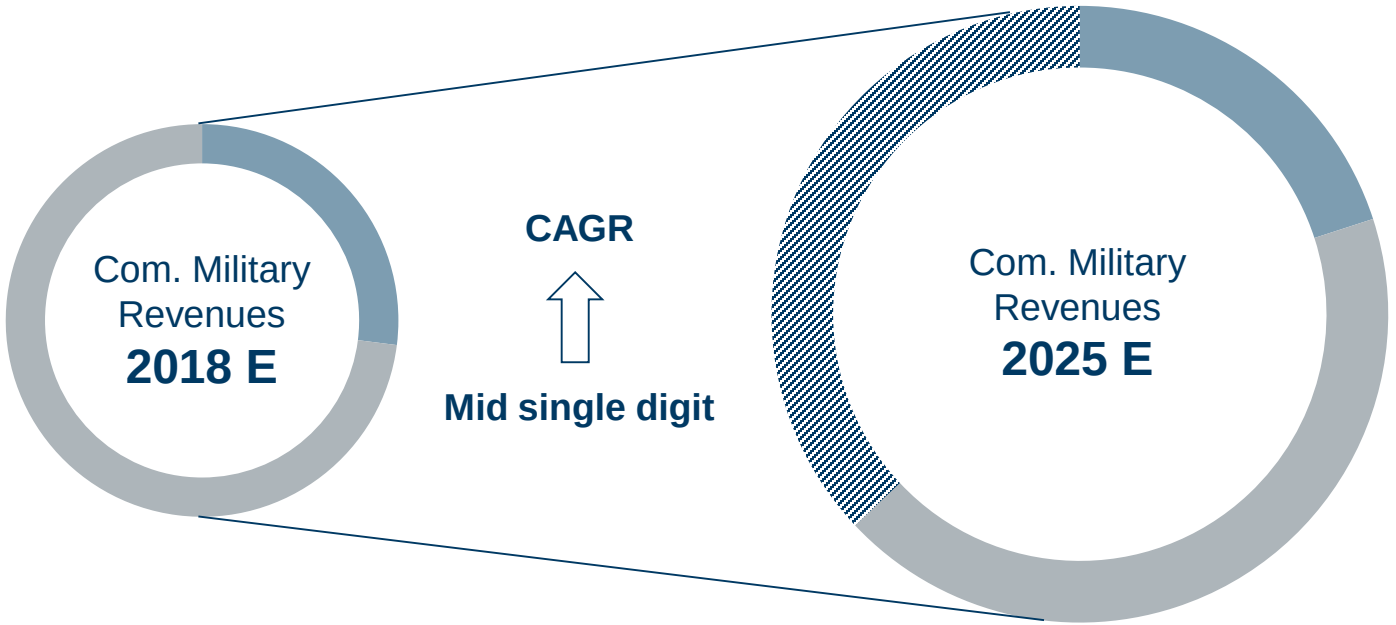
MTU Commercial Spares Revenue Breakdown



- V2500 contributes ~40% of spares revenues today and grows until mid 2020s
- PW1100G-JM starts to contribute 2020 onwards
- CF6-80 starts to decline early 2020s
- GEnx and GP7000 show steady growth and compensate decline of CF6-80
- PW2000 remains stable

Increasing likelyhood of campaign wins in military business leads to an improved outlook

