LRT CAPITAL MANAGEMENT

MTU Aero Engines (MTX.DE)

Investment Memo

Date: 6/11/2020; Closing stock price: €154.4 (EUR)

Overview

MTU Aero Engines ("MTU") operates in the aerospace engine market as an engine sub-system supplier and an independent provider of maintenance, repair, and overhaul services (MRO). MTU's business is broken down into three divisions – commercial OEM business, military OEM business, and commercial MRO business.

MTU's revenues are split 40/60 between new engine manufacturing and MRO services, respectively. The company possess significant competitive advantages, operates in an industry which has historically grown faster than global GDP and is lead by a management team that has a long track record of intelligent capital allocation. The company's relatively high ROIC is underpinned by extremely high barriers to industry entry, a very long cash conversion cycle and decades of R&D knowhow that help limit the intensity of industry competition. Since the beginning of the year, MTU's share price is down over 40%, representing a compelling opportunity for investors willing to have a longer-term view of the industry's growth prospects beyond the current Coronavirus induced uncertainty.

Contents

Company History

MTU has a rich history in producing airplane engines. It started from military engines in the first 40 years and then participated in developing commercial engines and Maintenance, Repair and Overhaul ("MRO") business in its second 40 years.

Stage 1: From military engine to commercial engine

1934 - The company was founded as BMW Flugmotorenbau[1] GmbH which was spun-off from BMW

1940 - The plant was expanded significantly to start large-scale production of BMW 801 aircraft engines, which powered for instance the Focke-Wulfe FW 190 fighter aircraft (Würger)

1945 - After WWII, U.S. troops occupied the factory as a U.S. Army vehicle and artillery repair shop

Late 1950s - the company resumed engine production under license agreements

1971 - MTU invaded the commercial engine market as a subcomponent manufacturer in the CF6-50 engine powering the Airbus A300

1979 - Growing demand for MRO services caused MTU to form its maintenance segment

Stage 2: Participate in engine programs and expand MRO capacities

1980s - Took stake in V2500[2], EJ200[3], MTR390[4], etc. programs

1990s - Launch of MTU Maintenance in Berlin-Brandenburg and Malaysia

2000s - Entered into a commercial core engine by providing high-pressure compressor (HPC) and low-pressure turbines (LPT); Launch of MTU Aero Engines Polska; Took stakes in the GEnx[5]; launch of MTU Maintenance with China Southern Airlines in Zhuhai, China

2011 - MTU took an 18-percent stake in the PW1100G-JM, the first engine selected to power the A320neo; Launch of MTU Maintenance Dallas

2014 - Participated in the GE9X engine for the new "Triple Seven"

2017 - Set up a joint maintenance company for Geared Turbofan™ engines in Rzeszów, Poland

2018 - Expand capacities in Canada, Poland and Berlin-Brandenburg

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[1] German, means aircraft engine construction

[2] The IAE V2500 is a two-shaft high-bypass turbofan engine which powers the Airbus A320 family (A320, A321, A319 and the Airbus Corporate Jet), the McDonnell Douglas MD-90, and the Embraer KC-390.

[3] The Eurojet EJ200 is a military low bypass turbofan used as the powerplant of the Eurofighter Typhoon.

[4] The MTU Turbomeca Rolls-Royce MTR390 is a turboshaft developed for light helicopter applications by MTU Turbomeca Rolls-Royce.

[5] The General Electric GEnx ("General Electric Next-generation") is an advanced dual rotor, axial flow, high-bypass turbofan jet engine in production by GE Aviation for the Boeing 787 and 747-8.

Growth Profile / Opportunity

Air traffic

Traffic is measured by Revenue Passenger Kilometers (RPK), which is calculated by the sum of kilometers each passenger traveling in a year. In the last two decades, the growth of traffic is twice as growth of GDP world widely. From the figure below, there are two recessions: 1) "9/11" & SARS; 2) Financial crisis. Now, we're under Coronavirus pandemic, another aerospace recession, and the International Air Transport Association (IATA) released updated analysis showing that the COVID-19 crisis will see airline passenger revenues drop by $314 billion in 2020, a 55% decline compared to 2019[i].

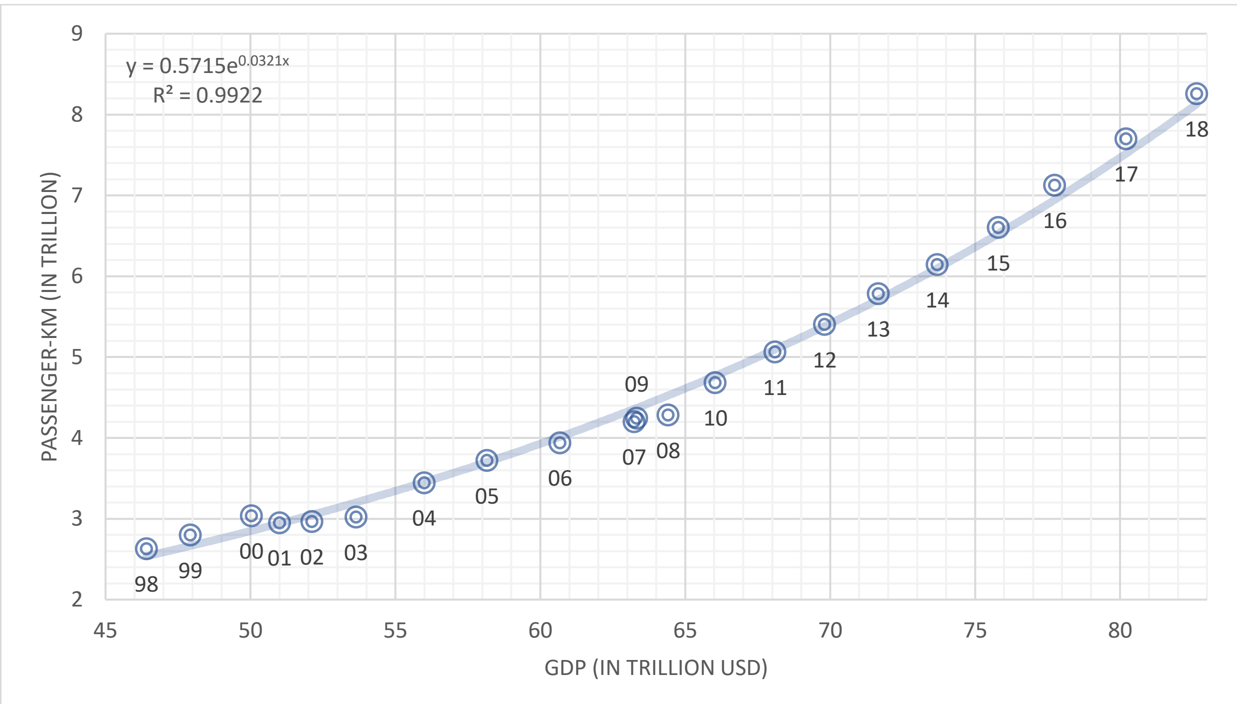


Figure 1 World passenger traffic and GDP[ii]

