

# ENABLING CO<sub>2</sub> REDUCTION

AMG TECHNOLOGIES  
CAPITAL MARKETS DAY JUNE 2019



AMG ADVANCED METALLURGICAL GROUP N.V.



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# AMG BUSINESS SEGMENTS



## AMG CRITICAL MATERIALS

AMG's conversion, mining, and recycling businesses

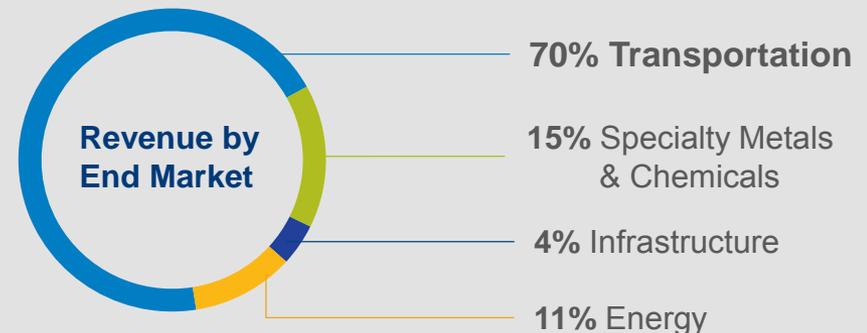
- Vanadium
- Superalloys (Chrome)
- Aluminum (Master Alloys)
- Mineração (Tantalum & Lithium)
- Antimony
- Graphite
- Silicon Metal



