



THE MRO MARKET & KEY TRENDS

MRO Summit
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London

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Today's Agenda

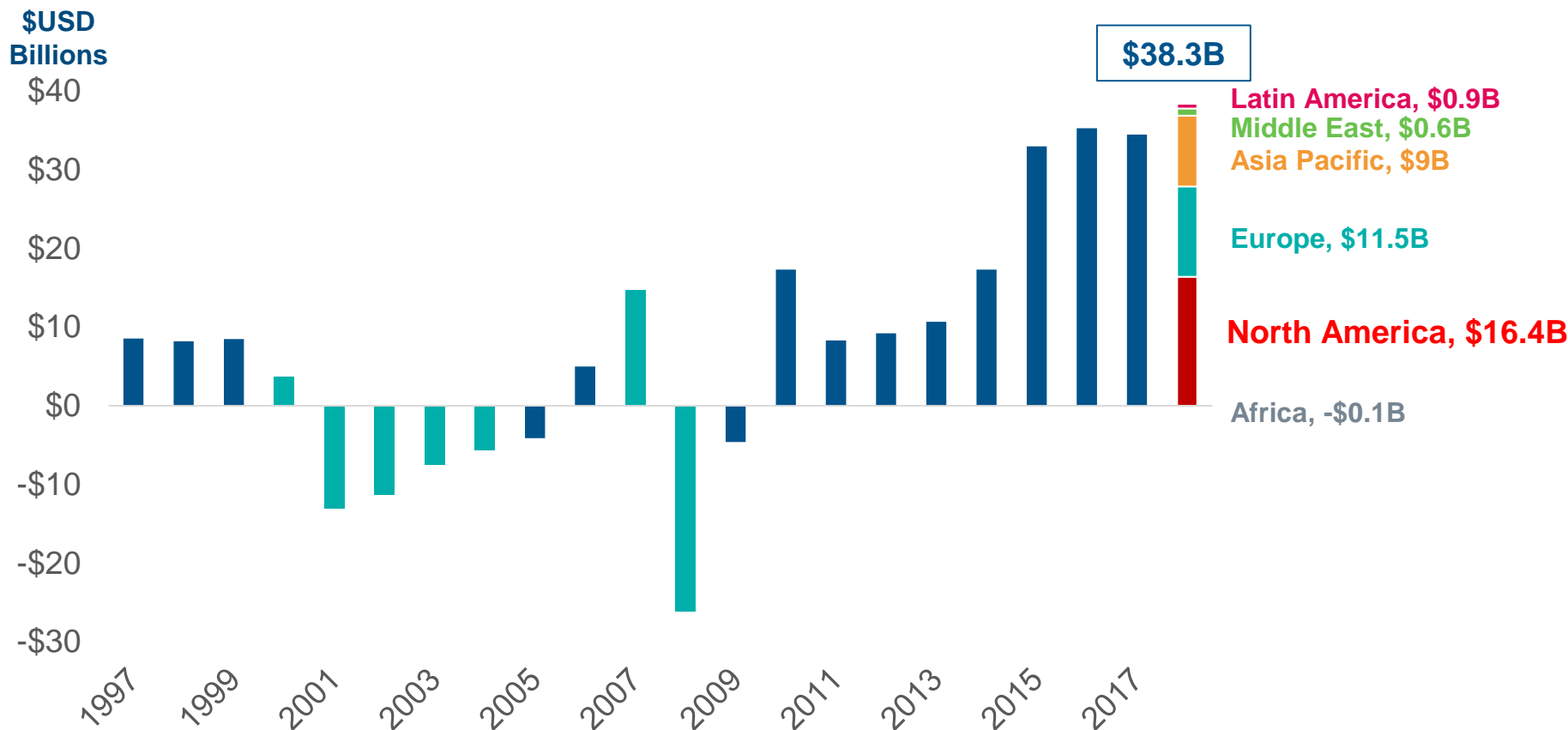
1. Industry Context
2. MRO Market
3. Trends to watch

Industry Context



The global airline industry is forecast to achieve a record profitability of over \$38B USD in 2018