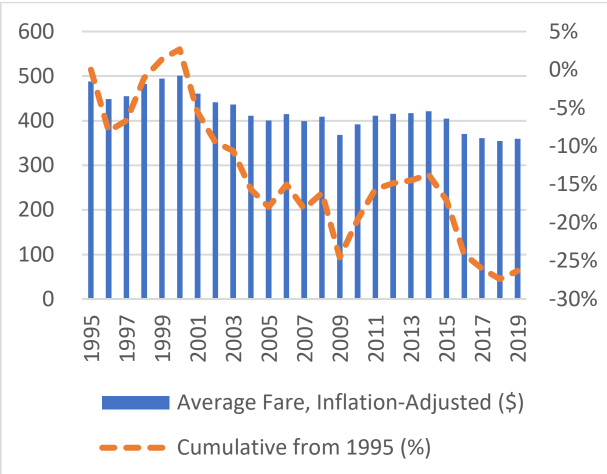
Regionally, all the traffic growth rates are stronger than GDP. In Asia and Pacific, an emerging market, its traffic-to-GDP ratio is 1.6x. At the same time, the traffic growth of mature markets, such as North America and Europe, are much higher than their GDP growth rates.

Table 1 Median traffic growth to GDP growth ratio by continent, 2007-2018

	Europe	Africa	Middle East	Asia and Pacific	North America	Latin America
RPK in 2018, in billion	2,175	176	758	2,871	1,852	424
Passengers per capita	1.52	0.08	0.98	0.38	1.99	0.47
Traffic growth rate (Median)	6.3%	5.8%	10.7%	9.4%	3.6%	7.7%
Real GDP growth rate (Median)	1.7%	3.7%	3.0%	5.7%	2.1%	2.1%
Median traffic to GDP ratio[6]	3.9 x	1.0 x	4.5 x	1.6 x	1.7 x	3.6 x

[6] Median of traffic growth rate to GDP growth rate ratio which is calculated each year from 2007-2018

More and more people choose to travel by airplane – a trend underpinned by the fact that ticket prices in real terms are at all time lows. Passengers per capita doubled in the last two decades. One reason for low fares is the use of new and more efficient jet engines.



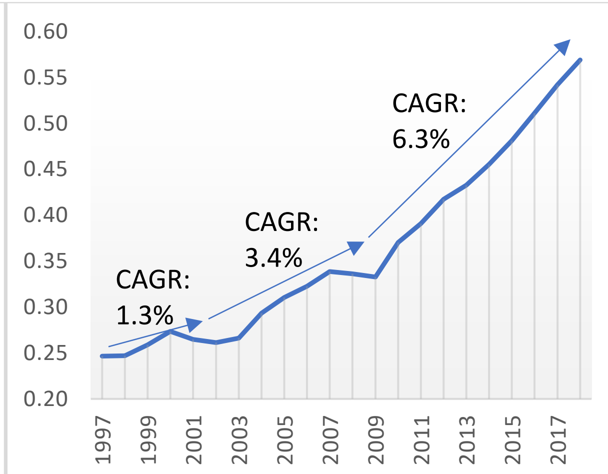


Figure 2 Annual U.S. domestic average itinerary fare

Figure 3 World passenger per capita

Opportunities in emerging markets

As air traffic is highly correlated with GDP, the opportunity in emerging markets cannot be overlooked. Boeing forecasts the growth rate of traffic, fleet and services in Asia-Pacific are 5.5%, 4.6% and 5.1%, respectively in next two decades. Airbus's forecast for traffic growth is 5.4% in Asia-Pacific. We believe the Coronavirus pandemic will only temporarily affect the demand for air travel, with the long-term trend of RPKs growing faster than GDP reasserting itself over the next twelve months. The figure below speaks to the enormity of the growth opportunity for travel in Emerging Markets.

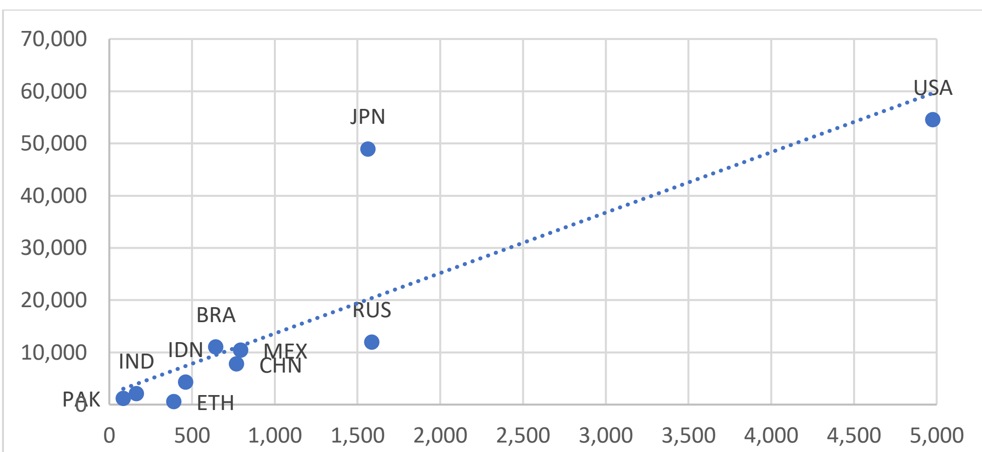


Figure 4 GDP per capita (Y in $) and RPK per capita (X) for top 10 populations[7]

[7] GDP, constant 2010 USD; USA: United States; JPN: Japan; RUS: Russian Federation; MEX: Mexico; CHN: China; BRA: Brazil; IDN: Indonesia; ETH: Ethiopia; IND: India; PAK: Pakistan

Increasing stake in engine programs

The market that MTU operates in has historically grown faster than GDP and within this fast growing market MTU continues to take market share by increasing its stake of many important risk and revenue sharing partnership (RRSP) with other OEMs or sub-system suppliers.

For a jet engine maker, it is crucial to be part of a successful engine program – a decision made by the aircraft companies (predominantly Airbus and Boeing). As the figure below shows, MTU has significant shares between 6% and 21% in many of the most important Narrow and Widebody engine programs which provides high visibility on the future OEM revenue development[iii].