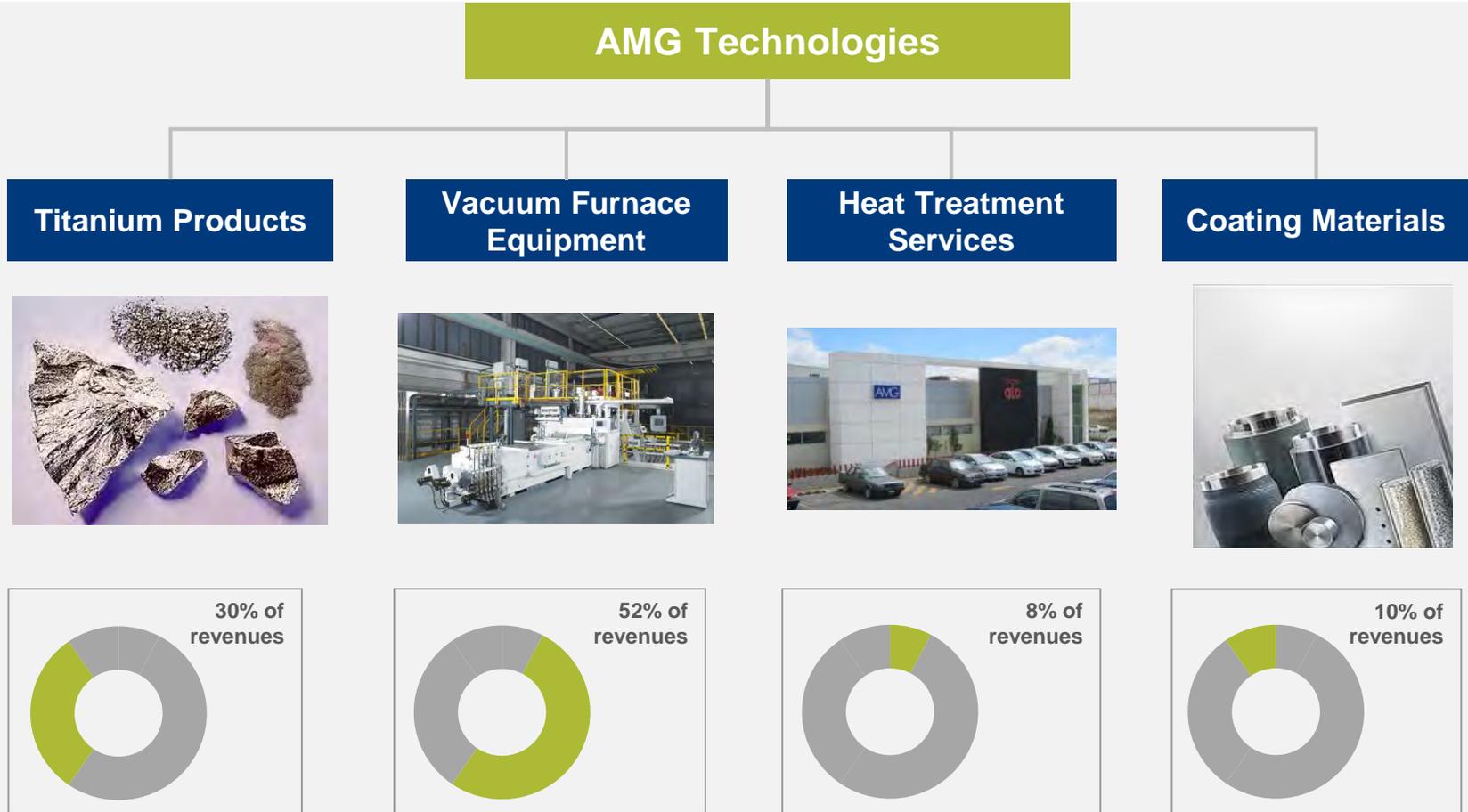
## AMG TECHNOLOGIES

AMG's titanium alloys, vacuum systems and services business

- Vacuum Furnace Equipment
- Titanium Products
- Coating Materials
- Heat Treatment Services



# AMG TECHNOLOGIES REVENUE SPLIT



AMG Technologies is leading supplier of equipment, materials and services to the transportation sector (primarily aerospace)

Note: Figures based on 2018 revenue split

# AMG TECHNOLOGIES REVENUE SPLIT

## AMG Technologies

### Titanium Products



**PREDOMINANTLY AEROSPACE**

30% of revenues



### Vacuum Furnace Equipment



52% of revenues



### Heat Treatment Services



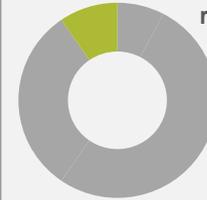
8% of revenues



### Coating Materials



10% of revenues



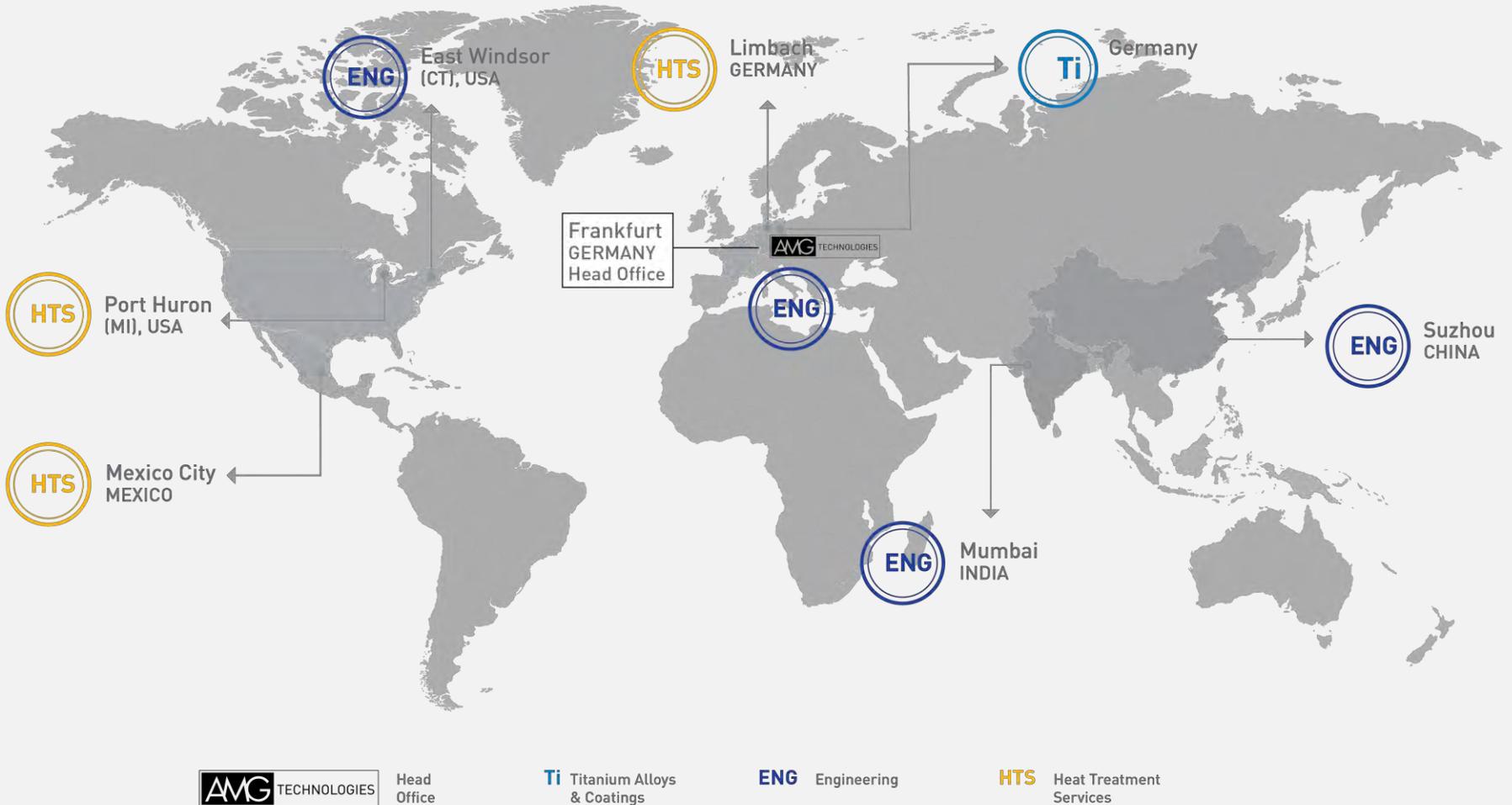
AMG Technologies is leading supplier of equipment, materials and services to the transportation sector (primarily aerospace)