GLOBAL AIRLINE PROFITABILITY, 1998 – 2018F

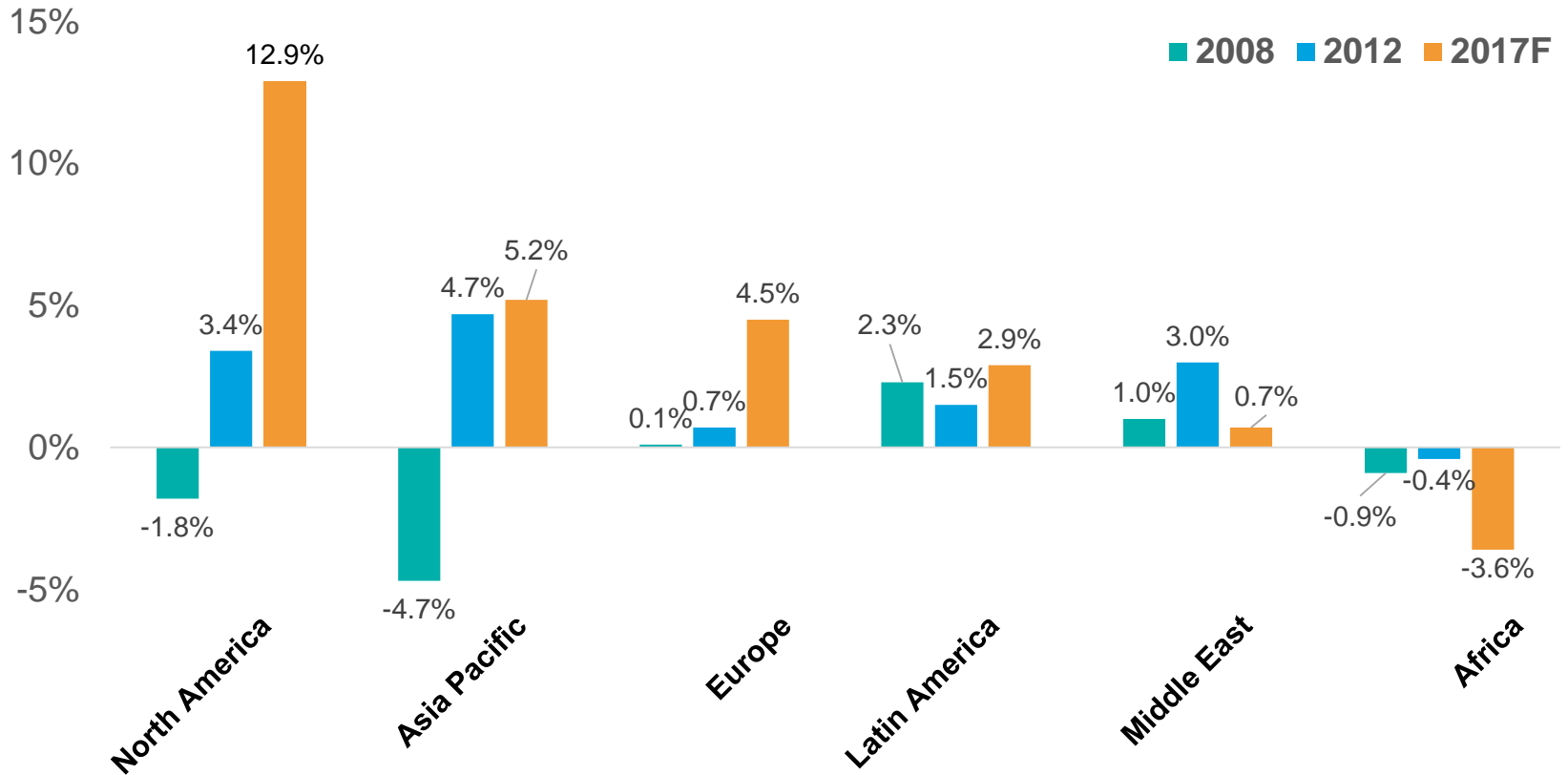


Source: IATA/ ICF Analysis



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

GLOBAL AIRLINE EBIT MARGIN BY REGION



Source: IATA/ ICF Analysis



Jet fuel price has remained low over the past couple of years but has been creeping up recently

US\$ per
Gallon

U.S. Gulf Coast Kerosene-Type Jet Fuel Spot Price

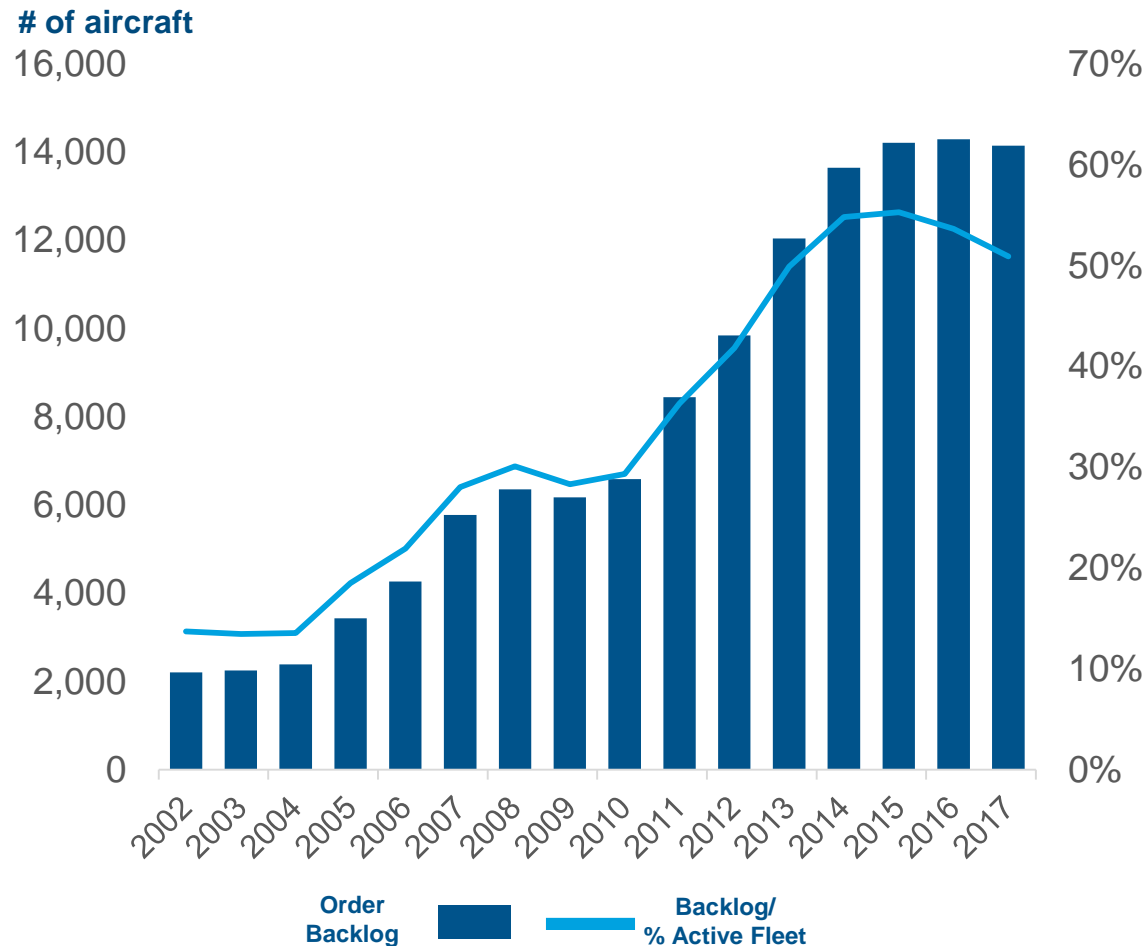


Source: EIA; ICF analysis



Commercial aircraft OEM production backlog remains at historical highs

COMMERCIAL AIRCRAFT OEM PRODUCTION BACKLOG



DRIVERS OF OEM BACKLOG

- Backlog more than doubled between 2010 and 2014, driven by:
 - Emerging market growth
 - Very low interest rates and plentiful capital
 - High oil and commodity prices
 - Introduction of new technology aircraft/engines
- In 2017, total backlog decreased for the first time since 2009 as deliveries ramp-up and orders slowdown