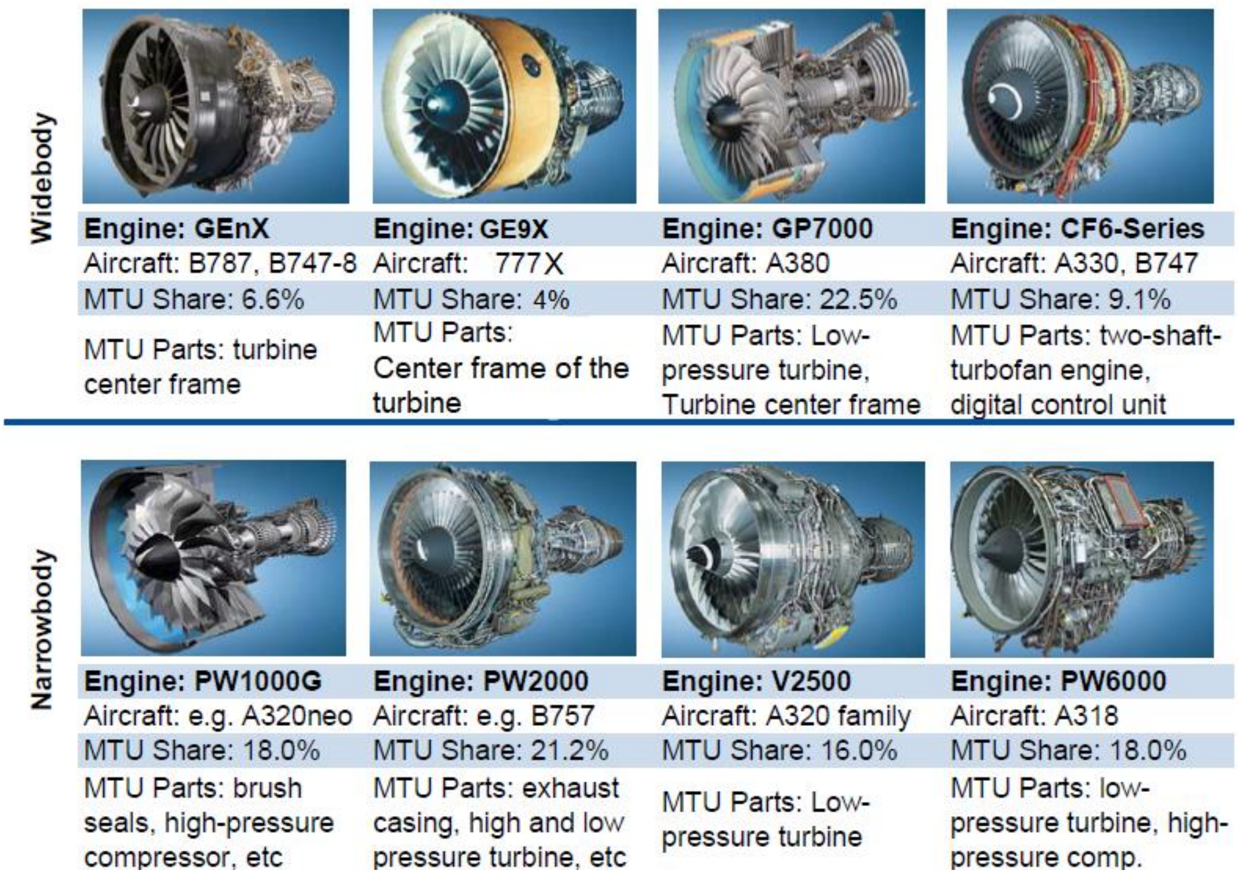
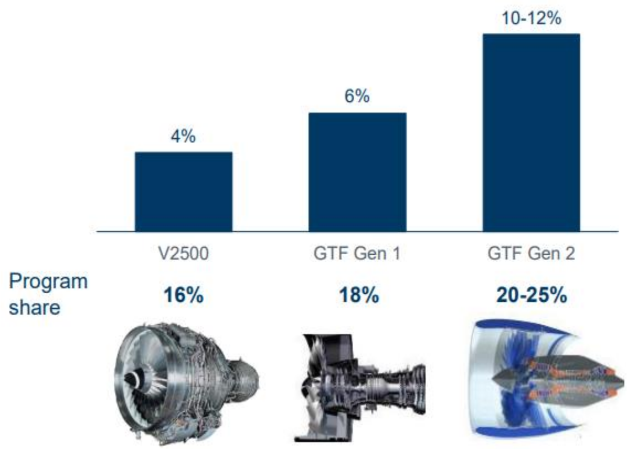


Figure 5 MTU's shares in major civil engine programs

The group is currently stepping up from a former 9-12% typical involvement to a figure in the range of 14-18%. On the widebody programs, MTU's highest stake in the past used to be on the PW2000, with a 21.5% stake. The program was ended in 2005 and since then the GP7000 for the A380 has taken over the position with a 22.5% stake. The ramp-up of this aircraft will further push new engine sales[iv].

MTU has succeeded in securing future revenue from the fast growing single-aisle airplane market. The PW1000G engine, codeveloped with Pratt & Whitney is one of the two engine options powering the A320neo – the fastest selling airplane in the history of the world. Moreover, MTU is targeting up to 25% share on Gen2 GTF.



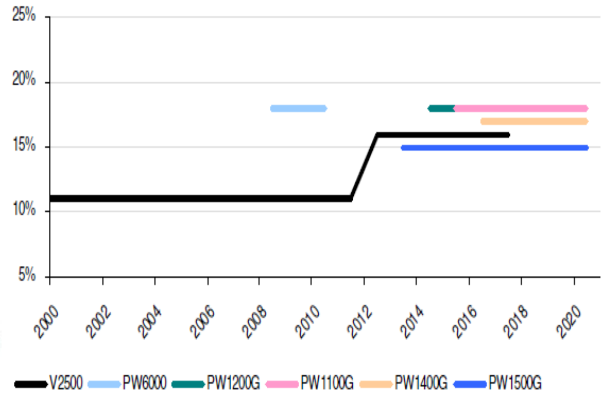


Figure 6 Program share for V2500/GTF engines

Figure 7 MTU stake in narrow engine programs

GTF engines opportunities

Geared Turbofan Engines ("GTF") are developed in conjunction with Pratt & Whitney (one of the largest engine OEMs) and entered series production in early 2016 for Airbus A320neo. The GTF reduces fuel consumption – decreasing carbon dioxide emissions by ~16% compared to engines like the V2500. The GTF engine powers five aircraft platforms, with the Airbus A220, the Airbus A320neo family, and Embraer E190-E2 already in commercial service.