## FINANCIAL SUMMARY – FY 2018 VERSUS FY 2017

AMOUNTS IN USD MILLIONS	FY 2018	FY 2017	% CHANGE
Revenue	<b>\$436.8</b>	\$367.8	19%
Gross Profit	<b>\$116.7</b>	\$90.0	30%
Gross Margin %	<b>26.7%</b>	24.5%	2%
EBITDA	<b>\$67.5</b>	\$45.5	48%
Capital Expenditures	<b>\$14.5</b>	\$16.7	(13%)
Return On Capital Employed (ROCE)	<b>26.1% *</b>	29.8%	(4%)
Order Intake (Vacuum Furnaces Operations)	<b>\$315.9</b>	\$290.4	9%
Order Backlog (Vacuum Furnaces Operations)	<b>\$241.4</b>	\$207.0	17%

\* IFRS 16 adjustments in 2018 results in lower ROCE due to capitalisation of operating leases

# AMG TECHNOLOGIES GLOBAL FOOTPRINT



Total headcount of approximately 1,350 staff employed across Europe, the USA, Mexico and Asia

# AMG TECHNOLOGIES – VALUE PROPOSITION

## **STRONG END MARKET FUNDAMENTALS**

Strong aerospace market is driving substantial growth for AMG Technologies, driven by both new aircraft build rates and new engine programs designed to improve fuel efficiency and reduce CO<sub>2</sub> emissions (i.e. LEAP engine platform)

## **INDUSTRY LEADING TECHNOLOGY SOLUTIONS AND PRODUCTS**

AMG Technologies offers industry leading technology solutions from the air inlet to the exhaust outlet of a modern aircraft engine

## **EXISTING PRODUCT PORTFOLIO AND NEW INNOVATIONS PROVIDE SIGNIFICANT OPPORTUNITIES FOR FUTURE GROWTH**

AMG Technologies' has developed market leading positions in a number of high growth aerospace applications, and continues to develop innovative solutions and products to drive future growth