Source: CAPA, ICF Analysis



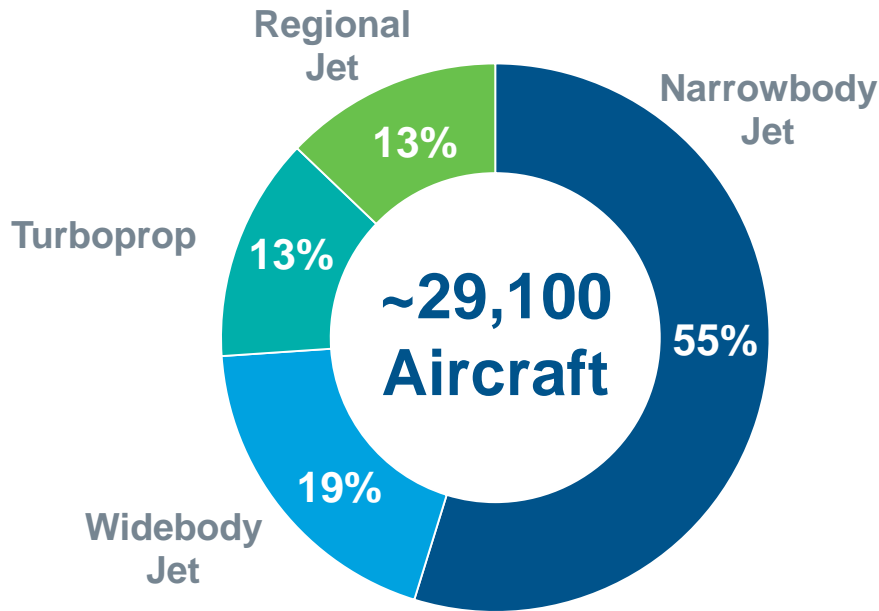
MRO Market

Index ▲ 1.56 ▼ 0.78

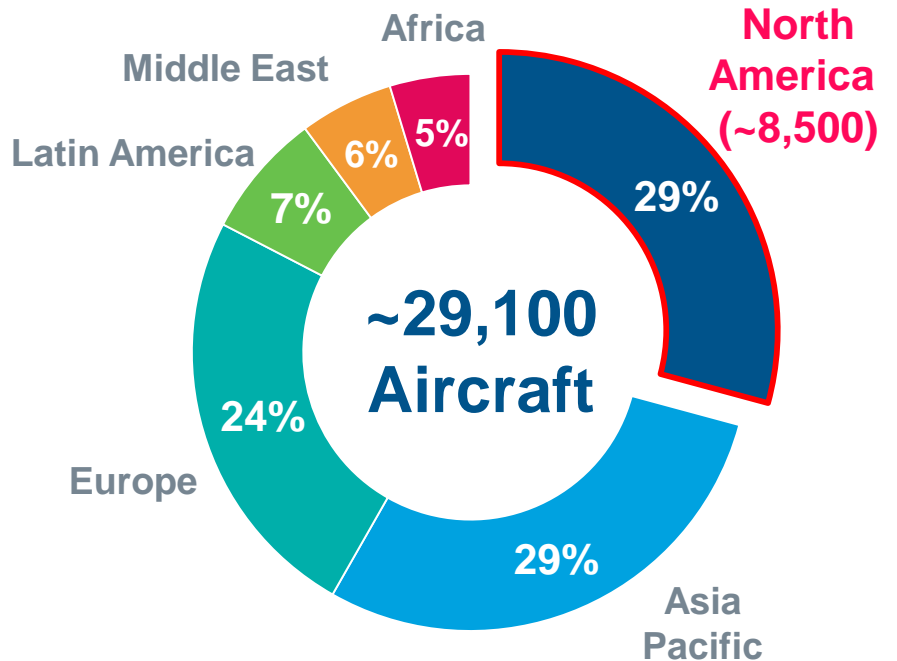
The current commercial air transport fleet consists of ~29,100 aircraft; ~8,500 are located in North America