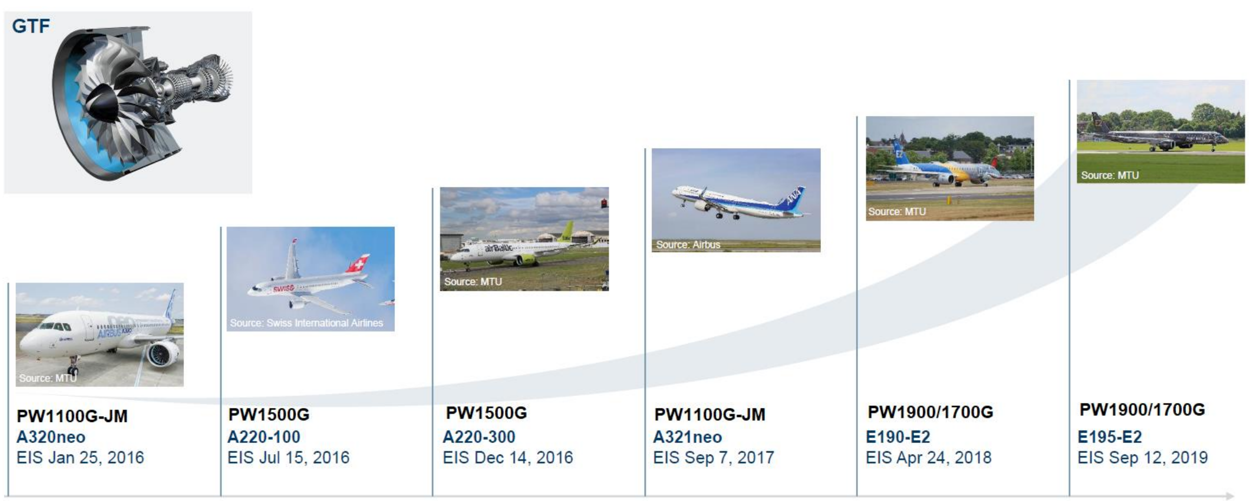


Figure 8 GTF powered aircrafts

PW1100G-JM powering the A320neo will be the key revenue driver in coming years. PW1100G-JM (A320 family) covers roughly 55% of the total GTF order book. At the end of April 2020, ~1,300 A320neo family jets have been delivered with ~7,400 remaining in the backlog. The A320neo is dual engine – offering both the GTF and the LEAP-1 engine made by CFM (a joint venture of Safran and GE). As the decided order book of the A320neo family, 3,027 orders chose LEAP engine by Safran, while 2,066 orders chose GTF engine. In other words, ~40% of the orders selected PW1100G-JM as their engines for A320neo family jets.

We believe that the GTF taking "only" 40% of the orders on the A320neo reflects the perceived risk and uncertainty of this new engine type. The GTF is after all a completely new design architecture, while the

LEAP-1 engine uses a more traditional engine setup but pushes the limits of material science to achieve extremely high pressures and temperatures which aid engine efficiency. However, it may be the case that the LEAP-1 engine represents the limits of efficiency that can be achieved in this design paradigm, with further engine efficiency gains coming for optimizing the GTF design. Royce Rolls, for example, is currently working its next generation of engines which it calls the "Ultrafan" – itself a GTF design. If the GTF is in fact the breakthrough needed to achieve higher engine efficiency, we would expect the share of the GTF engines to grow on future airplane models.

PW1500G is also the exclusive engine option designed for the A220 family (former Bombardier C-Series regional jet) – delivering ~20% lower fuel burn per seat than previous generation aircraft, half the noise footprint, and decreased emissions. As of April 2020, Airbus received 755 orders, delivering 113 of them.

Embraer's E190-E2 and E195-E2 chose PW1900/1700 as their engines. At the end of 2019, the company received 171 orders of these two jets.

Table 2 GTF engine breakdown by aircraft

Breakdown by aircraft	**A220-100**	**A220-300**	**A320neo**	**A321neo**	**E190-E2**	**E195-E2**
Orders	94	548	3948	3413	27	144
Deliveries	40	73	961	326	11	7

MTU estimates that the GTF engine fleet will increase to ~15,000 in 2030 – backed by the strong demand of the A320neo GTF engine. MTU will benefit from the strong demand of narrow-body jets over the course of the next few decades. Since Airbus has now surpassed Boeing in the narrow-body and regional jet market, MTU's GTF exposure will continue to gain MRO revenue as sales increase. MRO revenue is relatively predictable and high margin, allowing for revenue and profit visibility many years into the future.

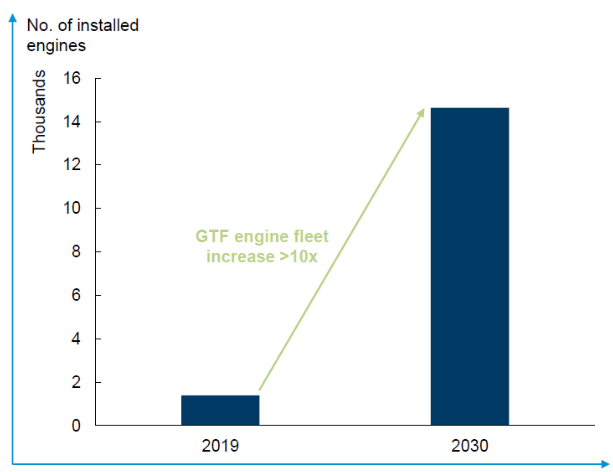


Figure 9 GTF engine fleet forecast

Moat

MTU Aero Engines benefits from high barriers to entry in its core aero engine markets. At first, the high upfront costs and rich experience are required to develop a new engine and the long time to generate returns. Secondly, the airline industry is so conservative that OEMs prefer to corporate with reliable suppliers under long-term contracts or RRSP[8]. It means stable cash flows from profitable MRO after sales. Thirdly, Certification requirements and regulatory approvals also protect the company from new entrants. Lastly, political preferences help the company get military OEM orders in Europe. The competition is in an oligopolistic structure throughout the complete engine value chain since entry barriers and capital requirements are very high.

Intangible assets

MTU is not responsible for building the whole engine but for supplying the largest engine OEM manufacturers (GE, Pratt & Whitney and Rolls-Royce) with the respective engine sub-system. The level of specialization in the industry is high, and every player has its focus with regard to their modules and technologies[v]. MTU focus on the High-Pressure Compressor (HPC) and the Low Pressure Turbine (LPT).

Figure 10 Engine value chain

Here is how a turbofan works[vi]:

Step 1: Suck. Thrust creation begins at the inlet where a large-diameter fan rotates thousands of times per minute, taking in massive amounts of air. Some of the air makes its way to the combustor, where it undergoes the fuel ignition sequence, while the majority of the air bypasses the core and enters a narrow fan duct where its speed increases before exiting at the rear.

Step 2: Squeeze. The remaining airflow enters the low- and high-pressure compressors where it passes through a series of rotating and stationary blades. During this stage, as the air is squeezed, the air-pressure ratio can reach 40-to-1 while air temperatures rise several hundred degrees.

Step 3: Burn. This high-pressure air then moves into the combustor, where fuel is added, and the mixture is ignited. The resulting energy spins both the high- and low-pressure turbines, which are connected

[8] RRSP: • Risk and revenue sharing partnership

concentrically via shafts to the compressors and the fan at the front of the turbofan engine. As the turbines turn, so do the fan and the compressors, creating the engine's continuous process of air intake and expulsion.

Step 4: Blow. After powering the turbines and decreasing in pressure, the air moves to the exhaust assembly and exits the engine, providing the remaining thrust.