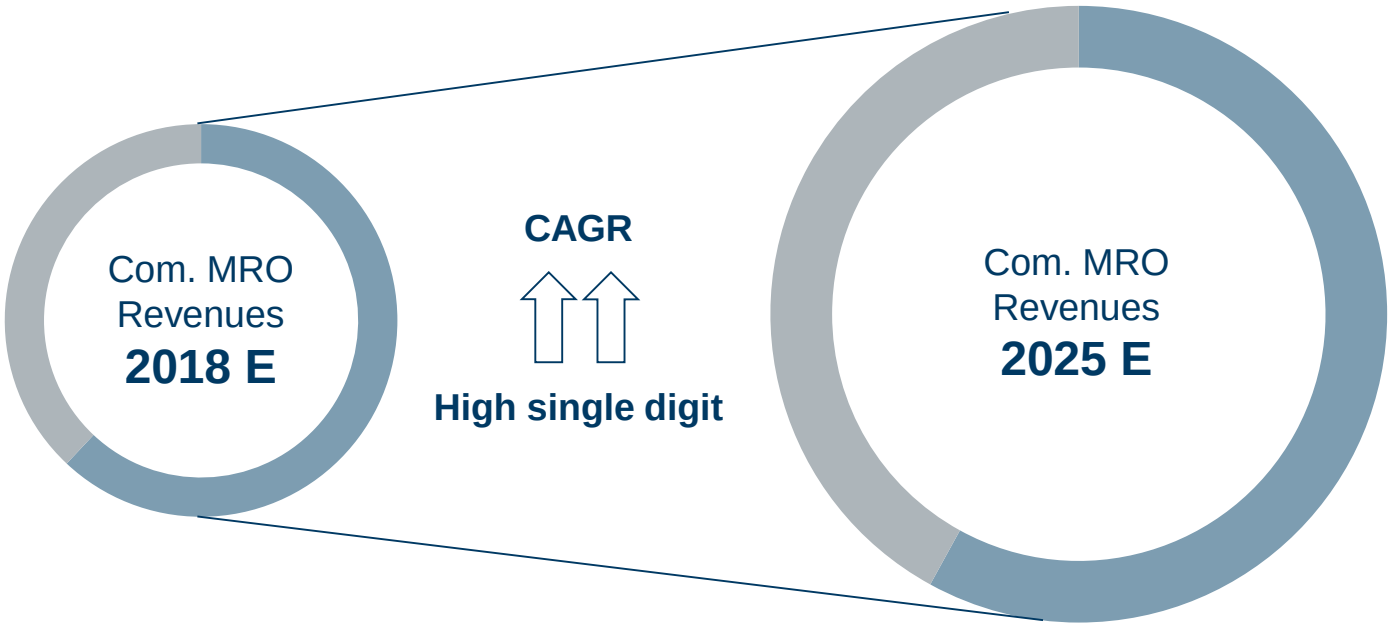
MTU military OEM revenue breakdown



- ~2/3 of today‘s revenues come from fighter engines EJ200 and RB199
- Military Revenue will grow towards ~600 m€ until 2025
- Underlying assumption are campaign wins for Eurofighter and the development of the next fighter engine

Both market segments within commercial MRO business will continue to grow strongly

MTU commercial MRO revenue breakdown



- Majority of newer engines sold by the OEM with flighthour agreements
- OEM-MRO cooperation workload secured through risk & revenue sharing agreement
- Strong independent MRO wins in the past years lead to an improved growth expectation
- Share of independent vs. OEM-MRO cooperation will remain stable