2017 GLOBAL COMMERCIAL AIR TRANSPORT FLEET

BY AIRCRAFT TYPE



BY GLOBAL REGION



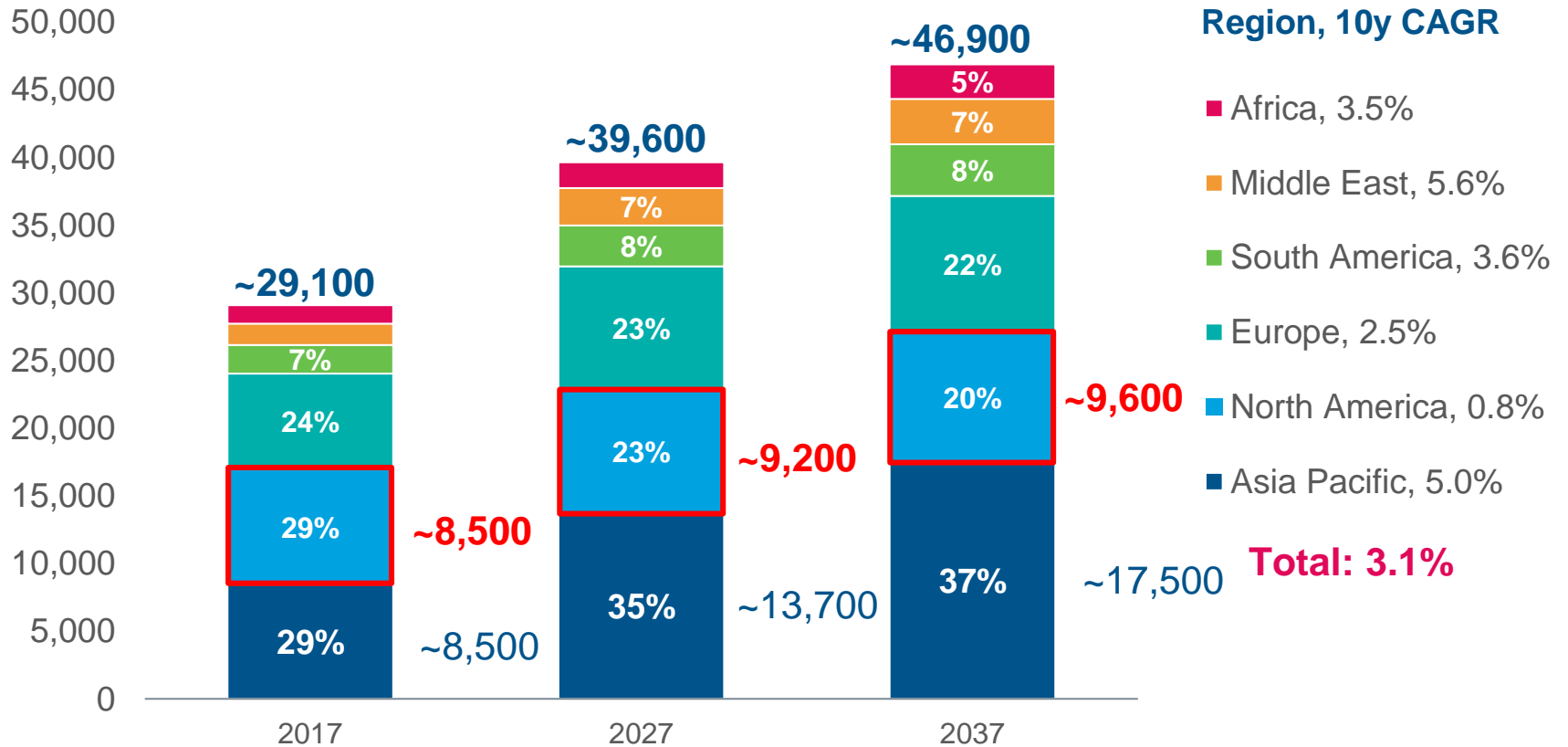
Source: ICF Analysis: CAPA 2017



The combination of strong air travel demand and the need to replace ageing aircraft will drive fleet growth at a healthy 3.1% p.a.

20 YEAR GLOBAL AIR TRANSPORT FLEET GROWTH

Aircraft



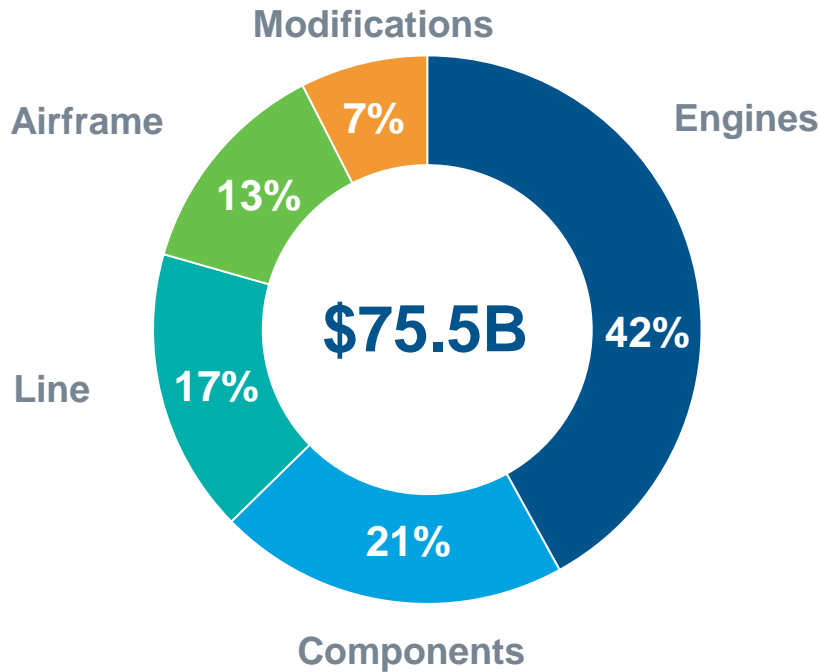
Source: ICF Analysis: CAPA 2017



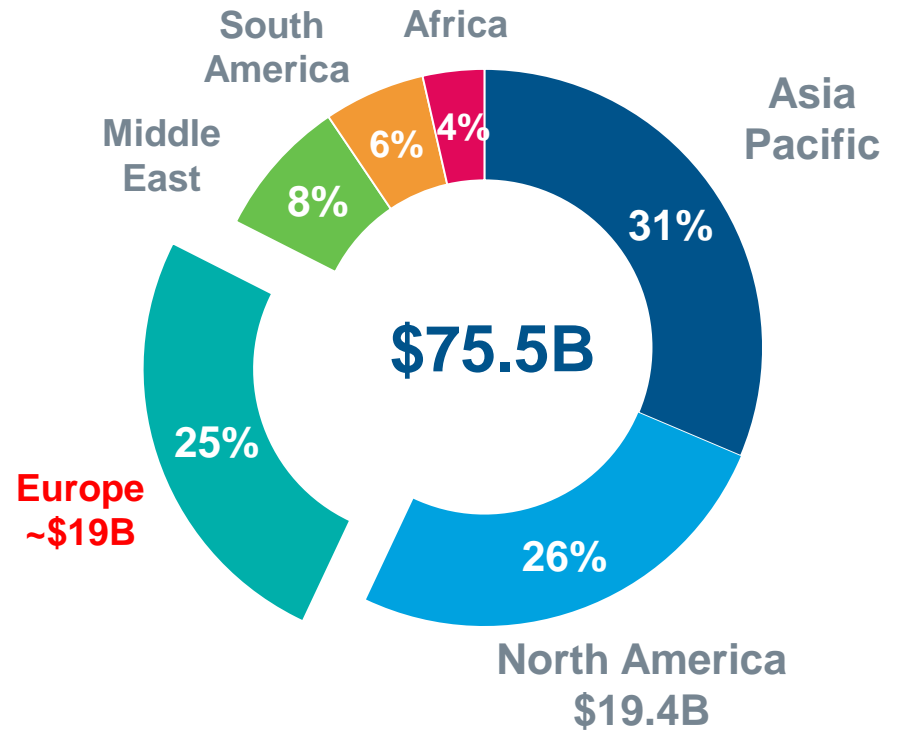
2017 commercial air transport MRO demand is \$75.5B; Asia is now larger than North America and Europe in market size