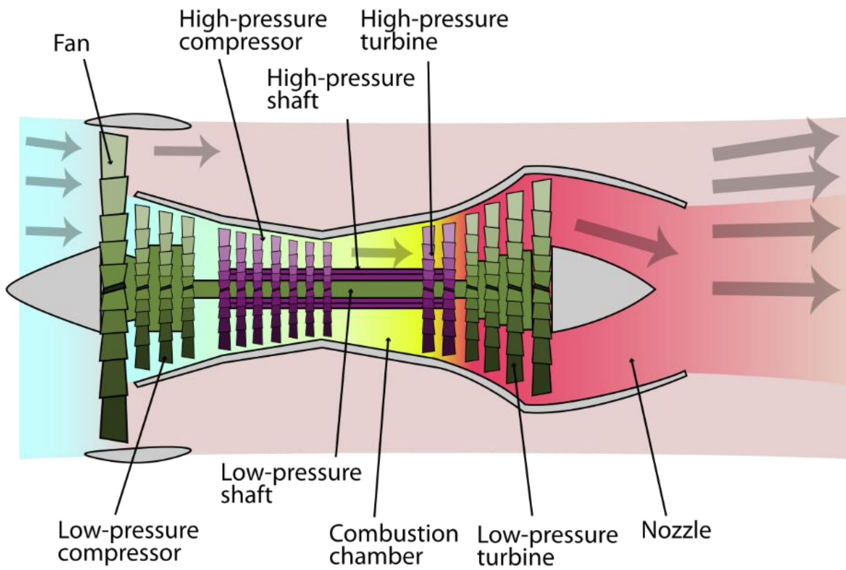


Figure 11 Structure of turbofan engine

Barriers to entering the industry

High capital investments and long cash conversion cycle

The aero engine industry's business model consists of selling the original equipment at a loss, and then recouping economic value over the engine's life though the sale of high margin spare parts and services. This creates significant entry barriers to new entrants. The players in the industry have a well-balanced engine portfolio that utilizes the cash from mature engine programs to research, develop new engines, as well as absorb the loss from selling the engines in the early stages of production. On the other hand, the lifespan of a typical engine program is ~40 years, which is a very long time to achieve a full payoff on an investment program.

Historical accumulation of experience

Extensive experience, the strong *'know-how'* in engine technologies, patents, and scale advantages have enabled the few players to continue to capture and grow their aero engine business. MTU started as a BMW aero engine company and built numerous BMW 801 engines for the famous fighter aircraft during WWII. Moreover, Safran and Royce-Royce began making aircraft engines simultaneously in 1914; Pratt & Whitney started its first engine program in 1925, etc. Players are also required to master the whole process – going from design to final production requires a complete system-integration knowledge and capability.

Closed partnership within the few players

Risk and Revenue Sharing Partnership (RRSP) builds a solid relationship between OEMs (Rolls-Royce, Pratt & Whitney or GE) and sub-system providers (MTU, IHI, GKN, etc.). Partner takes an equity stake on an individual engine program by RRSP. Furthermore, the partners usually join the new engine RRSP together after the previous engine reach to the end. MTU key competences lie within low-pressure turbines and high-pressure compressors. The high-pressure compressor and the low-pressure turbine each account for 10%-15% of the value of an engine. Due to the long life of aero engine programs (30-40 years), these permanent relationships provide good revenue visibility into the future.

All three of these factors make the industry more and more consolidated…with fewer players every year. Nowadays, there are only four major engine OEMs and five Tier 1 suppliers in the value chain.

Sub-system players

Compared to GE, Pratt & Whitney, Rolls-Royce and even Safran, MTU operates at a lower tier of the aero engine industry, acting as a tier one supplier rather than a prime contractor or integrator of complete engines. However, MTU still has full design authority for its module work and significant technology expertise in design and production of these complex components. Within the tier-one supplier base, MTU competes with IHI, ITP, GKN Aero, and Avio. The level of specialization in the industry is high, and every player has its focus with regard to their modules and technologies.

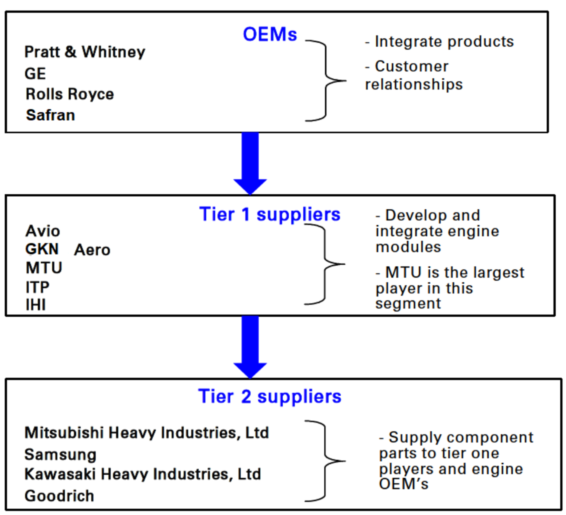


Figure 12 Key aero engine players and industry structure

IHI is Japan's leading maker of jet engines. IHI collaborates in international projects to develop and supply both large and small engines, components, and modules for all types of civilian aircraft. IHI focuses on fan modules and shafts. IHI participated in the V2500 program (for Airbus A320ceo), PW1100G-JM (for Airbus 320neo), GEnx (for Boeing 787 and 747-8), etc.

ITP Aero is a Rolls-Royce Group corporate entity as a Tier 1 supplier to the main aircraft engine manufacturers and is responsible for the design, development, production, and assembly of engine subsystems and components, including the low-pressure turbine (LPT). ITP focuses on the low-pressure turbine on wide-body aircrafts. ITP also joined the PW1000G program for A320neo as a supplier who designs and produces inter-turbine structures, external connection systems, and integrated bladed rotors.

GKN Aero (*historically Volvo Aero*) is a leading Tier 1 provider of high performance metallic and composite structural engine components. GKN focuses on regional and narrow-body jets. GKN Aerospace is a risk and revenue sharing collaborator (RRSP) directly with Pratt & Whitney. GKN has design and production responsibility for the intermediate compressor cases and the turbine exhaust cases for the entire Geared Turbofan family.

Avio Aero is a GE Aviation business which designs, manufactures, and maintains components and systems for civil and military aviation. Under the PW1100G-JM engine program, Avio designs and produces the gear system, the accessory gearbox, and the oil tank for the engines.

High switching cost

Not only engines and parts need to be certified by the authorities but also the engine manufacturers and the suppliers. MTU holds certificates from the world's major aviation authorities: EASA, FAA, and CAAC. The individual locations of the MTU Maintenance network additionally hold all relevant approvals required by and issued in the respective countries.

The risk and revenue sharing agreements span over the full lifetime of an engine program making it impossible for new entrants to break into the OEM partnerships. Furthermore, the aircraft manufacturers close long-term contracts with the OEMs to equip the airplanes with the chosen engine types also preventing new entrants from winning contracts with existing aircraft programsvii.

As a result, airlines cannot switch their engine because of certification and regulation. This means MTU has a steady cash flow when providing spare parts and MRO services as a subsystem supplier. Due to the rising complexity of engine design, and the extremely high upfront development costs, the trends in the industry has been for airframe makers to over fewer engine options than in the past. For example, 737 Max only chose the Leap-1 engine by CFM and Airbus 320neo chose Leap-1 and PW1100G. Table 4 in appendix shows a detailed list of all the engines of major fleets.

Table 3 Engine options (new vs previous)

	Number of new options	Number of previous options
737	1	1
747	1	2
767	1	3
777	1	3
A320	2	2
A330	1	3
A350	1	2

Cost advantages[viii]

MRO is highly competitive with shops competing globally on quality, speed and price. MTU has focused on the motto "Repair beats Replacement" which is aligned with their customers' focus to keep maintenance costs down. MTU's MRO IP revolves around advanced repair capability which helps keep cost down for Airlines. MTU serves as an independent performing MRO on non-MTU engines where it does not have the conflict of interest that engine OEM providers have had whereby replacing instead of repairing a part would provide high margin spare part revenues. MTU operates the service centers in Germany, Poland, Canada, U.S. and China and own test benches for important maintenance programs.

