

The MRO Market & Key Trends

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Reston, VA



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Today's Agenda

1. Industry Context
2. MRO Market
3. Trends to watch

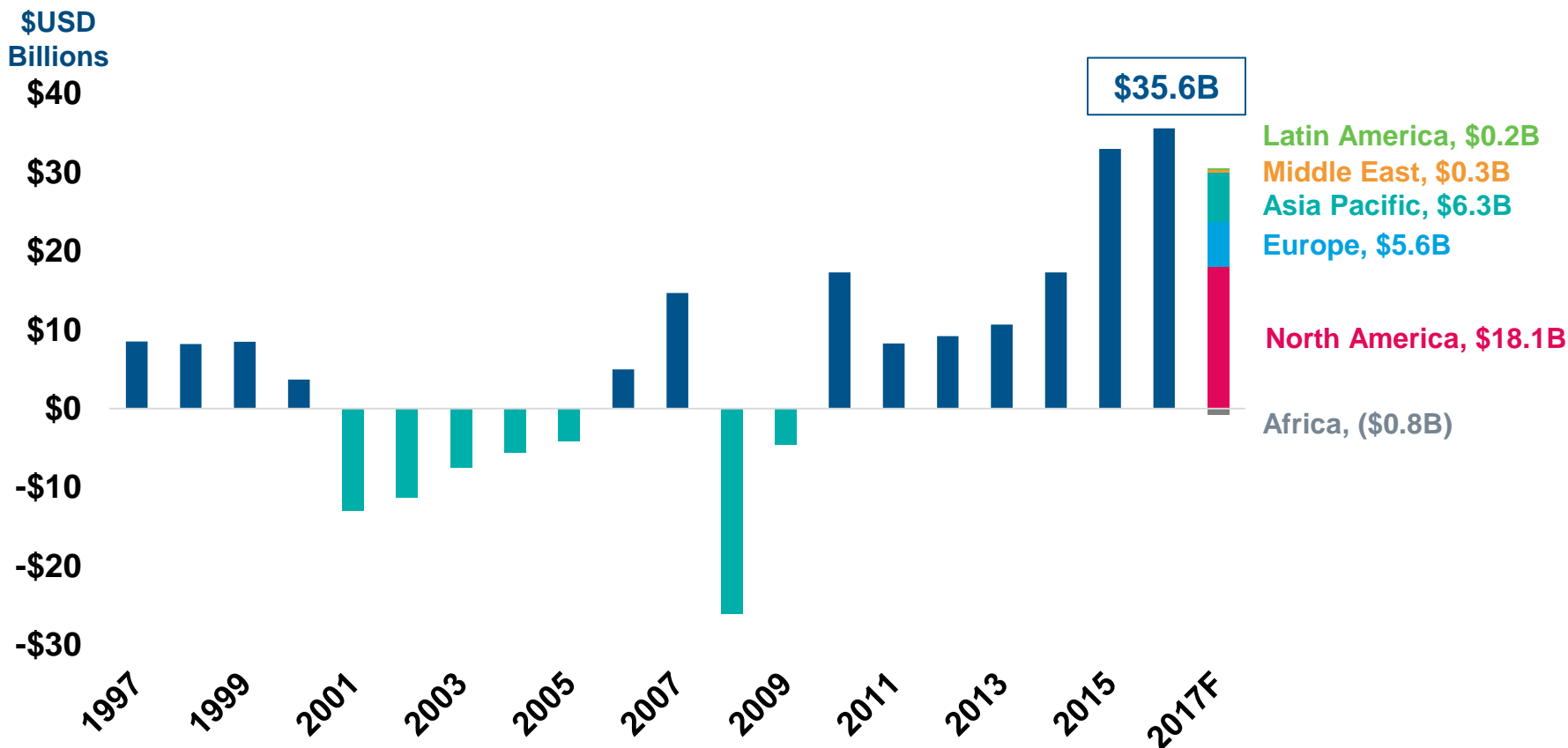


Industry Context



The global airline industry achieved record profitability of over \$35B USD in 2016... driven by low fuel costs and greater cost control...

GLOBAL AIRLINE PROFITABILITY, 1997 – 2017F

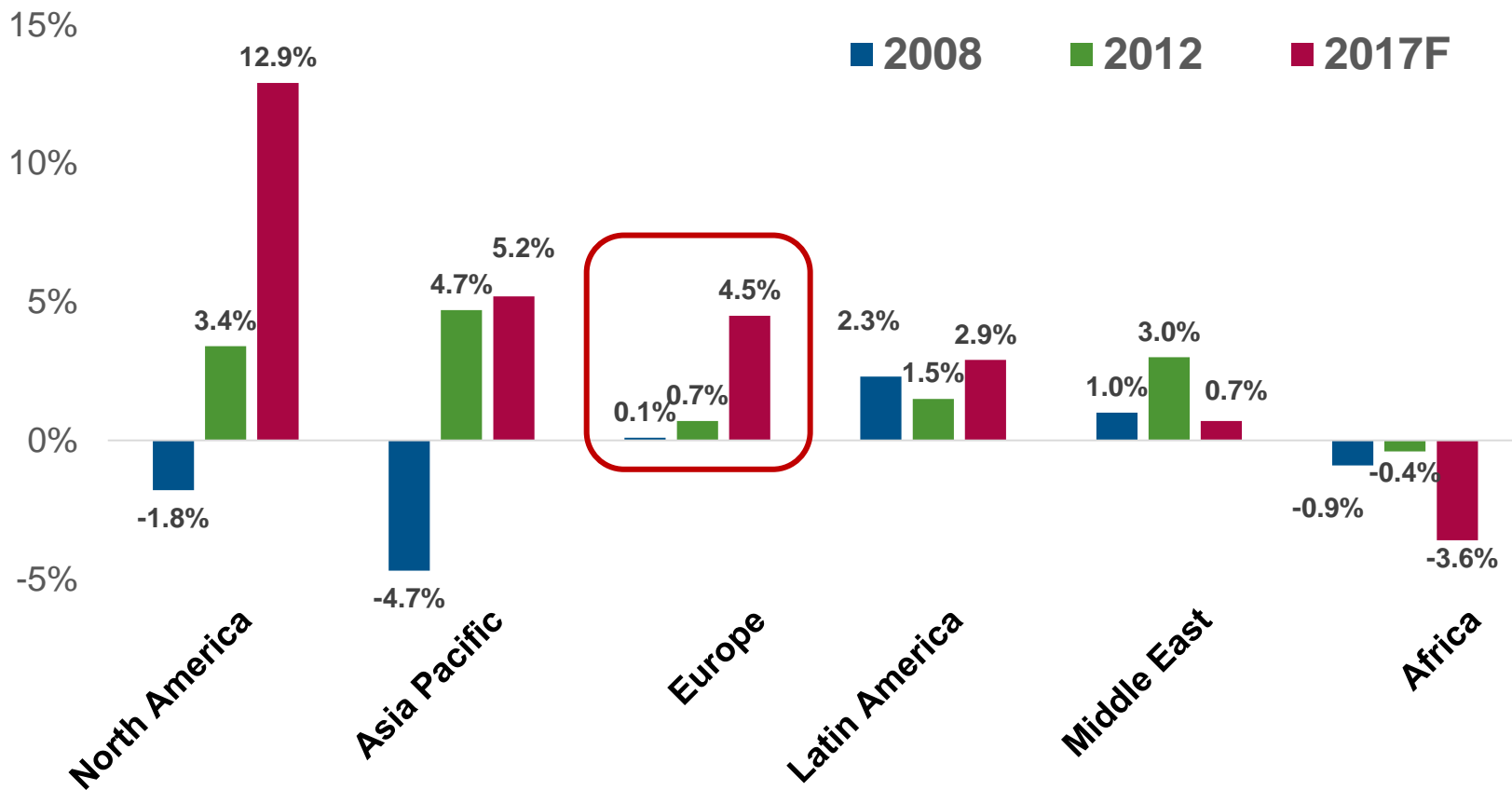


Source: IATA, ICF Analysis



...but many airlines continue to struggle though North America has been a bright spot and is leading the way in 2017