**AMG Technologies has achieved an EBITDA CAGR of 44% since 2015**

# STRONG END MARKET FUNDAMENTALS

## DRIVING FINANCIAL GROWTH 2015 - 2018

**REVENUE** (IN MILLIONS OF US DOLLARS)



**CAGR:**  
11%

**GROSS PROFIT** (IN MILLIONS OF US DOLLARS)



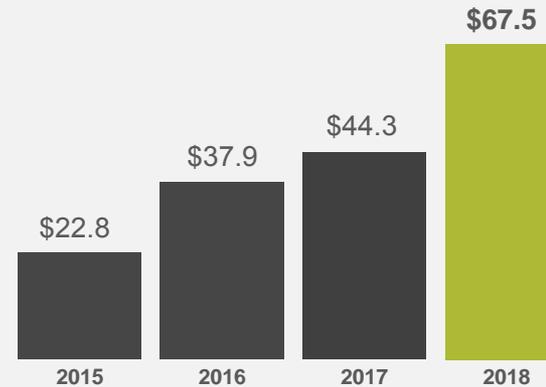
**CAGR:**  
22%

**ORDER INTAKE** (IN MILLIONS OF US DOLLARS)  
*AMG ENGINEERING ONLY*



**BOOK TO  
BILL RATIO  
OF 1.22X  
IN 2018**  
*AMG ENGINEERING  
ONLY*

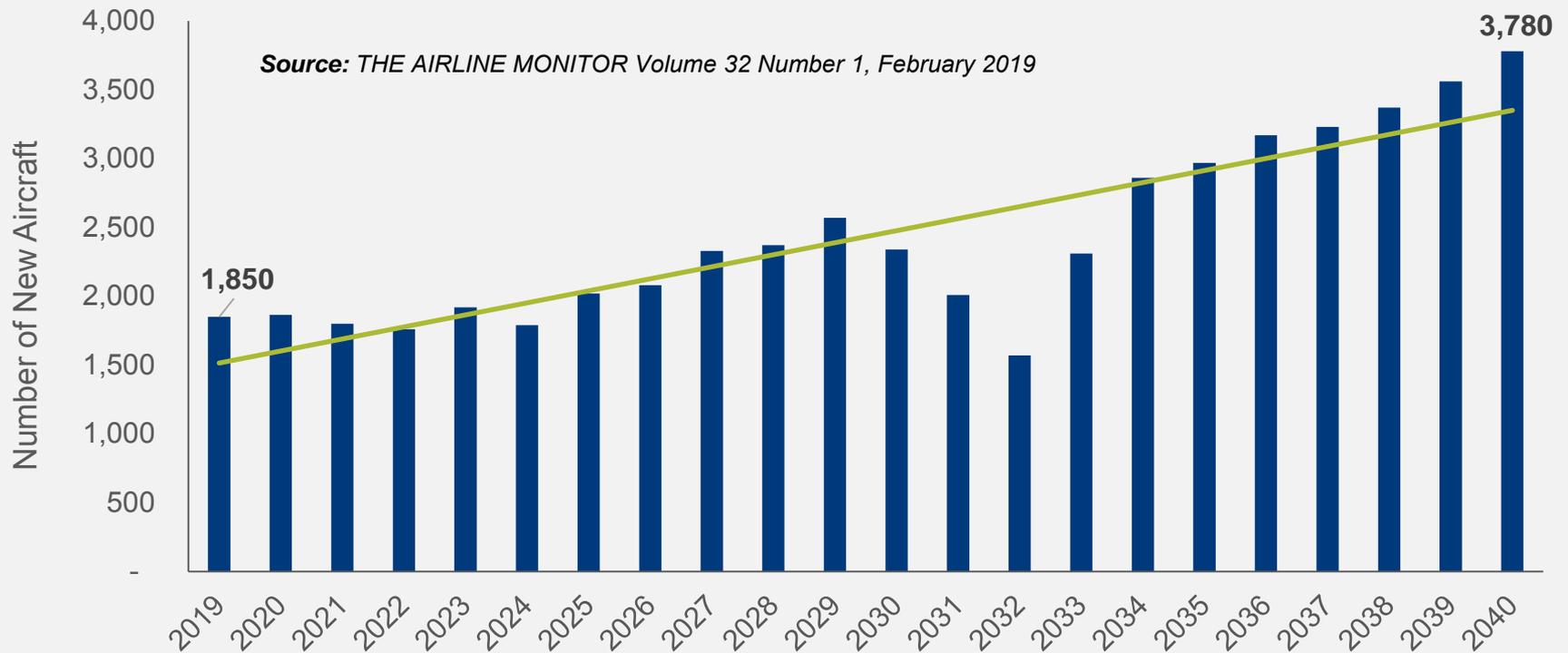
**EBITDA** (IN MILLIONS OF US DOLLARS)



**CAGR:**  
44%

# STRONG END MARKET FUNDAMENTALS

## FORECAST NEW AIRCRAFT DELIVERIES: AIRBUS AND BOEING



Underlying fundamentals point to continued growth in this critical end market

# STRONG END MARKET FUNDAMENTALS

## SUSTAINED GROWTH IN LEAP ENGINE PLATFORM THROUGH 2036



Boeing and Airbus new aircraft forecast as of October 2018 results in a total demand for LEAP 1A/B engines for single aisle aircraft of approximately 88,000 units