Long-term Outlook 2019–2025 Update

Improved Free Cashflow conversion confirmed despite ongoing capacity build-up

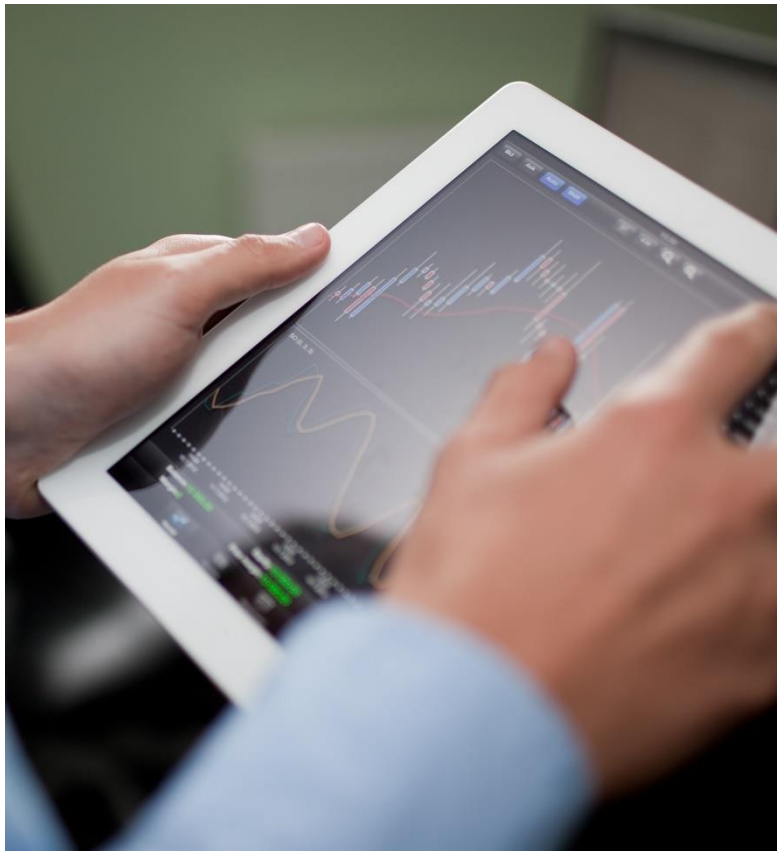
Net Income adj.	**Steady growth**	
Working Capital	**Growing less than revenues** • No consumption of prepayments • Inventory turns will improve • More FHAs with preferential Cashflow profile	
CF from investing	**Will decline moderately** • Less payments for intangibles • Mid-term higher spendings for capacity build-up (PPE) and automation • R&D capitalization declines as programs enter into service	
CCR*	**High double digit %**	

*) Cash Conversion Rate = Free Cashflow/Net Income adj.