GLOBAL AIRLINE EBIT MARGIN BY REGION

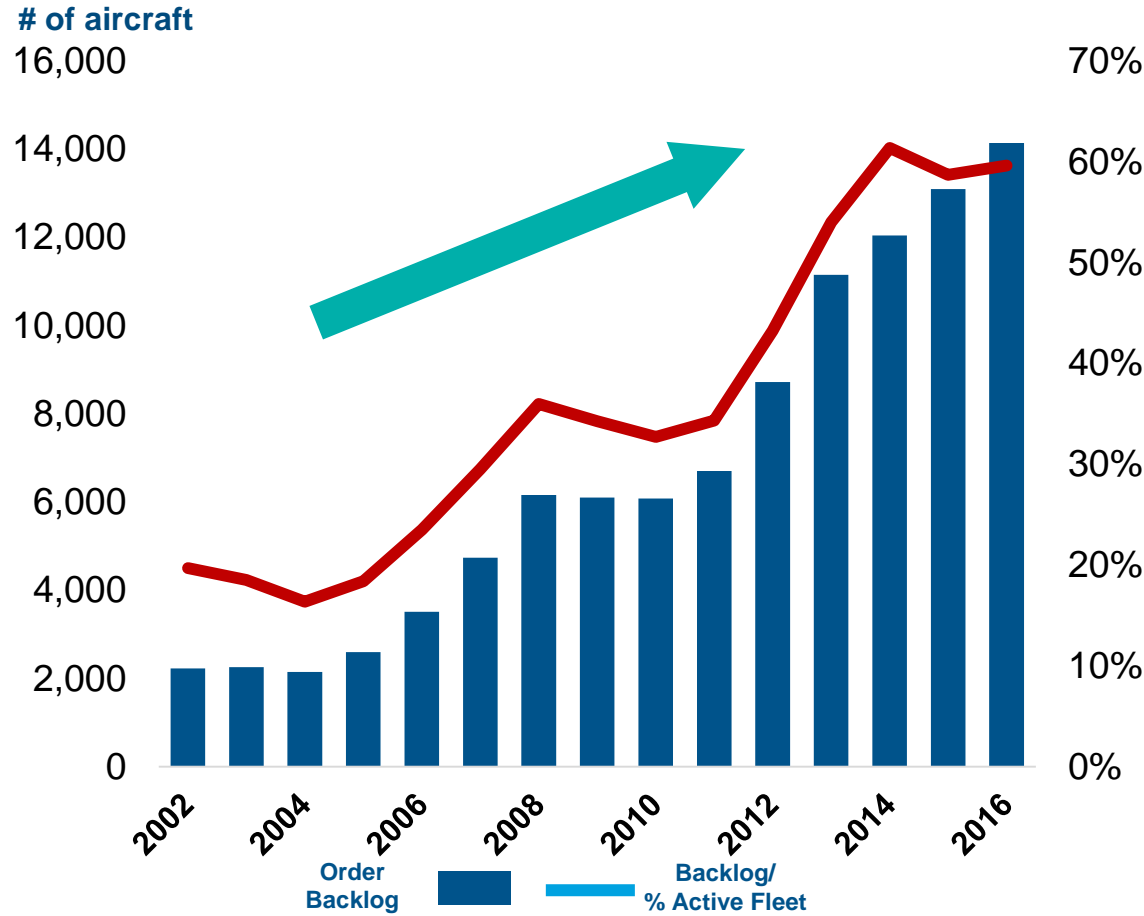


Source: IATA/ ICF Analysis



Commercial aircraft OEM production backlog remains at historical highs...

COMMERCIAL AIRCRAFT OEM PRODUCTION BACKLOG



DRIVERS OF OEM BACKLOG

- Emerging market growth
- Very low interest rates
- Previously high oil and commodity prices
- Introduction of new technology aircraft/engines

Source: CAPA, ICF Analysis

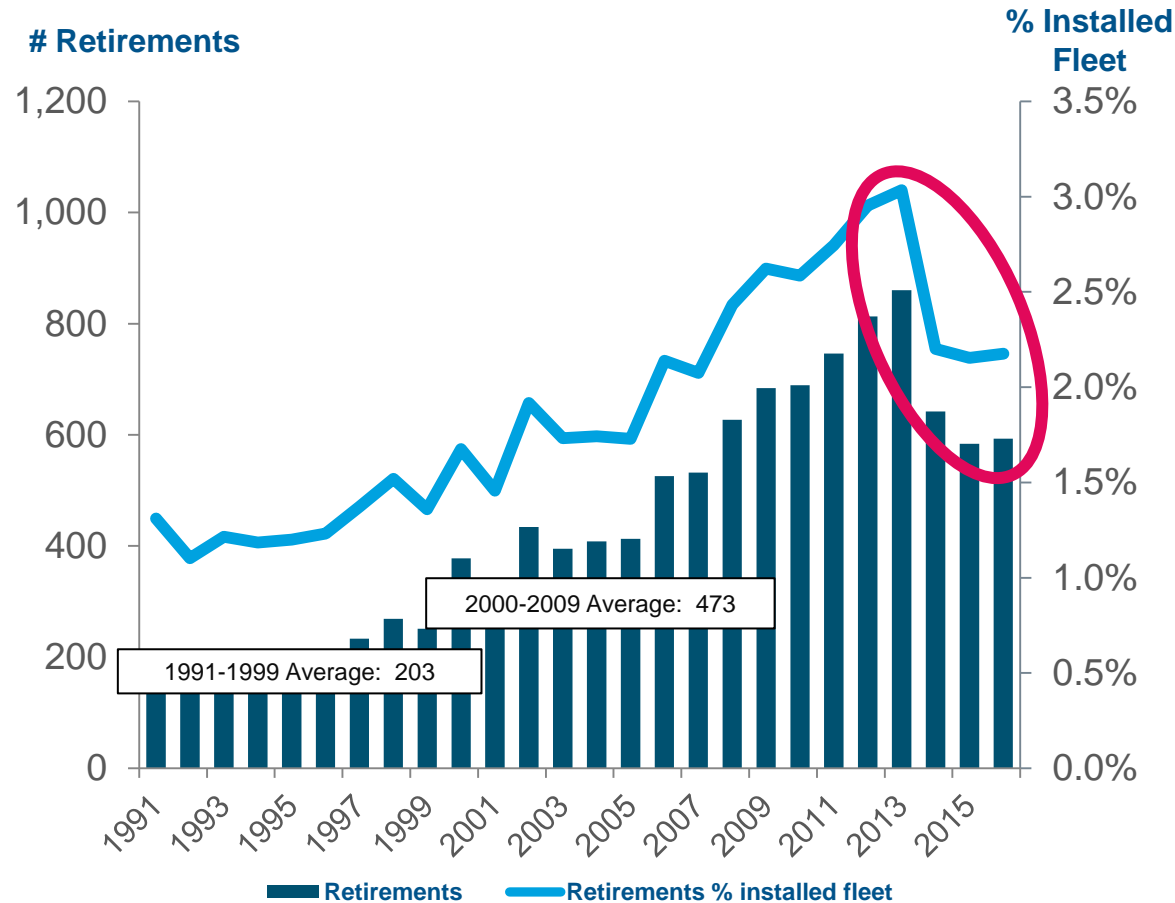


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... and more stable fuel costs have slowed aircraft retirements

COMMERCIAL AIR TRANSPORT ANNUAL AIRCRAFT RETIREMENTS



INDUSTRY IMPACT

- **MRO suppliers - positive:** increased spend on older airframes & engines
- **Surplus market suppliers - positive:** reduced part-out “feed stock”
 - OEMs: improved new part sales
 - Distributors: improved used part values / pricing
- **Operators – negative:** increased material costs

Source: CAPA, Airline Monitor, ICF analysis



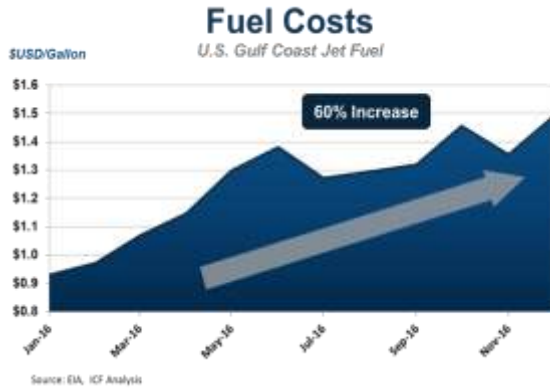
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Four external macro-economic forces are creating headwinds for global airlines and the broader aerospace & MRO supply chain

OVERVIEW OF EXTERNAL MACRO-ECONOMIC FORCES

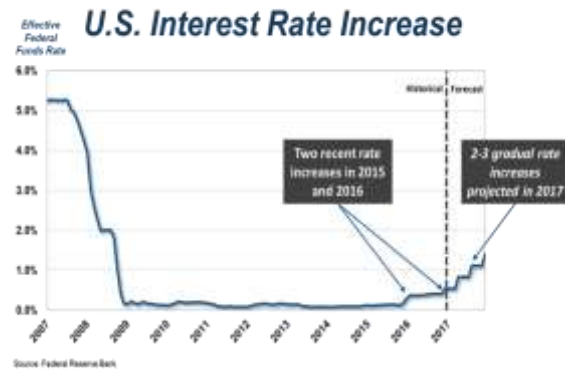
INDUSTRY IMPACT



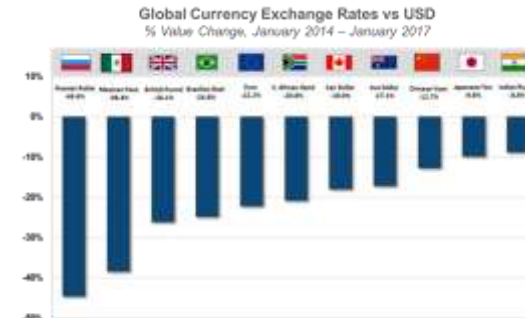
Growth of Populism/Nationalism & Impact to Global Trade