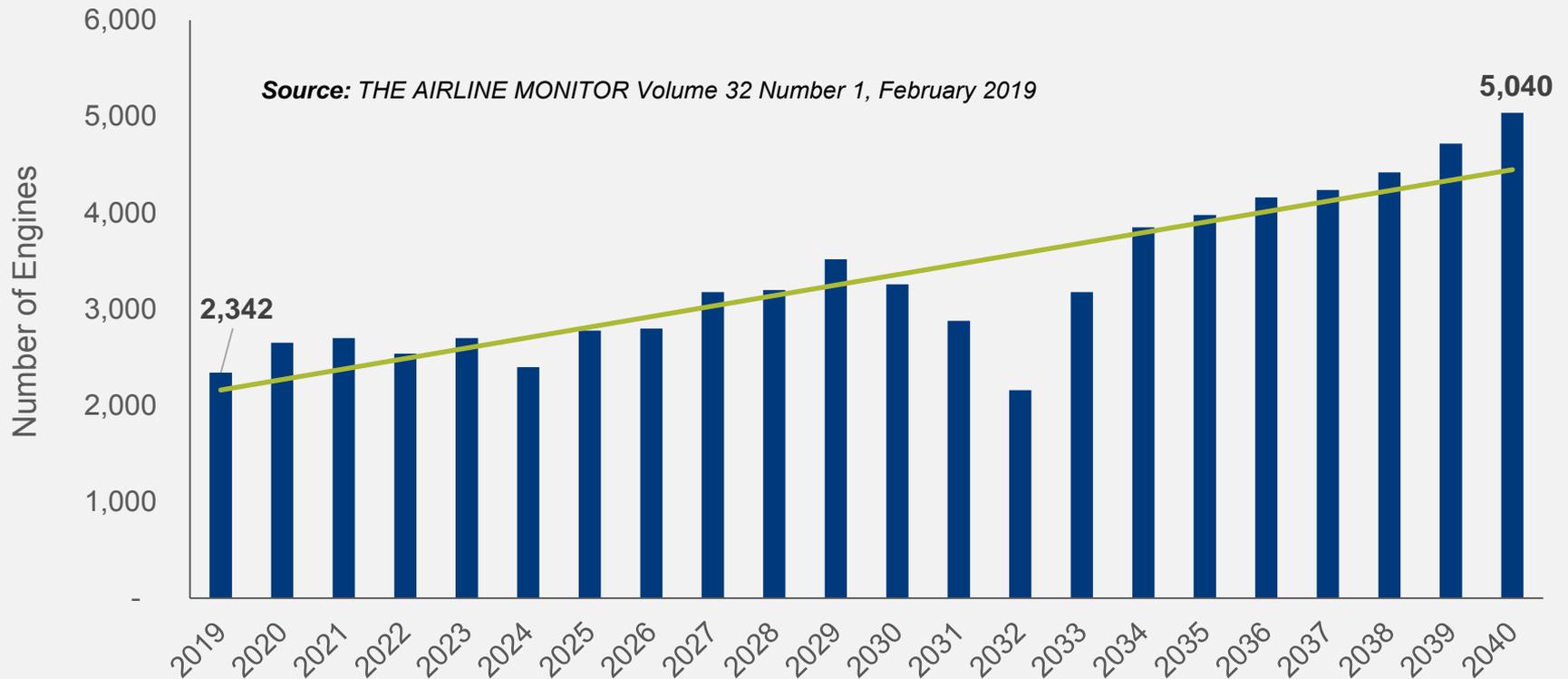


**37,740** new airplanes

Source:  
Airbus Global Market Forecast 2017 – 2036  
Boeing Current Market Outlook 2017 - 2036

# STRONG END MARKET FUNDAMENTALS

FORECAST ENGINE DELIVERIES: AIRBUS 320 NEO AND BOEING 737 MAX



Underlying fundamentals point to continued growth in this critical end market

# AMG TECHNOLOGIES – VALUE PROPOSITION

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# INDUSTRY LEADING TECHNOLOGY SOLUTIONS AND PRODUCTS

## SELECT TECHNOLOGY HIGHLIGHTS



- Vacuum melting technologies
- Thermal barrier coaters (world leader)
- Ceramic matrix composite (CMC) fiber coaters
- Powder atomization machines (Ti & Ni-based alloys)
- Heat treatment furnaces



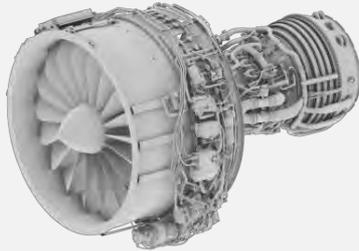
- Titanium Aluminides (world leader)
- Master alloys for titanium alloys
- Master alloys for Ni-based superalloys
- Physical vapor deposition (PVD) coating materials
- Hydrogen storage alloys for fuel cells

AMG Technologies offers technological solutions from the air inlet to the exhaust outlet of a modern aircraft engine

# INDUSTRY LEADING TECHNOLOGY SOLUTIONS AND PRODUCTS

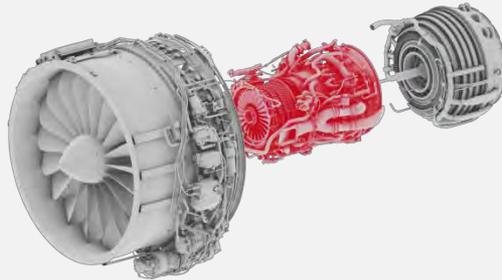
## AMG TECHNOLOGIES IN THE LEAP ENGINE

### Compressor Applications



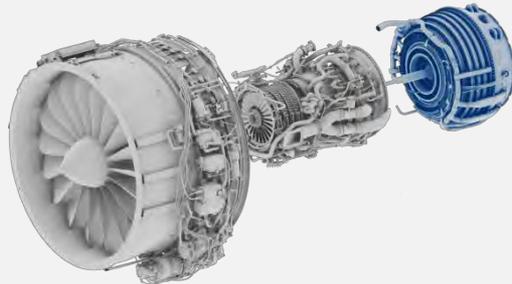
- Remelting Furnaces e.g. for Ti64
- Atomization Furnaces for Plasma Spray Powder, HIP'ed and Forged Parts
- Master Alloys for Ti Base Alloys
- Plasma Melting Systems for Ti Base Alloys