MTU's target is a balanced leverage ratio in the range of 1 x net Debt/EBITDA

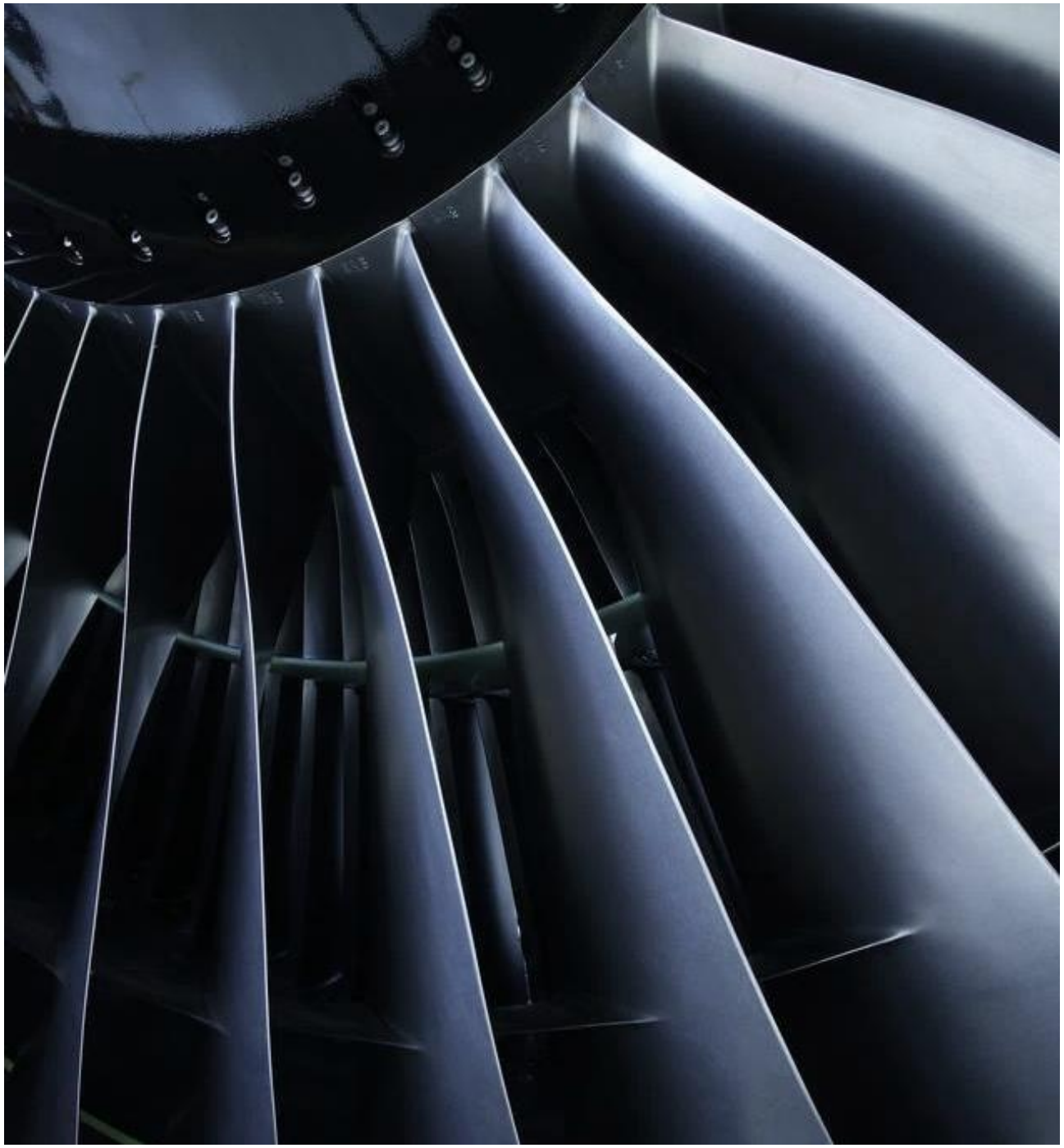
MTU's Cash Deployment Strategy

Prio	Instrument	2019–2025	
I	Investment in organic growth	Limited opportunities for new programs Ongoing spendings for capacity build-up	↘
II	Dividend deployment	Growth stronger than net income	↗
III	Share buyback programs	Instrument to limit deleveraging and manage dilution	↗
IV	M&A	No new targets expected	→