- Increased airline costs:
 - Aircraft financing
 - Fuel
 - MRO
- Downward pressure on global GDP growth
- Downward pressure on aircraft valuations
- Potential for increase in aircraft delivery deferrals (backlog risk)



Strengthening US Dollar



Source: ICF Analysis



MRO Market

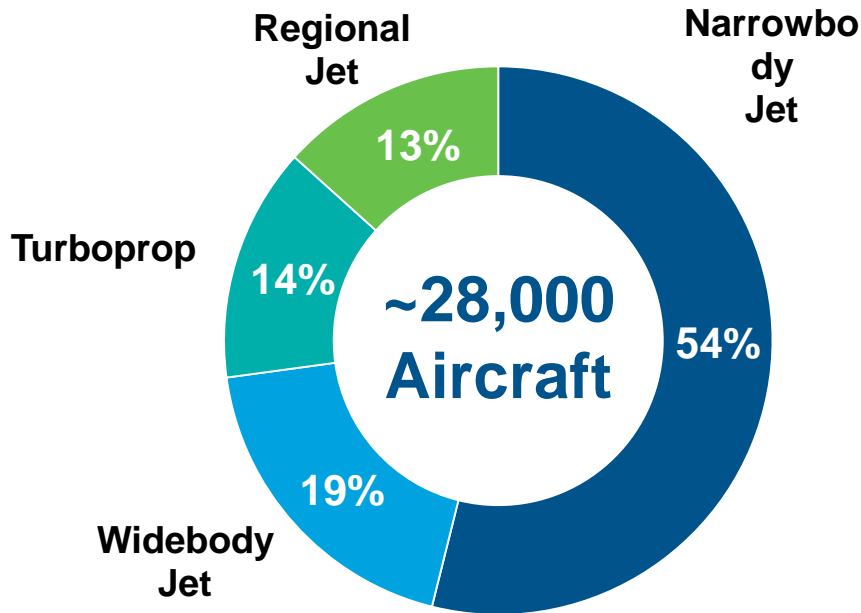
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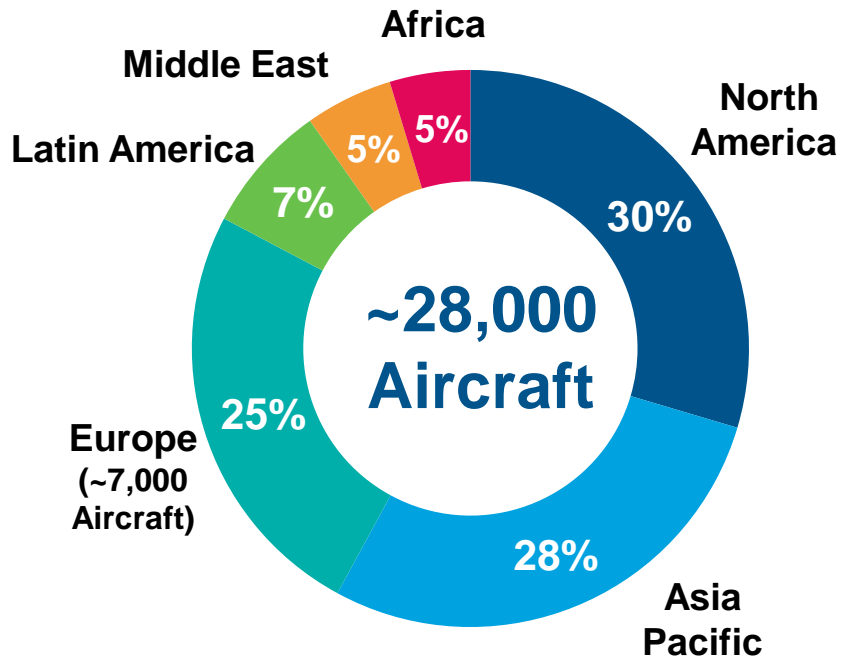
The current commercial air transport fleet consists of ~28,000 aircraft; ~7,000 are located in Europe

2016 GLOBAL COMMERCIAL AIR TRANSPORT FLEET

BY AIRCRAFT TYPE



BY GLOBAL REGION



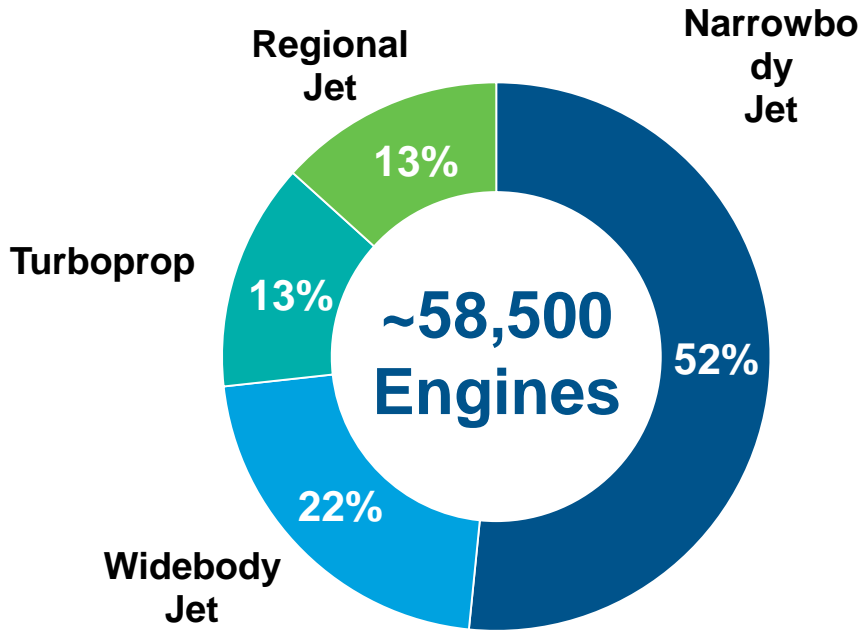
Source: ICF Analysis: CAPA 2016



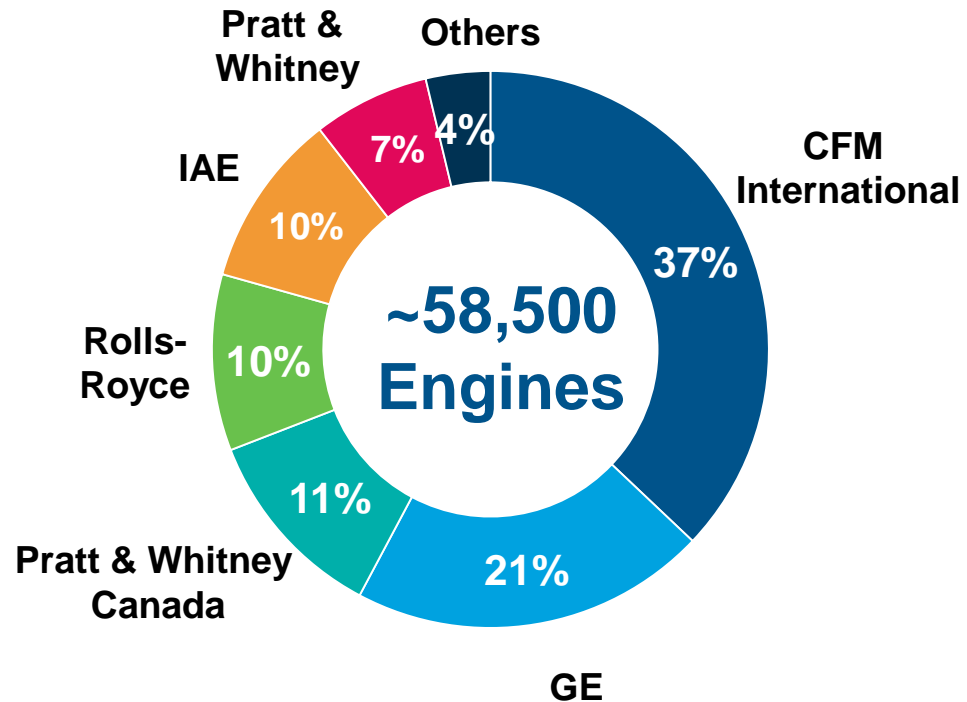
The current commercial air transport fleet consists of under 58,500 engines; narrowbody engine types continue to dominate