Capital Allocation

Management has a clear priority list for capital allocation. MTU has focused on increasing market share around its core competency as an aero engine subsystem supplier by acquiring program shares. ~55% FCF is used for capital expenditure; ~15% FCF is used for M&A and ~30% is used for dividends.

Dividend policy and debt

Table 4 Capital Allocation

	Capital expenditure	M&A	Dividends
% of Free cash flow	55%	15%	30%

The median of Net Debt-to-EBITDA ratio is 0.7x and MTU pays ~30% of adjusted net income as dividends since 2006.

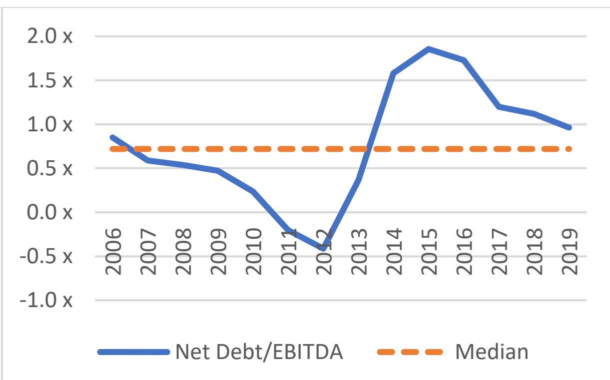


Figure 13 Net Debt to EBITDA

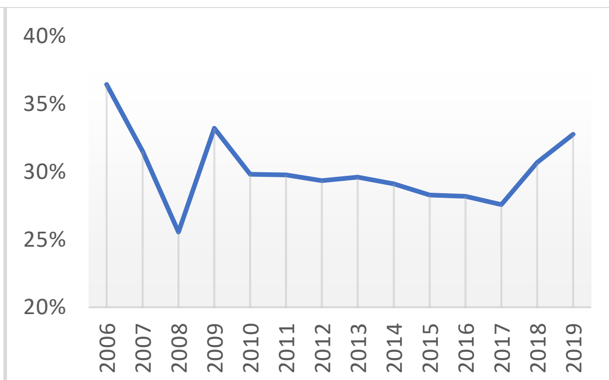


Figure 14 Dividend payout ratio

Acquisition

In 2012, Pratt & Whitney purchased the Rolls-Royce V2500 program share in the IAE collaboration and MTU Aero Engines has increased its program share from 11% to 16% via a separate risk revenue sharing agreement with Pratt & Whitney, which cost €541.1 million. The V2500 (for A320ceo family) is MTU's most important commercial engine program. By increasing its share in this program, MTU expects to generate additional revenue worth three to four billion Euros over next 25 years. The company's share in the MRO business for this engine also increased. After applying the new RRSP, MTU takes the responsibility for ~500 additional components and manages the supply chain, as well as the vendor-supplied parts *(Figure 15)*.

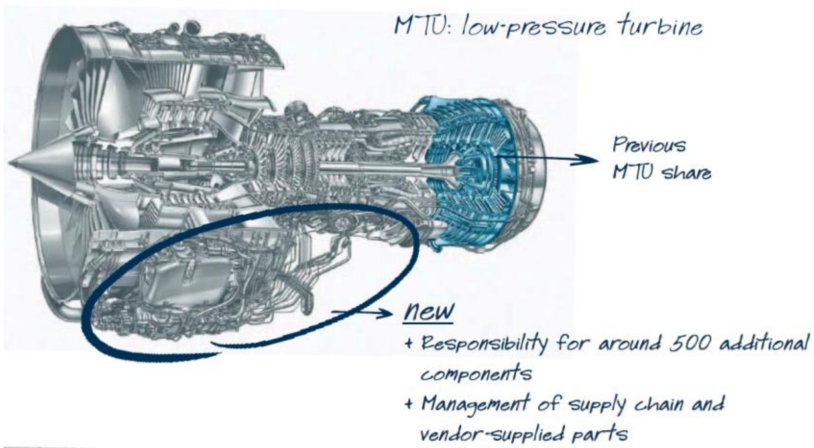


Figure 15 MTU increases its share in the IAE 2500 program

On December 19, 2008 MTU acquired a 6.65 % stake in the GEnx engine program for the Boeing 787 and 747-8 through a cooperation agreement between the General Electric Company and MTU Aero Engines GmbH, Munich. The investment in this new engine program in 2008 is included in the capital expenditure of the OEM business as an intangible asset valued at an amount of € 126.1 million.

Balanced portfolio

The balanced portfolio of MTU shown in the graph below is the key for maintaining a solid free cash flow and value creation in the group while growing with new engines.

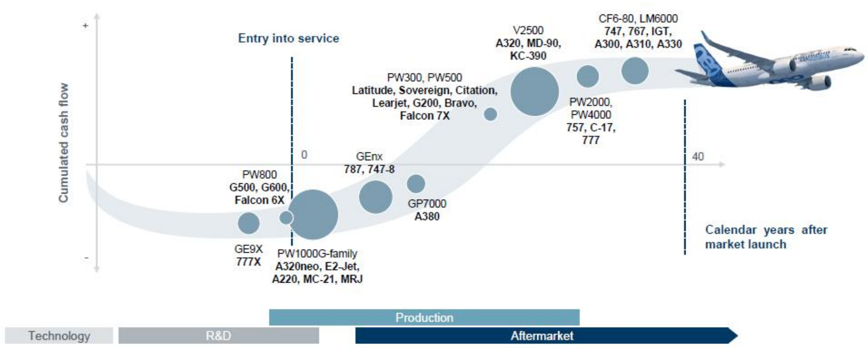


Figure 16 Cumulated cash flow of MTU's portfolio and products

Developing a new type of engine has a very long payback period. The company need to invest in research and development at first five years. However, the new engine has to be sold with substantial discounts which makes the profits close or even below to zero. Typically, after about 7-years of services the engine undergoes its first overhaul and engine companies get cash and profits from MRO services. It usually takes about 15 years for an engine company to achieve cash breakeven since starting R&D. And this is called Time & Materials (T&M) based aftermarket model. However, about half of new deliveries are under Flight Hour Agreements (FHA), where cash is received as the aircraft is flown i.e. immediately upon entry into service rather than after 5-7 years upon the first overhaul as under a Time & Materials model. The FHA model help MTU achieve a more stable cash flow, but at the same time it also means that the company must invest to lower maintenance cost to improve margins on fixed cost contracts.

In Figure 17, the capital expenditure on intangible assets in the OEM segment is related to the capitalization of self-generated development work for MTU's engine programs as well as acquisition cost in 2012. The capital expenditure on PP&E in the OEM segment is related to building new facilities or expanding the capacities. The capital expenditures under MRO is mostly related to expanding capacity.