MTU Financials & Outlook: Ramp-up of cash conversion continues

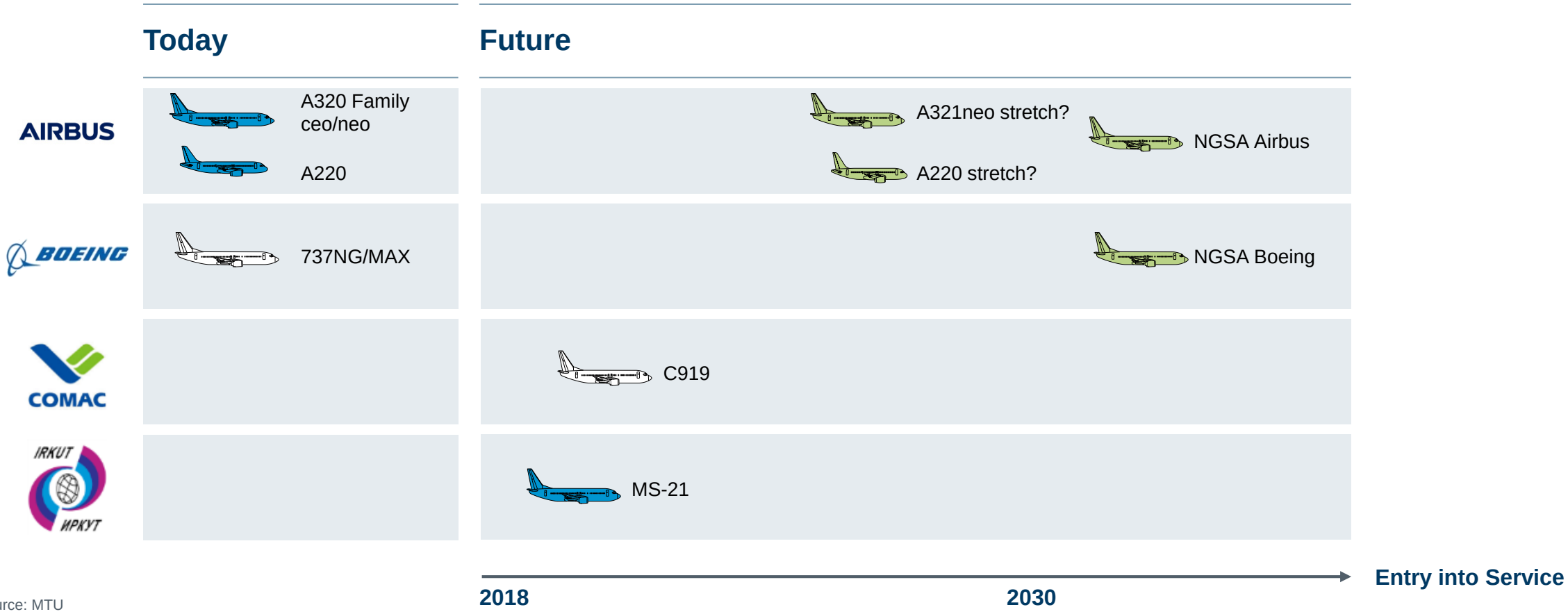
Q&A



Outlook & Summary

Reiner Winkler, Chief Executive Officer

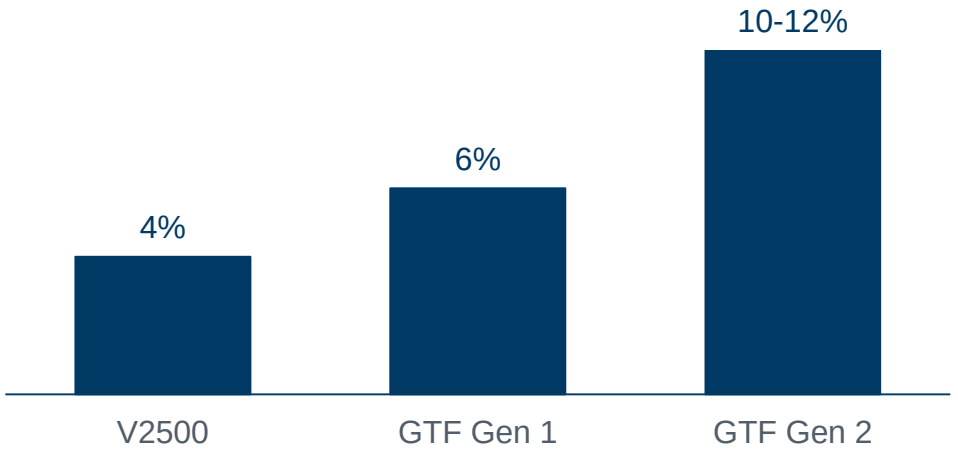
For the potential expansion of Airbus portfolio and the next generation of narrowbodies the GTF technology is very well positioned



Source: MTU

MTU is targeting up to 25% program share for the next generation of GTF engines

Increasing MTU share of narrowbody engine revenues



Program share	V2500	GTF Gen 1	GTF Gen 2
	16%	**18%**	**20-25%**

Building on success

- MTU has succeeded in growing its single-aisle revenues through A320neo, A220 and MS-21 applications
- MTU is targeting up to 25% share on Gen2 GTF
- Technology roadmap aligned and discussions with partner ongoing
- 25% program share would almost double MTU´s market share in a favorable dual-source scenario with Airbus and Boeing

In the widebody segment, MTU benefits from a positive outlook for CF6-80C, GEnx and GE9X