2016 GLOBAL COMMERCIAL AIR TRANSPORT ENGINE FLEET

BY AIRCRAFT TYPE



BY ENGINE OEM



Source: ICF Analysis: CAPA 2016

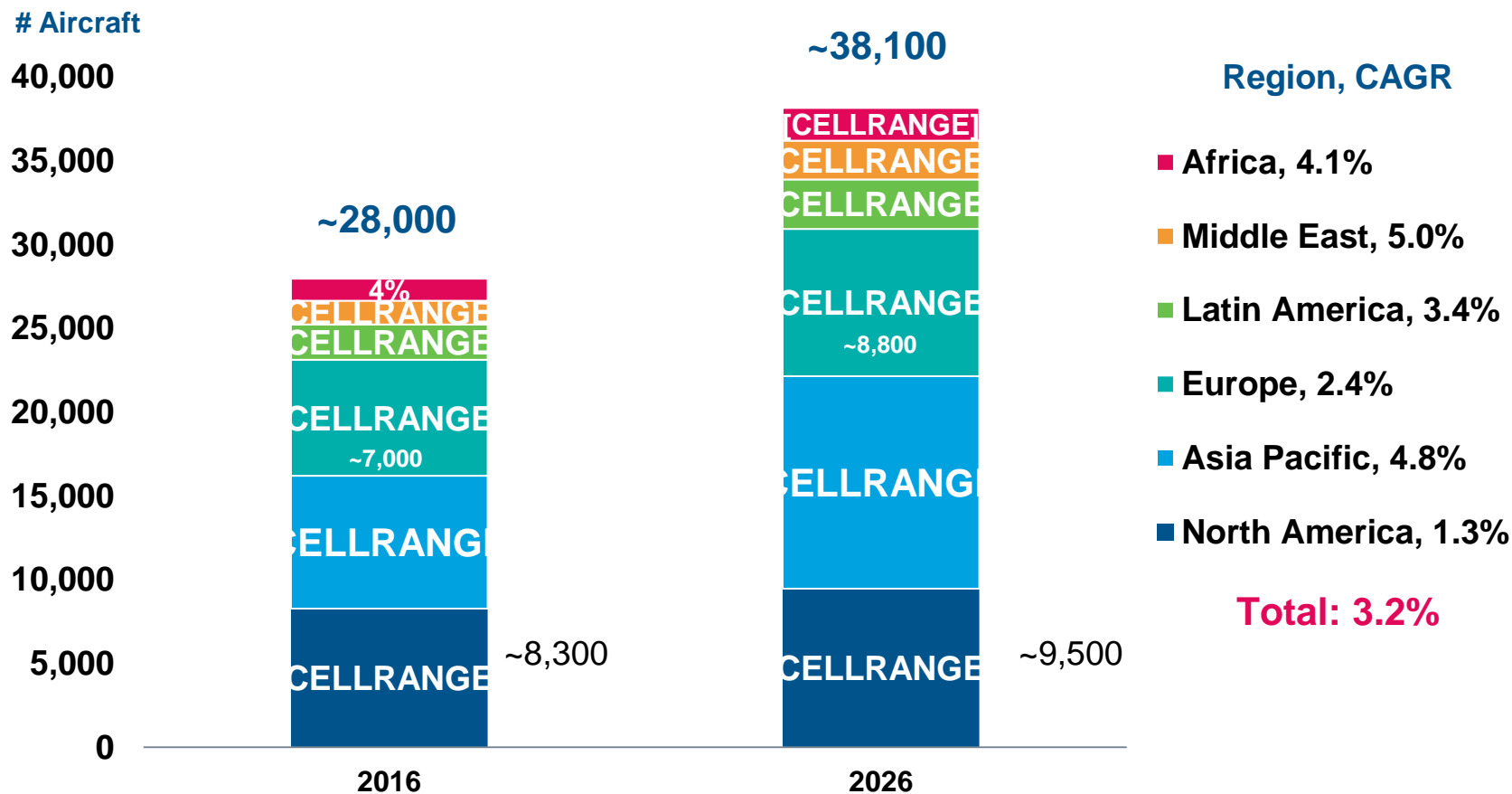


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The combination of strong air travel demand and the need to replace ageing aircraft will drive fleet growth at a healthy 3.2% p.a.

10 YEAR GLOBAL AIR TRANSPORT FLEET GROWTH



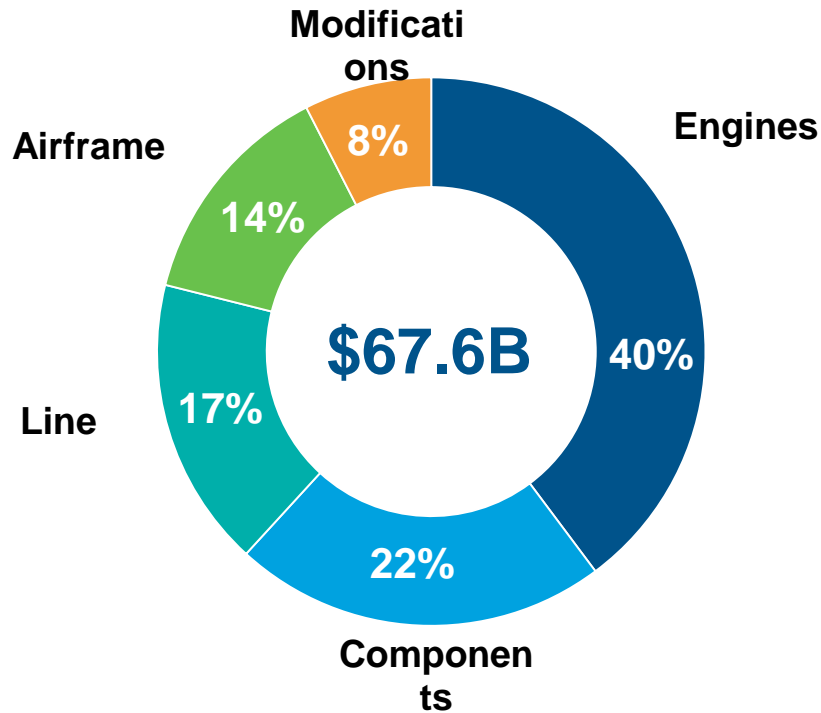
Source: ICF Analysis: CAPA 2016



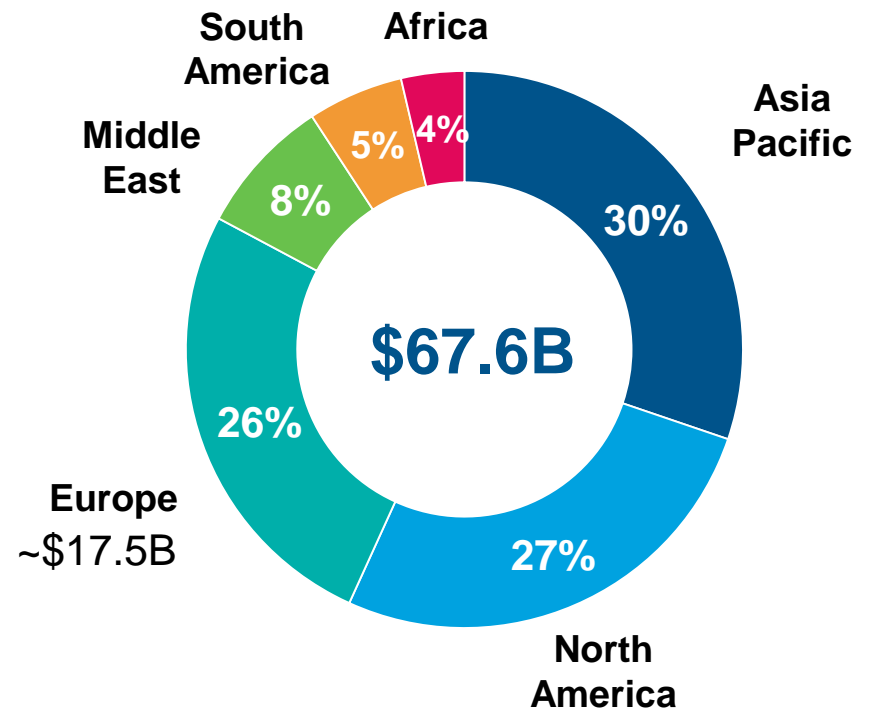
2016 commercial air transport MRO demand is \$67.6B; Asia is now larger than North America and Europe in market size