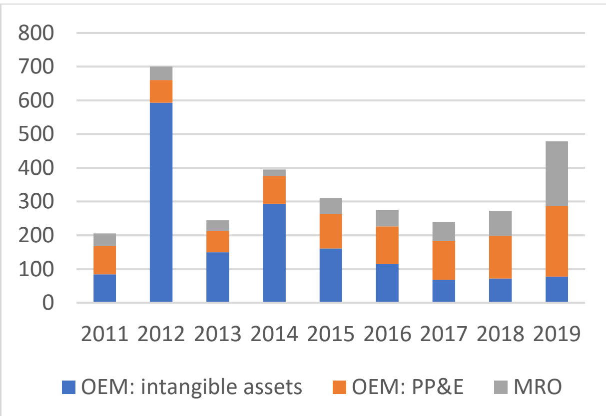


Figure 17 Capex by segment, €m

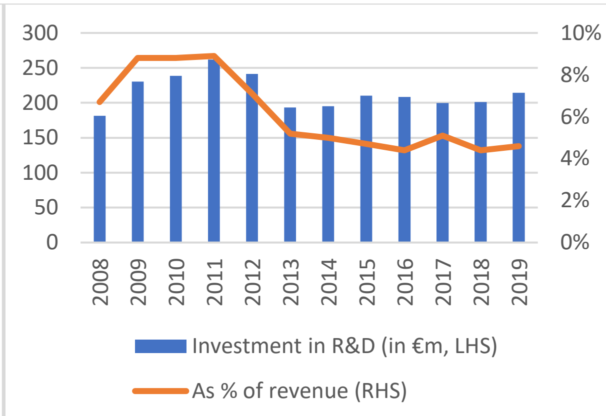


Figure 18 Investment in R&D

The long-term nature of the investment required in this industry is underscored by the company's experience with the A320neo. Originally planned for 2014, the first delivery of the A320neo with PW1100G engine slipped to early 2016. Lufthansa took delivery of the first A320neo on January 20, 2016. However, MTU started investing R&D heavily since 2011 and need to keep investing during the whole life of the GTF engines.

Table 5 Capex program, 2011-2019

	OEM: intangible assets	OEM: PP&E	MRO
2011	PW1100G, GE38 helicopter engine, GEnx	New site in Portland	Intangible assets and PP&E
2012	Stake in IAE, V2500, PW1100G, GE38	PP&E for blisk manufacturing facility in Munich	
2013	PW1133G-JM, PW1524G, PW1700G, PW1900G, GE38	Expansion of the Polish site and PP&E; construction of new logistics center in Munich	
2014	GTF[9], GE38, GE9X, PW800		New and replacement purchases of PP&E
2015		Expansion of the Polish site and PP&E	
2016	GTF, T408, GE9X, PW800	Ramp-up to series production of the GTF programs	
2017	GTF, GE9X, PW800	Expansion of production capacity for GTF programs	Capacity-related new and replacement purchase
2018			
2019			

[9] GTF include PW1100, PW1500, PW1700 and PW1900 series engine

Low-cost capacity

MTU invested in new capacity and development expenditure which consumed significant portions of internally generated cashflows. Since 2000, MTU substantially increased its share of MRO business performed low-cost countries – primarily Poland and China with the launches of new MRO shops in those countries. MTU refers to these locations as "best cost".

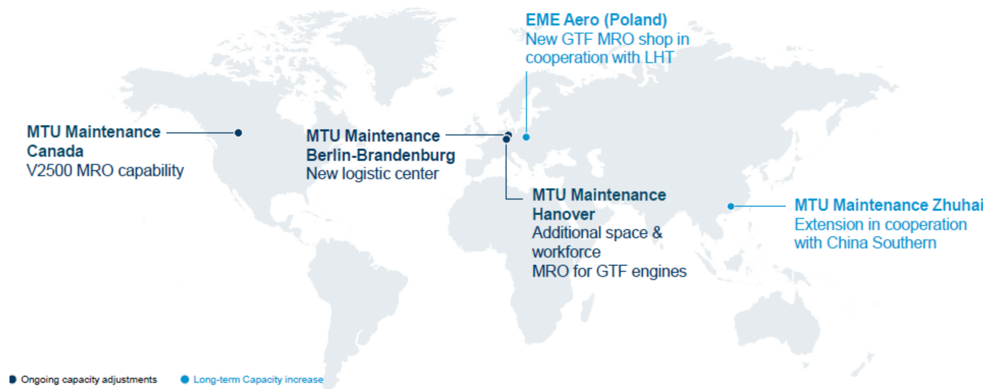


Figure 19 Expansion of MRO network

MTU is going to increase capacity at best cost locations, such as strengthen partnership with China Southern, Lufthansa Technik (LHT) in Poland, Malaysia, etc. The company plan to increase the weight of capacity at best-cost locations to 50% in 2029.

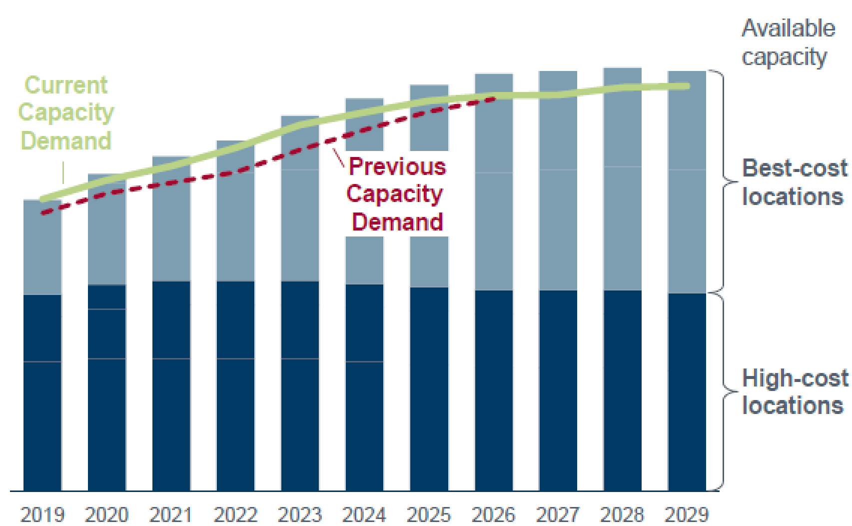


Figure 20 Increase capacity at best-cost locations

Conclusion

MTU Aero Engines is the largest independent Tier-1 civil aero engine supplier and provider of aero engine MRO services in the world. MTU possess all three characteristics we look for in a business at LRT – moat, growth, and capital allocation skills. The moat is extremely wide – high capital investments with long cash conversion cycle, sticky contracts, and certifications. Over the last two decades, the growth of air traffic has doubled that of worldwide GDP…with plenty of runway still to go – the long-term growth of air traffic cannot be ignored.

We believe that recent volatility provides an opportunity for long term investors as MTU's price has dropped significantly due to the COVID-19 pandemic. Investors are afraid that air traffic may be in for a secular decline…when this is not the case. We believe the aero industry is still young and will continue to outpace GDP.