2017 COMMERCIAL AIR TRANSPORT GLOBAL MRO DEMAND

BY MRO SEGMENT



BY GLOBAL REGION



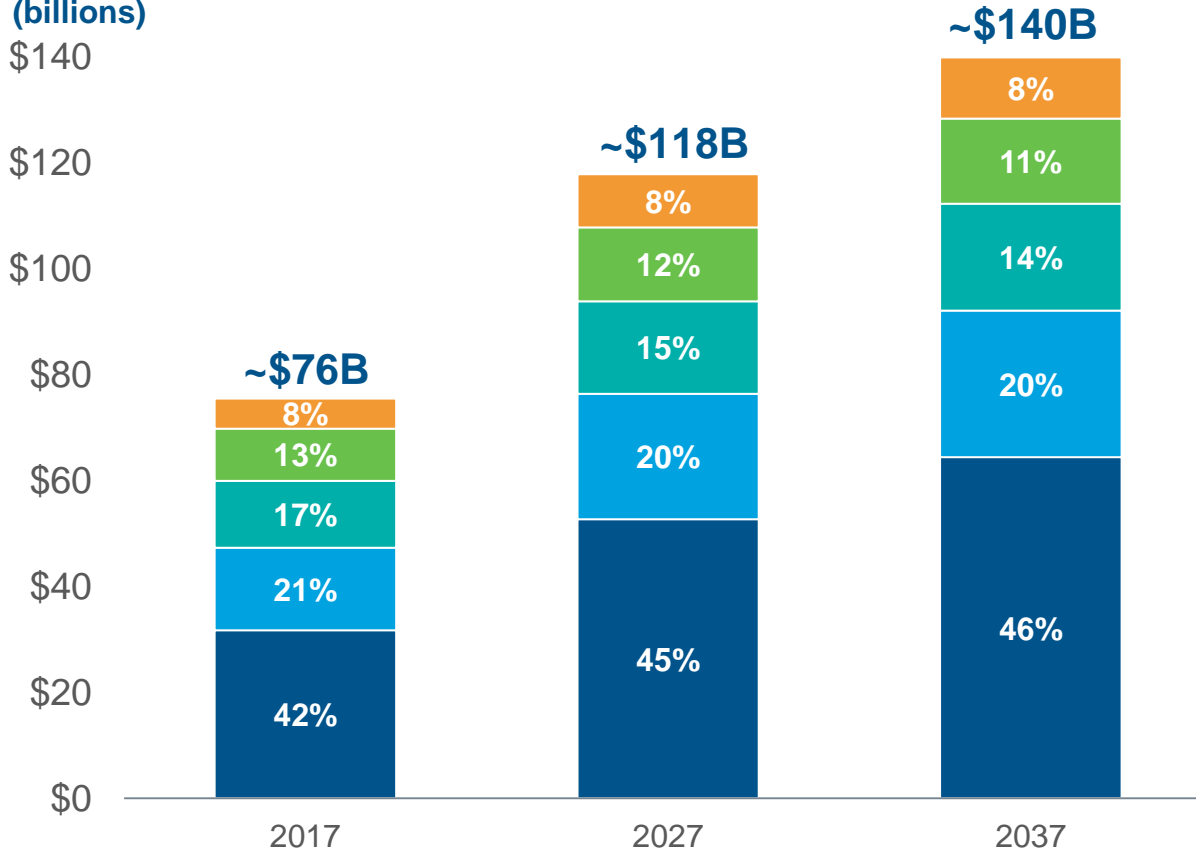
Source: ICF Analysis: CAPA 2017



The global MRO market is expected to grow by 4.6% per annum to ~\$118B by 2027

20 YEAR GLOBAL COMMERCIAL AIR TRANSPORT MRO DEMAND

\$ USD
(billions)
\$140



Region, 10 y CAGR

- Modifications, 5.8%
- AHM, 3.5%
- Line, 3.3%
- Component, 4.3%
- Engine, 5.2%

Total: 4.6%

Source: ICF Analysis: CAPA 2017, 2017 constant \$



Asia continues to grow strongly and will generate 38% of MRO demand by 2037...

20 YEAR GLOBAL COMMERCIAL AIR TRANSPORT MRO DEMAND

\$ USD
(billions)

\$140

\$120

\$100

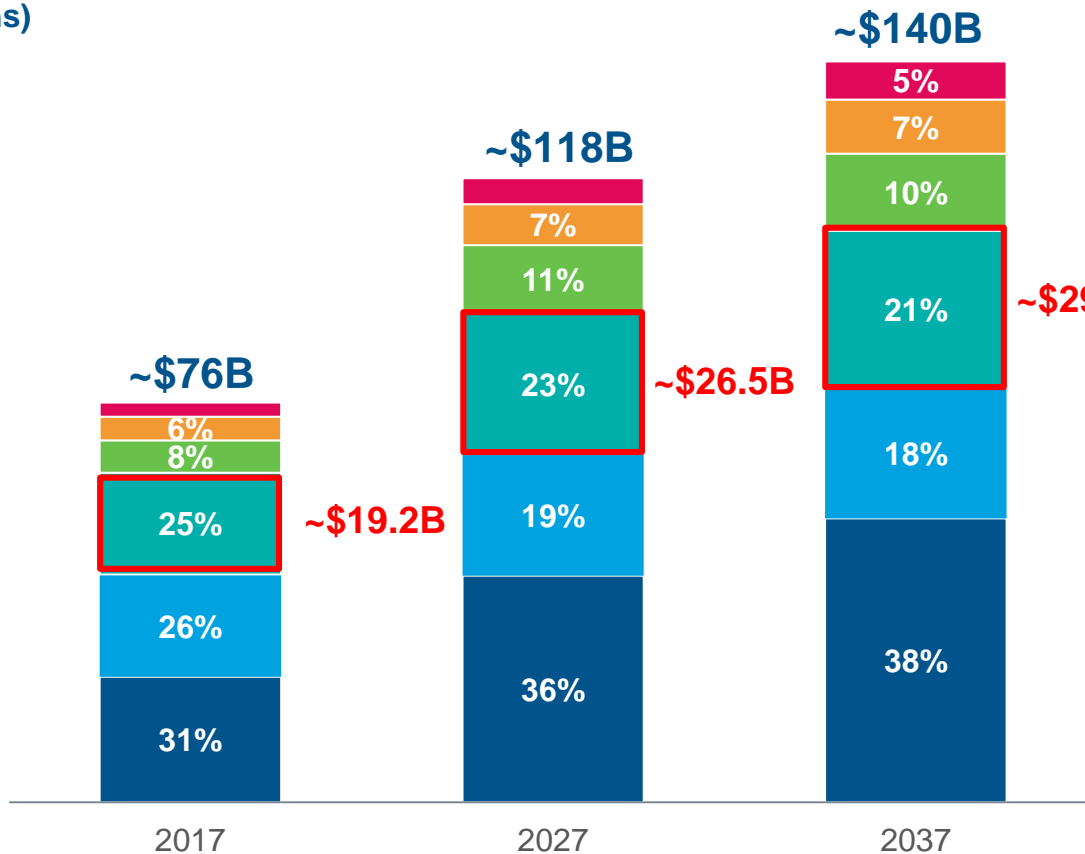
\$80

\$60

\$40

\$20

\$0



Region, 10y CAGR

- Africa, 6.1%
- South America, 5.7%
- Middle East, 7.9%
- Europe, 3.3%
- North America, 1.7%
- Asia Pacific, 6.1%