2016 COMMERCIAL AIR TRANSPORT GLOBAL MRO DEMAND

BY MRO SEGMENT



BY GLOBAL REGION

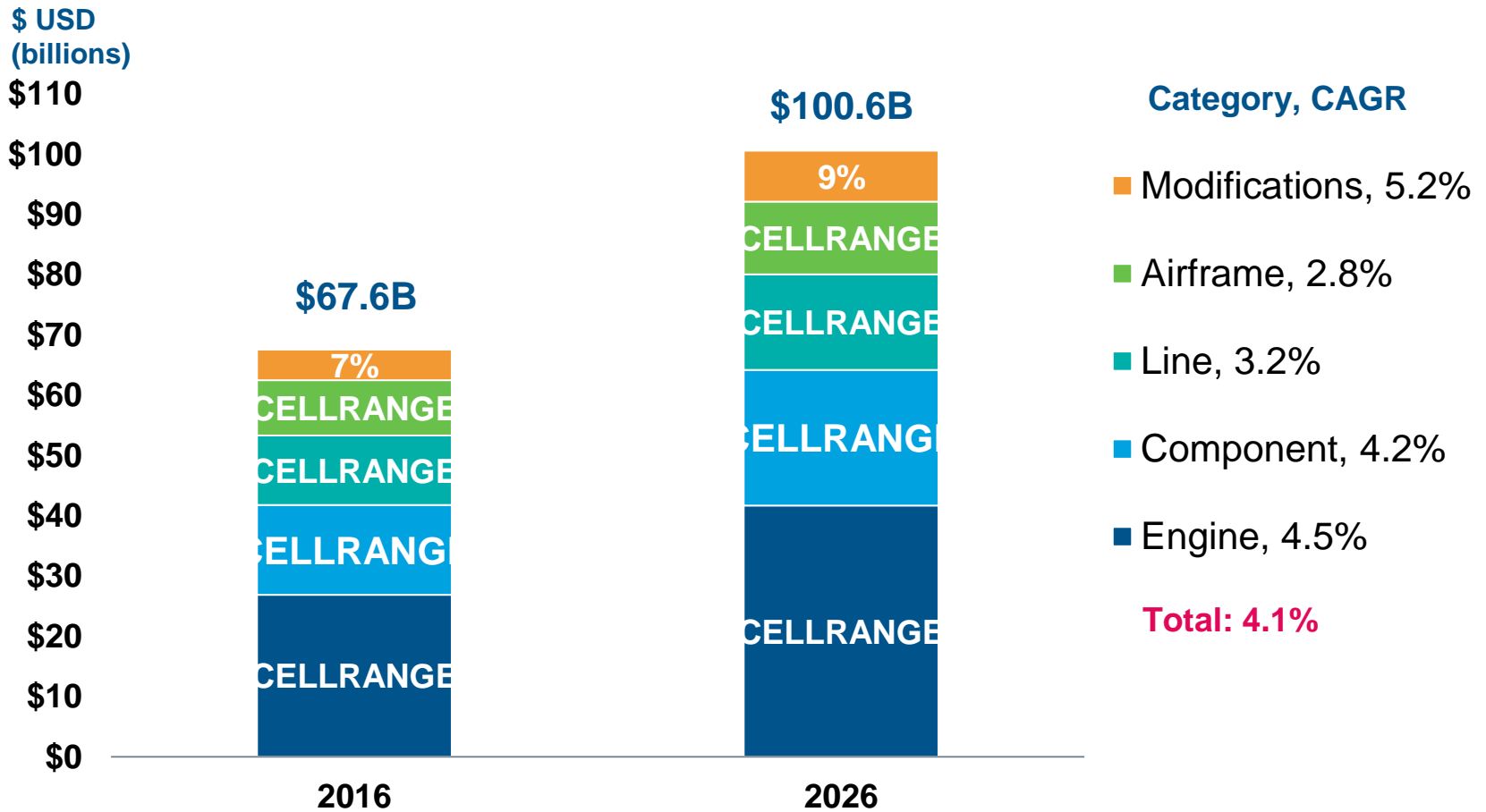


Source: ICF Analysis: CAPA 2016



The global MRO market is expected to grow by 4.1% per annum to over \$100B by 2026

10 YEAR GLOBAL COMMERCIAL AIR TRANSPORT MRO DEMAND (CONSTANT 2016 US\$)

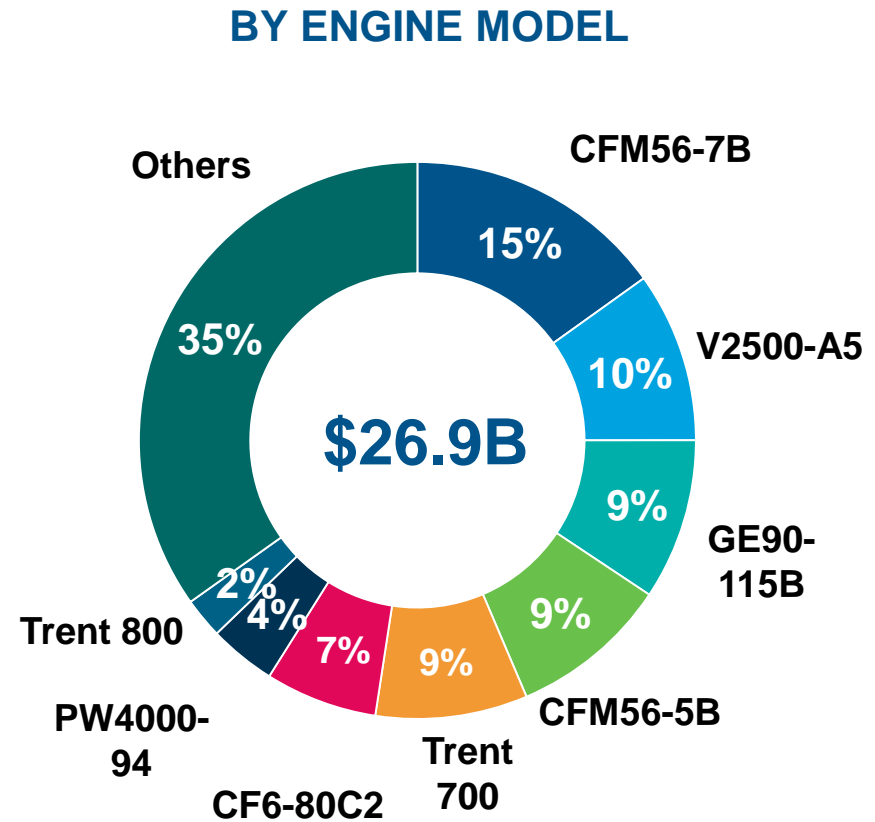
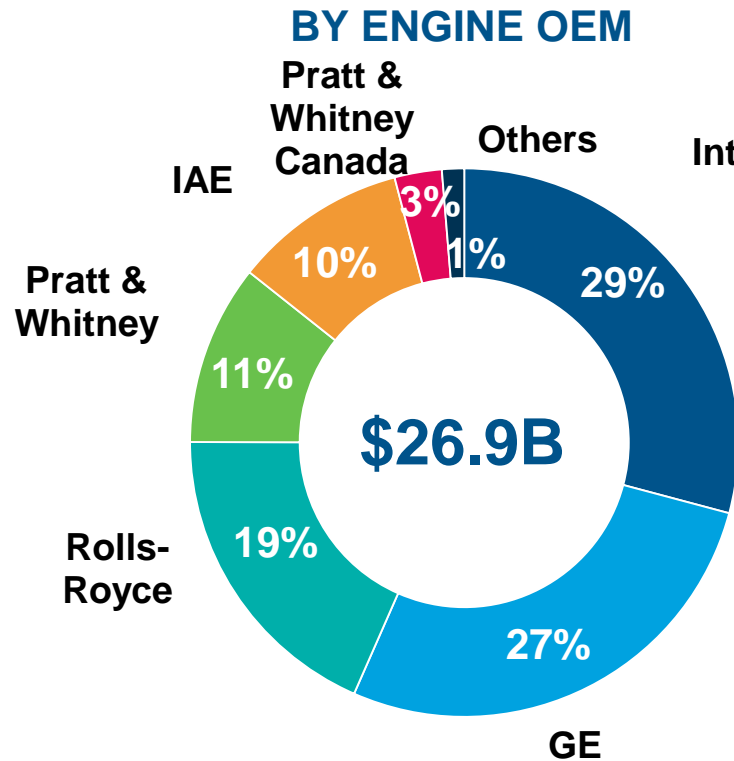