<u>LRT believes that MTU Aero Engines (MTX.DE) stock price is about to take off…</u>

Valuation[10]

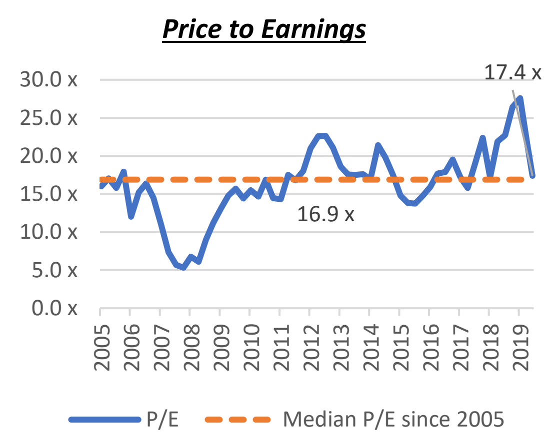


Figure 21 Historical P/E and median

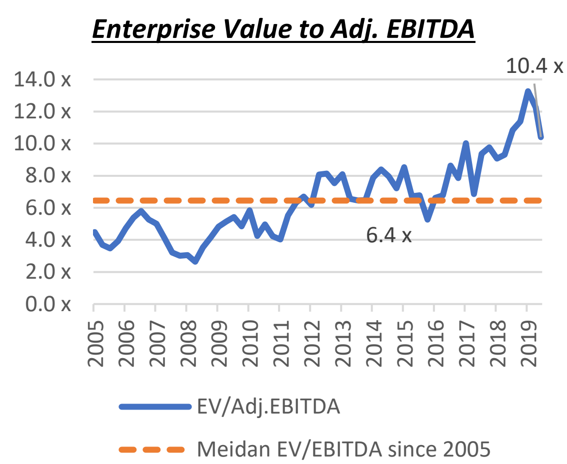


Figure 223 Historical EV/EBITDA and median

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[10] As 5/15/2020

Appendix

Table 6 Engines and planes in major fleets

Manufacturer	**Plane Type**	**Plane Name**	**Built**	**On Order**	**Seats**	**Engine**	**Engine Manufacturer**	**Engines**
Boeing	Narrow	737 Total	7376	4298				
		737 MAX	**387**	**4246**	**138-230**	**LEAP-1B**	**CFM (GE+Safran)**	2
		737 NG	6989	52	126-220	CFM56-7B	CFM (GE+Safran)	2
	Wide	747 Total	154	17				
		747-8	47		410	GEnx-2B	GE	4
		747-8F	**107**	**17**		**GEnx-2B**	**GE**	**4**
	Wide	767 Total	881	86				
		767-300F	**225**	**51**		**CF6-80C2B7F**	**GE**	**2**
		767-300ER	583		218-269			
			357			CF6	GE	2
			195			JT9D	Pratt & Whitney	2
			31			RB211	Rolls-Royce	2
		767-2C	73	35		PW4062	Pratt & Whitney	2
	Wide	777 Total	1861	375				
		777-300ER	838	18	396	GE90-115BL	GE	2
		777-200ER	422		273			
			161			GE90	GE	2
			93			PW4000	Pratt & Whitney	2
			168			Trent 800	Rolls-Royce	2
		777X	**309**	**309**	**384-426**	**GE9X**	**GE**	**2**
		777-200LR	61	1	317	GE90-115BL	GE	2
		777F	231	47				
	Wide	**787 Total**	**1510**	**538**				
		787-9	877	335	296			
			520	183		GEnx-1B	GE	2
			252	47		Trent 1000	Rolls-Royce	2
			105	105			TBD	2
		787-8	422	48	248			
			271	30		GEnx-1B	GE	2

Manufacturer	Plane Type	Plane Name	Built	On Order	Seats	Engine	Engine Manufacturer	Engines
			140	7		Trent 1000	Rolls-Royce	2
			11	11			TBD	2
		787-10	211	155	336			
			148	109		GEnx-1B	GE	2
			59	42		Trent 1000	Rolls-Royce	2
			4	4			TBD	2
Airbus	Narrow	A220-100	94	54	100-120	PW1500G	Pratt & Whitney	2
	Narrow	A220-300	548	475	120-150	PW1500G	Pratt & Whitney	2
	Narrow	A318	80	0	90-110			
						CFM56	CFM (GE+Safran)	2
						PW6000	Pratt & Whitney	2
	Narrow	A319ceo	1486	7	110-140			
						IAE V2500A5	IEA (Pratt & Whitney + MTU + Japanese Aero Engines)	2
						CFM56-5B	CFM (GE+Safran)	2
	Narrow	**A319neo**	**84**	**82**	**120-150**			
						PW1100G-JM	Pratt & Whitney	2
						LEAP-1A	CFM (GE+Safran)	2
	Narrow	A320ceo	4770	20	140-170			
						CFM56-5B	CFM (GE+Safran)	2
						IAE V2500	IEA (Pratt & Whitney + MTU + Japanese Aero Engines)	2
	Narrow	**A320neo**	**3948**	**2987**	**150-180**			
						PW1100G-JM	Pratt & Whitney	2
						LEAP-1A	CFM (GE+Safran)	2
	Narrow	A321ceo	1791	34	170-210			
						IAE V2500	IEA (Pratt & Whitney + MTU + Japanese Aero Engines)	2
						CFM56-5B	CFM (GE+Safran)	2
	Narrow	**A321neo**	**3413**	**3087**	**180-220**			
						LEAP-1A	CFM (GE+Safran)	2
						PW1100G-JM	Pratt & Whitney	2

Manufacturer	Plane Type	Plane Name	Built	On Order	Seats	Engine	Engine Manufacturer	Engines
	Wide	A300	561	0	247			
						CF6-50/CF6-80	CFM (GE+Safran)	2
						JT9D/PW4000	Pratt & Whitney	2
	Wide	A310	255	0	220-240			
						CF6-80	CFM (GE+Safran)	2
						JT9D/PW4000	Pratt & Whitney	2
	Wide	A330-200	660	18	210-250			
						CF6-80E	GE	2
						PW4000	Pratt & Whitney	2
						Trent 700	Rolls-Royce	2
	Wide	A330-200F	41	3				
						PW4000	Pratt & Whitney	2
						Trent 700	Rolls-Royce	2
	Wide	A330-300	785	14	250-290			
						PW4000	Pratt & Whitney	2
						CF6-80E	GE	2
						Trent 700	Rolls-Royce	2
	Wide	**A330-800**	**14**	**14**	**220-260**	**Trent 7000**	**Rolls-Royce**	**2**
	Wide	**A330-900**	**319**	**273**	**260-300**	**Trent 7000**	**Rolls-Royce**	**2**
	Wide	A340-200/300	246	0	210-290	CFM56-5C	CFM (GE+Safran)	4
	Wide	A340-500/600	131	0	270-370	Trent 500	Rolls-Royce	4
	Wide	**A350-900**	**760**	**439**	**300-350**	**Trent XWB**	**Rolls-Royce**	**2**
	Wide	**A350-1000**	**170**	**129**	**350-410**	**Trent XWB-97**	**Rolls-Royce**	**2**
	Wide	A380	251	9	400-550			
						GP7200	IEA (Pratt & Whitney + MTU + Japanese Aero Engines)	4
						Trent 900	Rolls-Royce	4

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