Source: MTU

Key Take Aways

Market indicators continue to outperform historical average

Ramp-up continues and requires ongoing investment into capacity and automation

Higher OE growth expectation in all thrust segments

Technology roadmap secures long-term market position and sustainability

Military business back on the rise

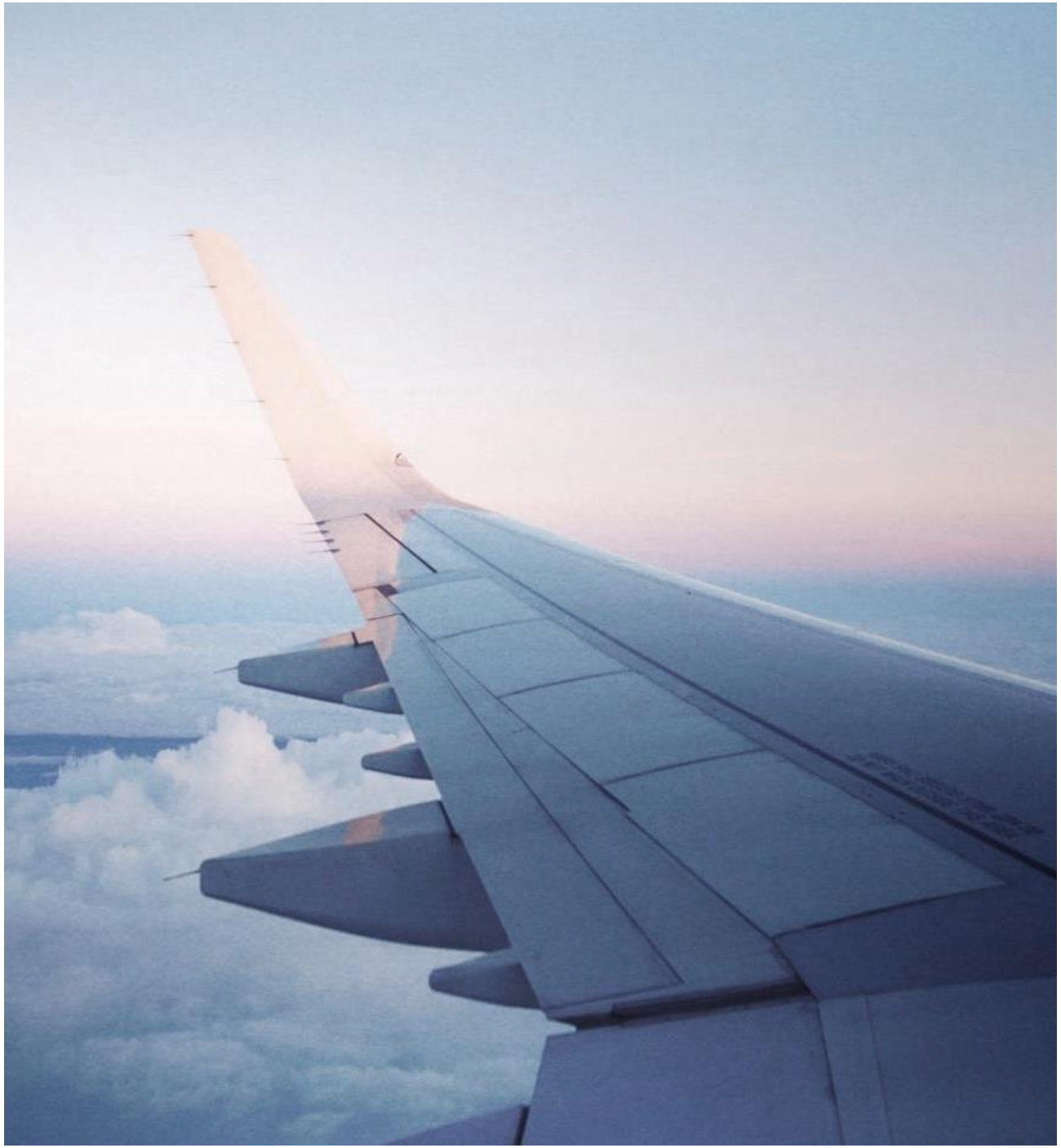
Ongoing growth of earnings and cash flow in 2019 and beyond

Aftermarket (spares and MRO) will continue its strong performance

Long-term guidance confirmed

Outlook & Summary

Q&A



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