Source: ICF Analysis: CAPA 2016



Narrowbody 737 and A320 Family engines continue to lead engine MRO spending

2016 COMMERCIAL AIR TRANSPORT GLOBAL MRO DEMAND (CONSTANT 2016 US\$)



Source: ICF Analysis: CAPA 2016





Trends To Watch

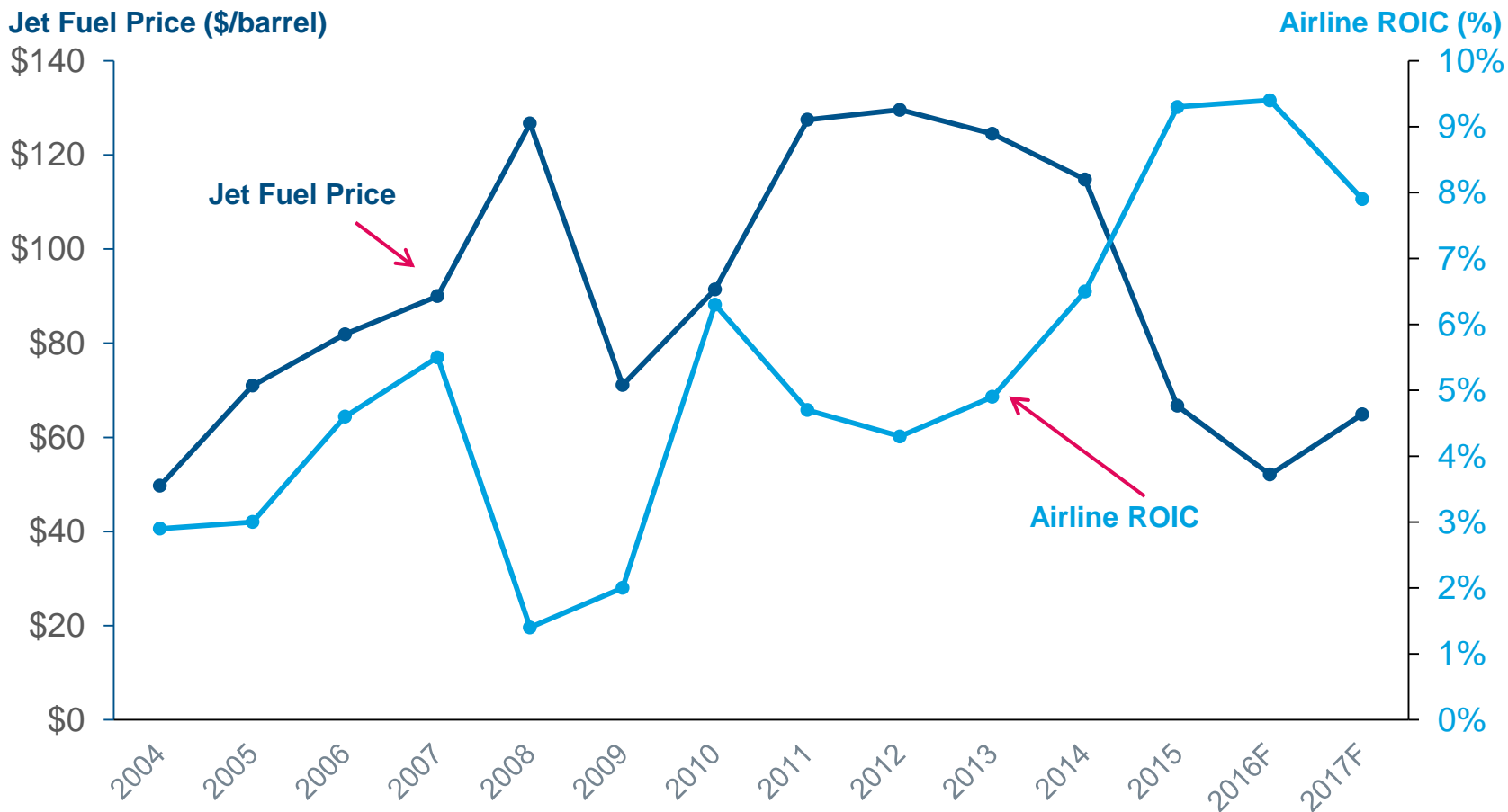


RONA-Driven Airlines



Airlines are achieving high return on invested capital (ROIC) levels

ROIC AND FUEL COSTS (2004 – 2017F)



Source: IATA, ICF Analysis

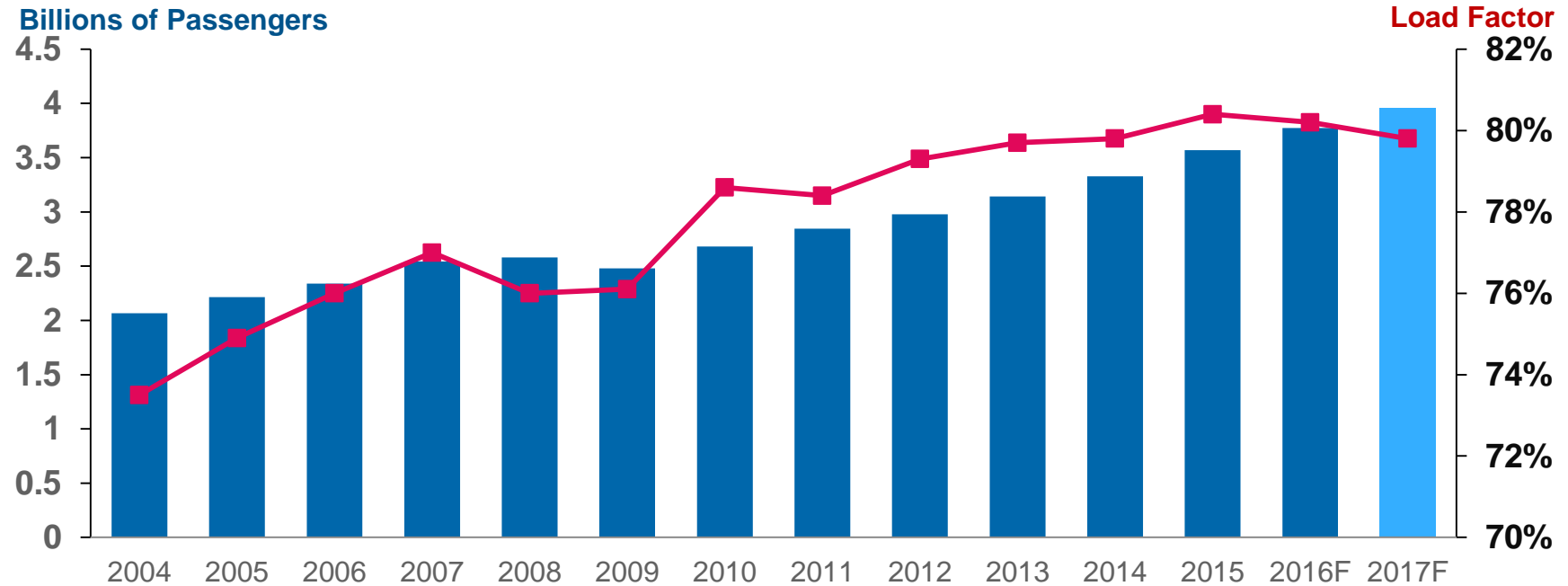


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Capacity management and asset utilization are replacing market share as key metrics...

2004 - 2017 GLOBAL AIRLINE SCHEDULED PASSENGERS



The airlines have historically been run by operationally-minded people, who tended to throw planes onto routes in a fight for market share. The name of the game is now capacity management, and the decision makers are the finance people. Derek Kerr, CFO, American Airlines

Source: ICF Research / IATA



The MRO Market & Key Trends

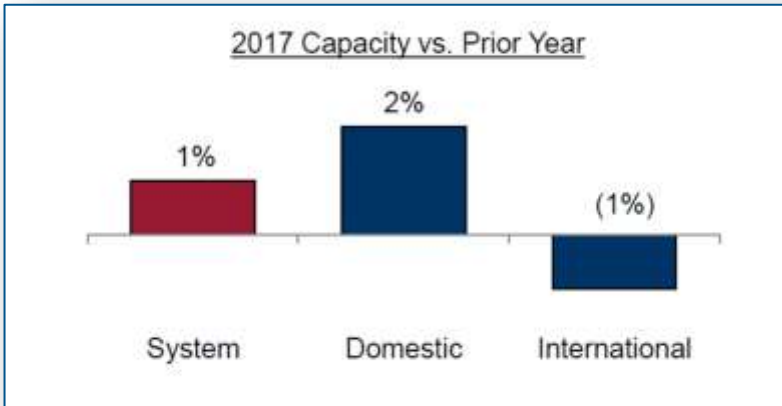
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...For example, Delta is focused on managing costs and maintaining capacity discipline

- Delta expects to drive ~\$1.5 billion of productivity savings in 2017, which will help mitigate cost pressures and fund investments in our business
 - Maintenance savings and productivity from new aircraft and materials purchases
 - Upgauging benefits continue
 - Further leveraging technology investments as well as our scale with suppliers to drive cost productivity

RONA driven airlines intently focus on costs:

- *Deferring maintenance*
- *Managing inventory*
- *Utilizing Used Serviceable Material*
- *Make vs buy*
- *Negotiating hard with suppliers*



Source: Delta Air Lines / J.P Morgan Aviation, Transportation and Industrials Conference, March 15, 2017





Whole Lifecycle MRO Solutions



With new aircraft orders softening, OEMs are even more focused on the aftermarket



Nov 2016:

- Announces goal to triple services revenue to \$50B USD over the next decade
- Hires ex-chief of GE's services business to lead Boeing's commercial unit

Dec 2016:



- Announces the establishment of a dedicated support division
- Announces goal to increase services revenue from 15% to 25% over next 10 years

Dec 2016



- 50% aftermarket revenue growth objective by 2020
- Opened a new support facility in London and looking to further expand existing U.S. & China support facilities