### High-Pressure Turbine & Combustion Section



- Equipment for CMC Shrouds
- EB-PVD Coaters for Thermal Barrier Coatings
- Hot Isothermal Forging Systems for Superalloy Disks
- VIM Furnaces for Ni Base Superalloys
- Master Alloys for Ni Base Superalloys

### Low-Pressure Turbine



- Hot Isothermal Forging Systems for Ni-based alloys
- Plasma Melting Systems for Titanium Aluminides
- VAR and VIM Furnaces for Titanium Aluminides
- Titanium Aluminide Feedstock for Blades

# INDUSTRY LEADING TECHNOLOGY SOLUTIONS AND PRODUCTS

## AMG IS THE GLOBAL LEADER IN TITANIUM ALUMINIDES

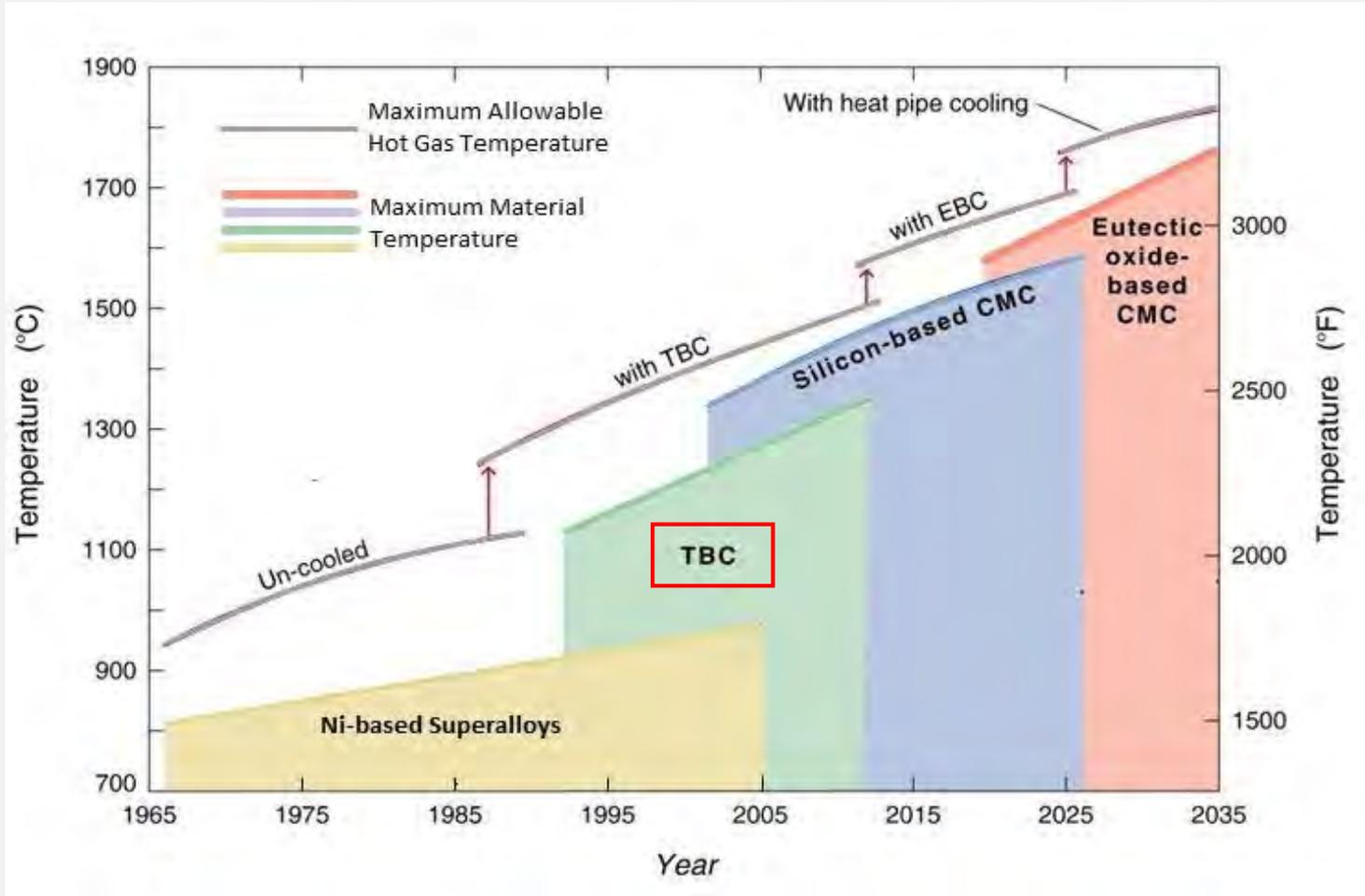
Titanium Aluminide can replace Nickel based materials in the final stages of the low pressure turbine (LPT)