Total: 4.6%

Source: ICF Analysis: CAPA 2017, 2017 constant \$



The MRO market in Western Europe is expected to grow by 2.1% per annum to ~\$16B by 2027

20 YEAR COMMERCIAL AIR TRANSPORT MRO DEMAND IN WESTERN EUROPE

\$ USD
(billions)

\$20

\$18

\$16

\$14

\$12

\$10

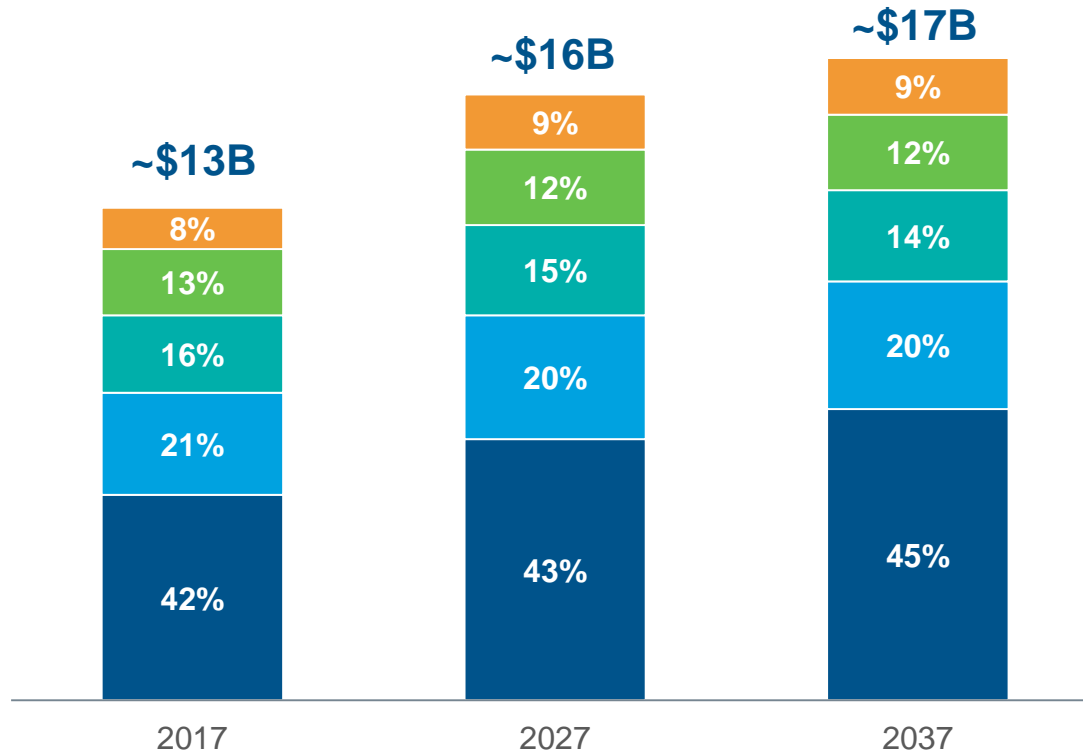
\$8

\$6

\$4

\$2

\$0



Region, 10 y CAGR

- Modifications, 2.9%
- AHM, 1.3%
- Line, 1.5%
- Component, 2.0%
- Engine, 2.4%

Total: 2.1%

Source: ICF Analysis: CAPA 2017, 2017 constant \$



The MRO market in Eastern Europe & CIS is expected to grow by 5.5% per annum to ~\$10B by 2027

20 YEAR COMMERCIAL AIR TRANSPORT MRO DEMAND IN EASTERN EUROPE

\$ USD
(billions)