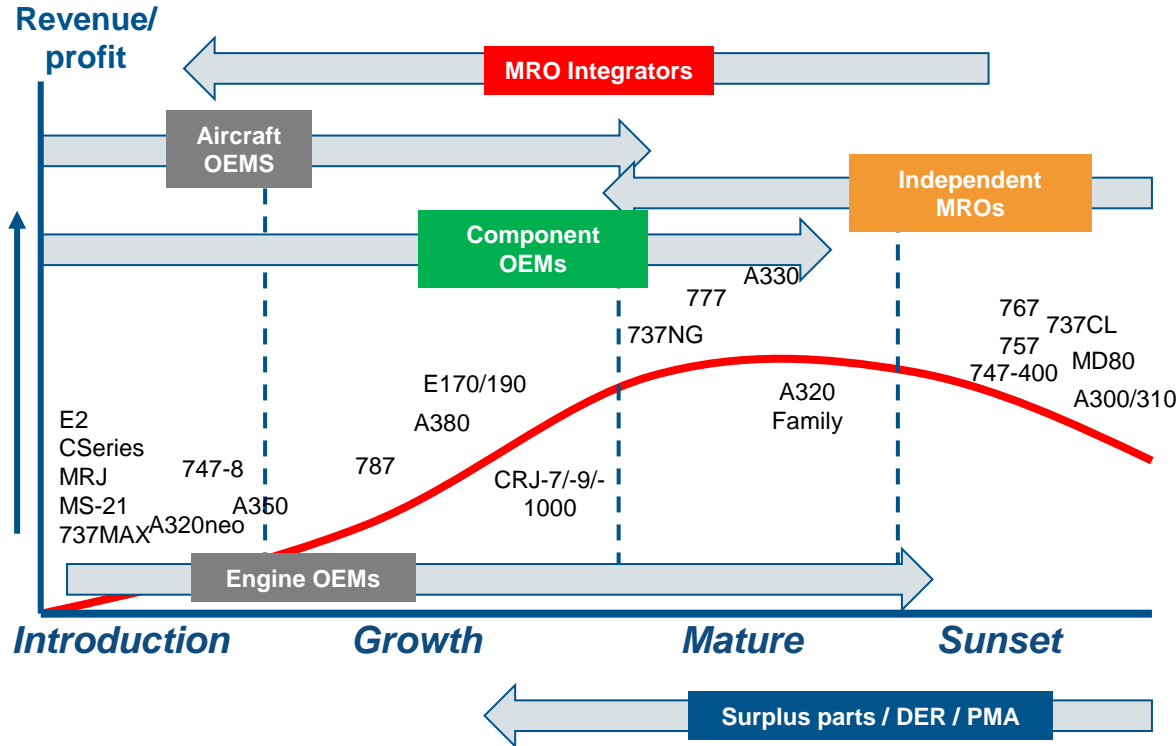
Source: ICF, Reuters, Bloomberg



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Aftermarket strategies vary across the aircraft lifecycle



Airframe OEMs

- Will Airframe OEMs succeed in the MRO market?
- Is their value-add clear?

Component OEMs

- Which integrators to work with – the airlines and/or Airframe OEMs?
- Surplus parts strategy

Engine OEMs

- Focusing on lessors, remarkability and residual values
- Leveraging Big Data
- Emphasizing choice of service offerings and service providers
- Embracing surplus, module swaps, reduced worksopes

Integrators

- How best to secure capability on new platforms?
- Airframe OEMs – customer, supplier or competitor?
- Who best to partner with?

Independent MROs

- Which will survive?
- What niches to pursue?
- What partnership strategy?

Source: ICF



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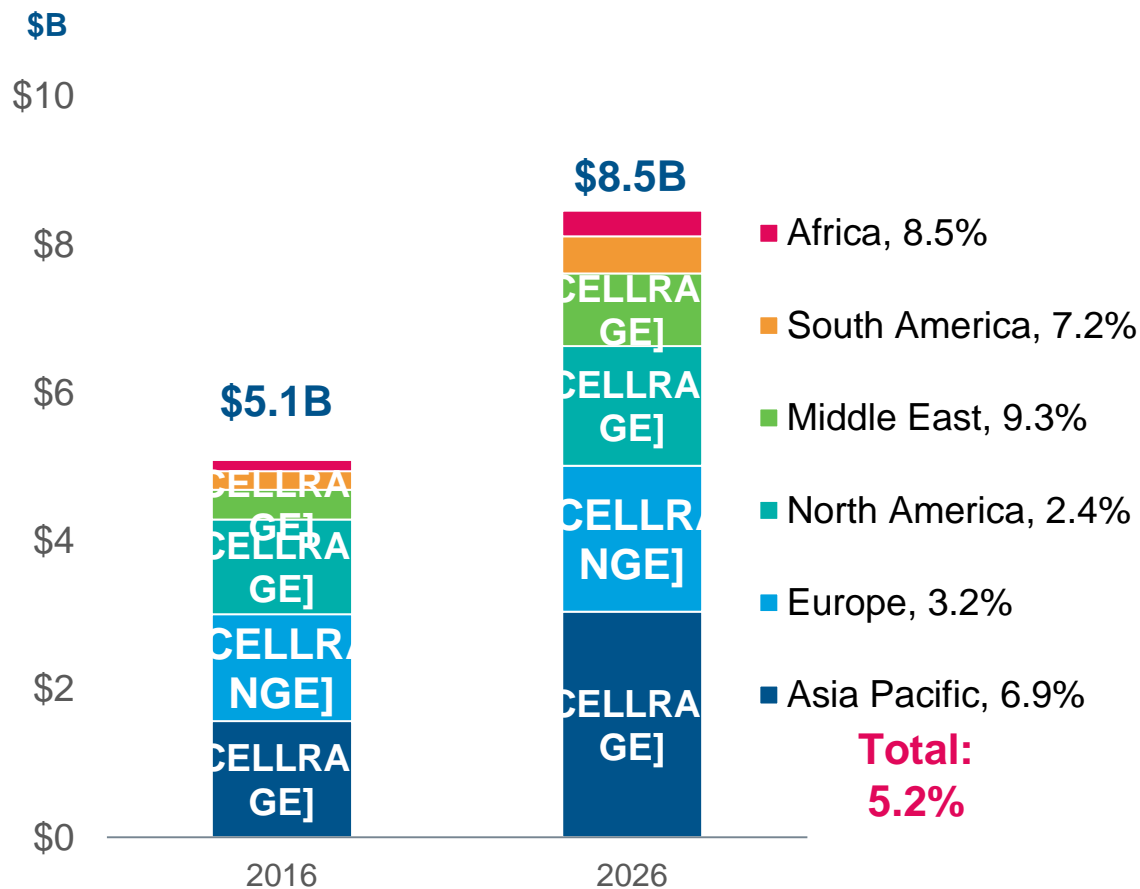
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Modifications

Improved airline revenues are yielding increased modifications spending particularly in the cabin

10 YEAR GLOBAL AIR TRANSPORT MODIFICATION MRO DEMAND



MODIFICATION MARKET OBSERVATIONS

- The interiors market is further consolidating through M&A as well as aircraft OEMs signing exclusive SFE deals with seat suppliers
- M&A examples
 - Rockwell Collins and B/E aerospace acquisition
 - Safran and Zodiac
- Boeing licensed Encore as SFE seat supplier on the 737 in 2016
- Airbus signed an SFE economy seat contract with Recaro in 2015

Source: ICF



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Airbus is hoping to capitalize and has set up a dedicated interior services division

NEW AIRBUS CABIN INTERIOR CONCEPTS: A380 11 ABREAST & AIRBUS FOLDING SEAT SMART CABIN



MODIFICATION MARKET TRENDS

- Recently, Airbus created Airbus Interiors Services (AIS) to perform commercial aircraft cabin upgrade work
- AIS has three lines of business:
 - Tailored equipment
 - Upgrade solutions
 - Innovative products
- Supporting A380 remarketing

- Airbus new 11 abreast configuration on the A380 will be introduced in 2017
- Other cabin innovations include:
 - Airbus's Smart Cabin Configuration concept features folding seats
 - 27 inch pitch slimline seats