As demonstrated below, two titanium aluminide blades on the right side of the scale weigh less, combined, than a single Nickel based alloy blade



# INDUSTRY LEADING TECHNOLOGY SOLUTIONS AND PRODUCTS

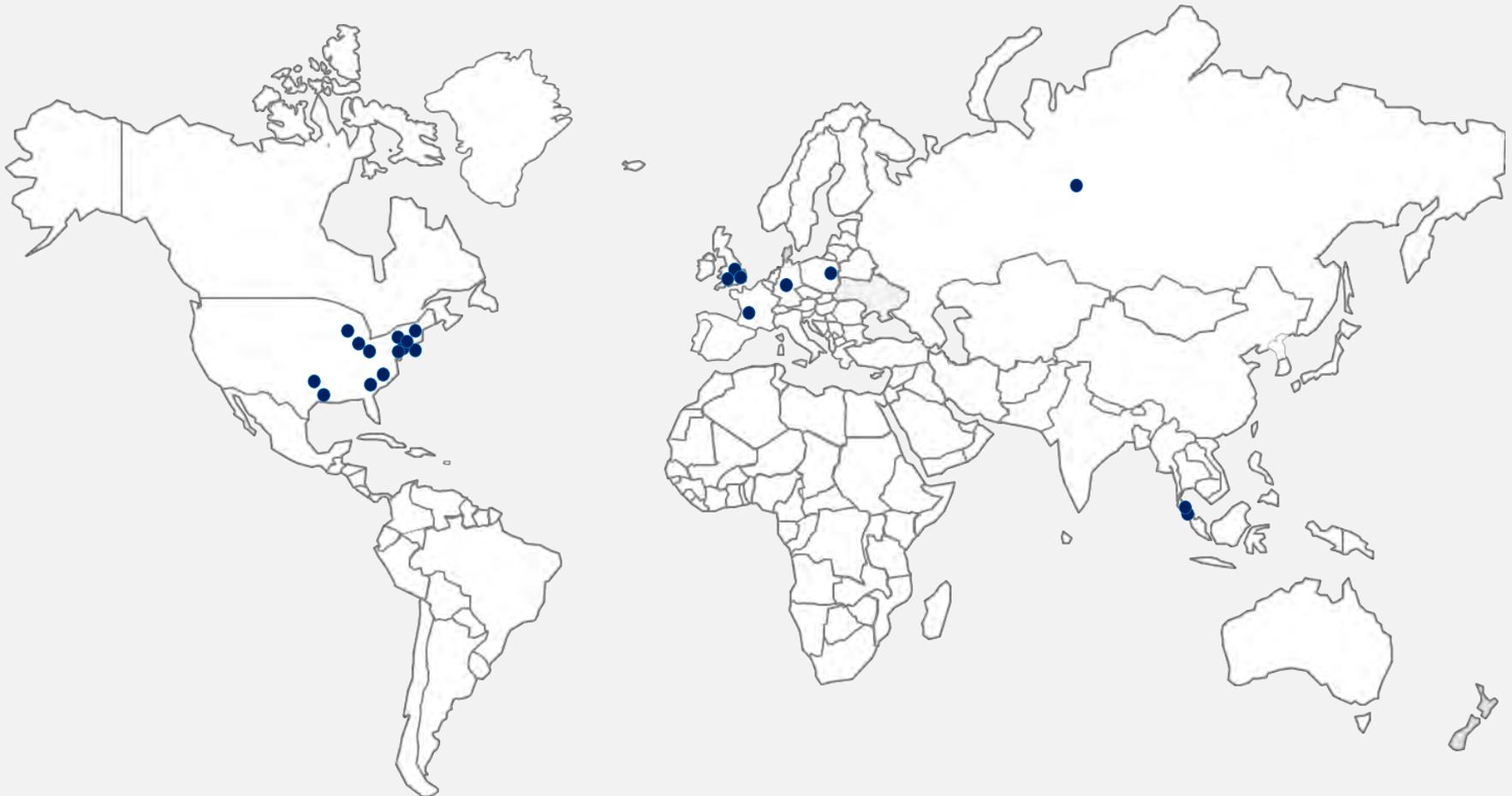
## THERMAL BARRIER COATING REVOLUTION



# INDUSTRY LEADING TECHNOLOGY SOLUTIONS AND PRODUCTS

## THERMAL BARRIER COATING (“TBC”)

AMG is the Global Leader in TBC Technology, with 23 of the 24 advanced TBC systems in operation globally developed by AMG