\$14

\$12

\$10

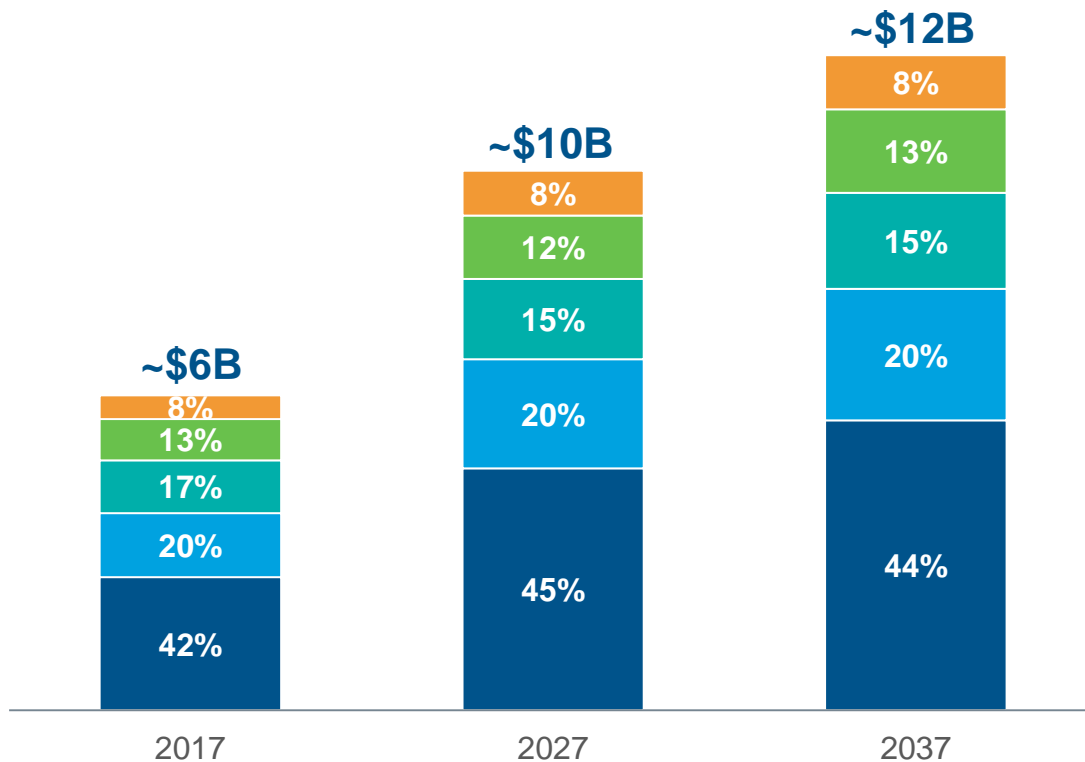
\$8

\$6

\$4

\$2

\$0



Region, 10 y CAGR

- Modifications, 6.6%
- AHM, 4.4%
- Line, 4.3%
- Component, 5.5%
- Engine, 6.2%

Total: 5.5%

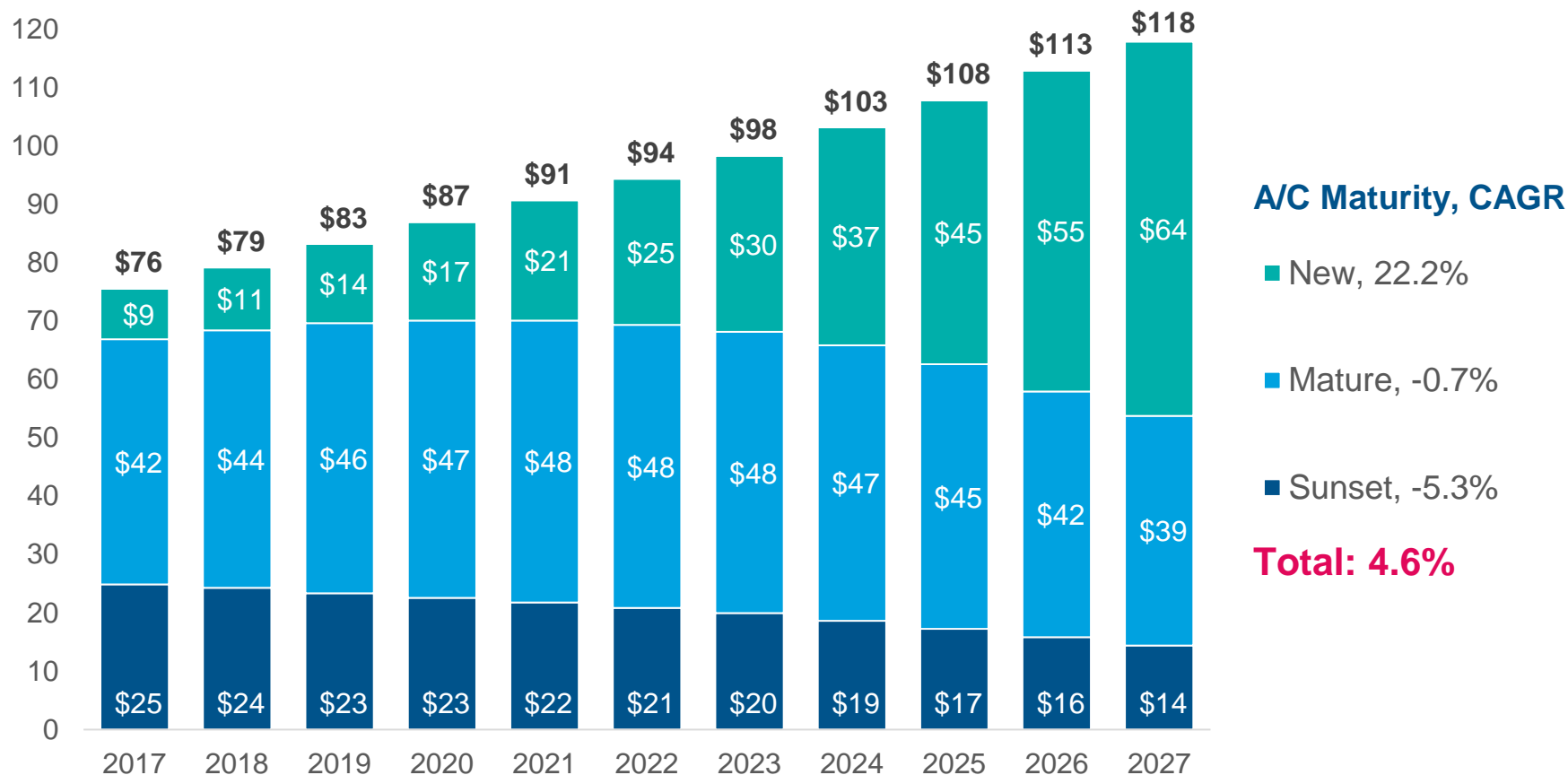
Source: ICF Analysis: CAPA 2017, 2017 constant \$



The 1990s/2000s technology aircraft are generating most MRO; However, new technology aircraft will comprise ~55% of MRO spend in 2027

ICF FORECAST: 2017-2027 TOTAL MRO DEMAND BY A/C MATURITY

\$ USD (billions)



Note: constant 2017 USD

A/C Maturity: Sunset (1960s, 1970s and 1980s), Mature (1990s), New (2000s, 2010s and 2020s)

Source: ICF

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Trends To Watch

Consolidation continues among System OEMs



Next?

Acquisitions?

Divestments?