Source: ICF International, Airbus

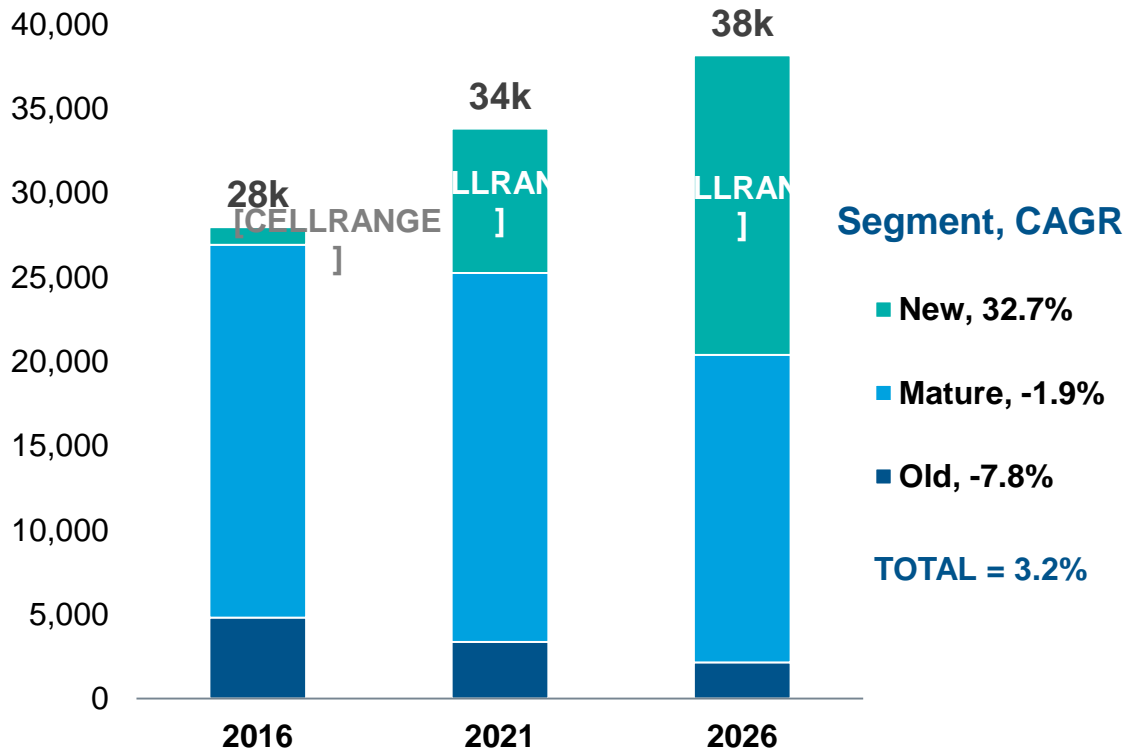


Impact of New Technology Aircraft

The “new technology” fleet is set to grow significantly

AIR TRANSPORT FLEET DEVELOPMENT BY TECHNOLOGY GROUPING

Aircraft



Old: first flight <1990s, e.g. A300/A310 / 747-1/2/3 / BAe146
 Mature: first flight >1990s, e.g. 737CL / 737NG / A330/340 / 777 / E-Jet
 New: first flight >2005; e.g. 787 / A350 / A380 / CSeries / E-Jet E2
 Source: ICF

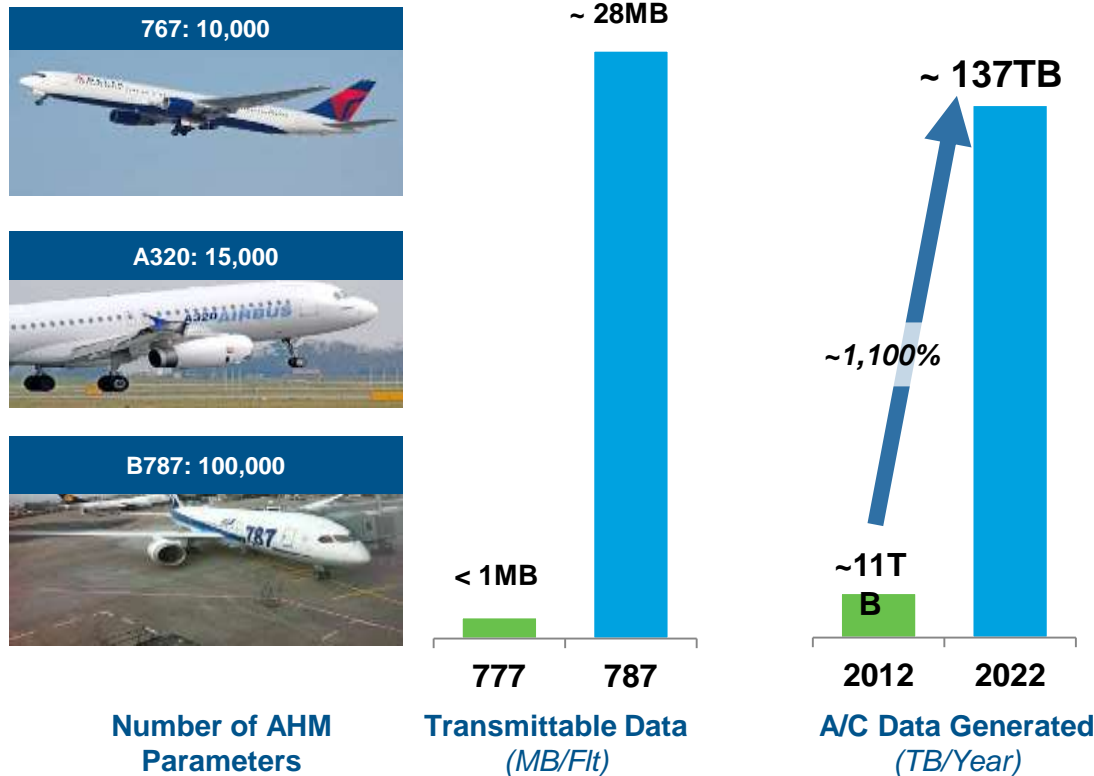
OBSERVATIONS

- A fleet of new aircraft was introduced in the 2010s, as the A350 and B787 led a number of new re-engine aircraft types
- As the A320NEO and 737MAX enter service, the new technology fleet is set to grow significantly
- This category will grow at a ~33% CAGR over the next decade, and will represent nearly 50% of the total fleet by 2026, displacing older and mature aircraft



MROs need to understand how best to realize value from the disparate terabytes of data generated by new technology aircraft

LEGACY VS NEXT-GEN DATA TRANSFER CAPABILITY



KEY ISSUES

- Stakeholder battle: who will control and profit from the operating data IP?
 - Operators
 - Lessors
 - OEMs
 - MRO suppliers

- Ownership and control of data, workscope and assets is key
- Big data analytics is a key enabler

Big Data Analytics:

- Aircraft health monitoring
- Predictive maintenance
- Inventory optimization

Leading to...

- Improved aircraft availability
- Reduced maintenance costs and improved cost control including optimized inventory

Source: ICF Research

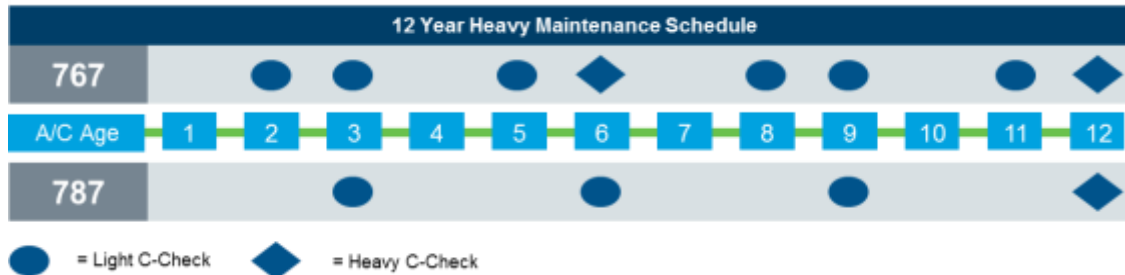


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New technology aircraft continue to challenge traditional MRO sourcing strategies

767 VS 787 HEAVY MAINTENANCE SCHEDULE



	Impact		
	Volume (C-checks)	Intensity (man-hours)	Days (Hangar)
767	8	95,000	136
787	4	33,000	47

THE CHALLENGES

Getting a return on investment

- Facilities
- Tooling & Equipment
- Training
- IT Systems

Implications for legacy infrastructure and staff as new aircraft enter into service

- **Cost Savings:** ~65% fewer routine airframe heavy maintenance man-hours drives an estimated savings of ~\$3.5M
- **Asset Utilization:** ~90 additional available flying days enables increased revenue generation potential

*Based on 4,000 FH/yr utilization
 767 C-check = 18mo, 4C = 72mo; 787 C-check = 36mo, 4C = 144mo
 Assumed industry standard labor man-hour rate
 Aircraft out of Service (AoS) calculated for C/4C/8C checks assuming industry standard MRO hangar productivity



Considerations



In Conclusion...

- The Air Transport MRO market outlook remains robust with expected growth of 4.1% per annum to reach ~\$100B by 2026
- MRO participants are promoting new value propositions to better meet operator and lessor needs across the lifecycle (and signing new partnerships along the way)
- Growth in New Technology Aircraft brings change that provides opportunities and challenges
- With a highly competitive aftermarket ecosystem, MROs need to continually identify “how to win” and invest to maintain leadership



Thank You!

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ICF guides manufacturers, airlines, independent MROs, suppliers, and the financial community through every step of the aerospace and MRO supply chain to realize value and deliver strategies that drive growth. We understand and focus on the key aspects of the industry, and have the proprietary tools necessary for successful operations. Below, we briefly describe our core aerospace & MRO services and proprietary supporting products.

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Production value breakdown by component category and raw material content across the aerospace supply chain.

MRO Best Practices and Benchmarks

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ICF focuses on key aspects of the industry that drive value in both revenue growth and cost control.

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For airlines, OEMs, and independent MROs, ICF has deep experience in comprehensive operational and financial diagnostics based on extensive proprietary benchmarks, followed by results-oriented improvement programs.