# AMG TECHNOLOGIES – VALUE PROPOSITION

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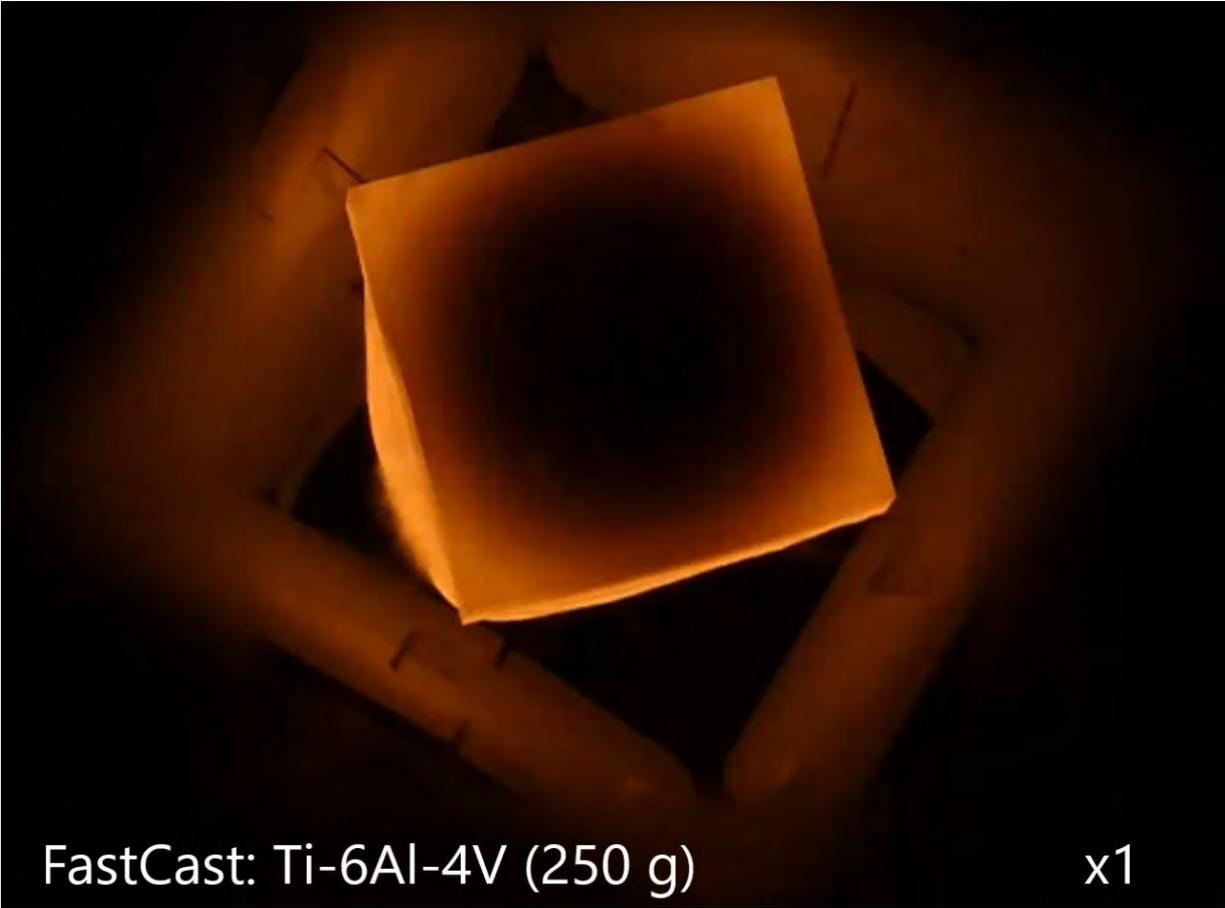
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# INNOVATIONS DRIVING FUTURE GROWTH

- **Ceramic Matrix Composite (CMC) fiber coater** – development of next-generation aerospace coating technology, permitting higher turbine temperatures while achieving significant weight reductions
- **Additive manufacturing** – powder production and innovative 3D printing technology equipment, capable of producing larger components
- **FastCast** – new, proprietary casting technology which significantly improves yield in the casting process (e.g. low pressure turbine blades for aero engines)

# FASTCAST IN OPERATION



FastCast: Ti-6Al-4V (250 g)

x1

# HEALTH AND SAFETY FOCUS

## SAFETY INDICATORS

At the end of Q1 2019, lost time incident rate and total incident rate were down 27% and 33%, respectively, from Q1 2018.

12 MONTHS ENDING	LOST TIME INCIDENTS IN THE LAST 12 MONTHS	12 MONTH AVERAGE LOST TIME INCIDENT RATE	12 MONTH AVERAGE TOTAL INCIDENT RATE
Q1 2018	9	0.91	1.41
Q1 2019	7 	0.66 	0.94 



Rigorous commitment to safety reflected in continually improving safety records