Honeywell

United Technologies

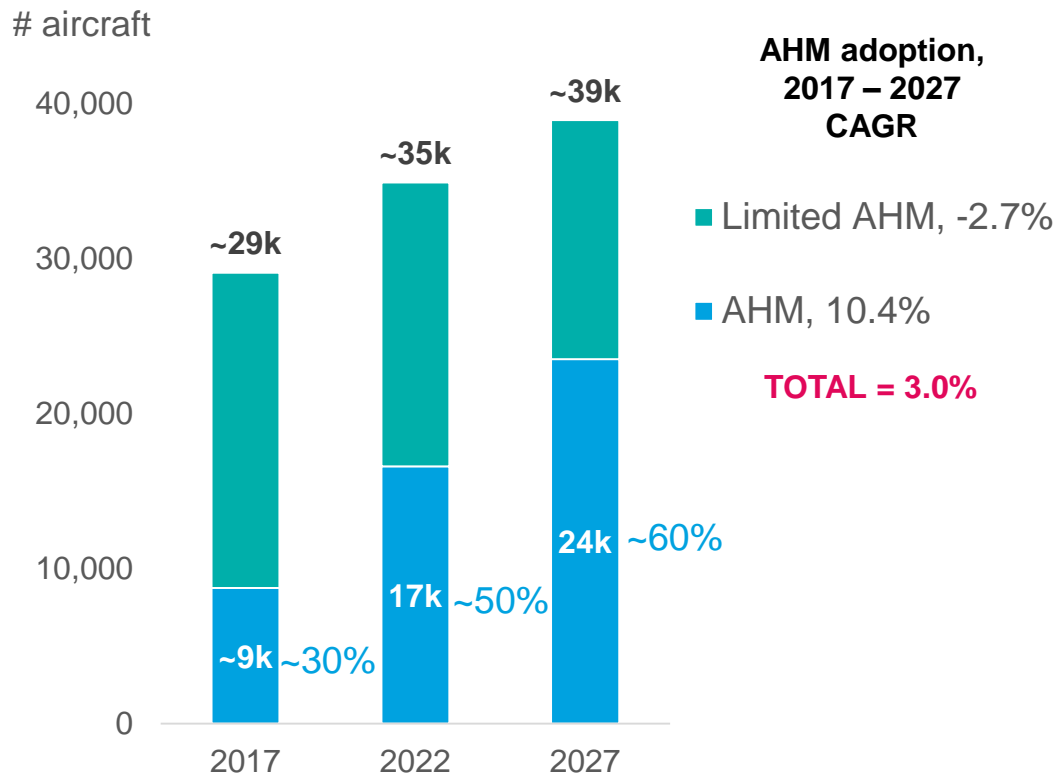




Impact of New Technology Aircraft

The fleet of e-enabled aircraft is set to more than double over the next decade

ICF IN-SERVICE AIR TRANSPORT FLEET FORECAST



OBSERVATION

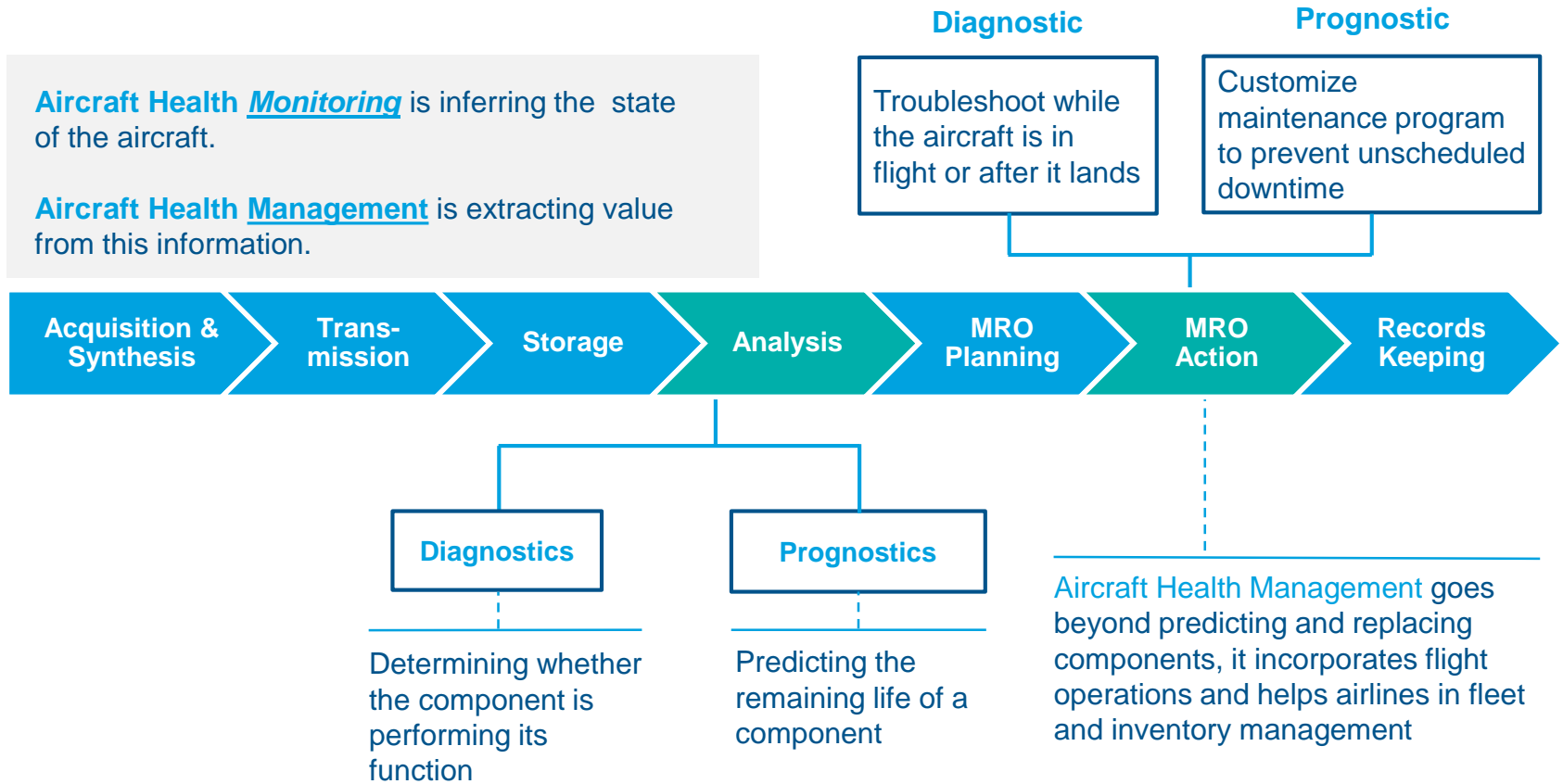
- ICF expects ~23,500 aircraft will be equipped with Aircraft Health Monitoring (AHM) by 2027, growing at 10.4% CAGR
- This is driving a digitisation of aircraft operations, which will see high growth in the e-enabled services and further advances in health management

Source: ICF



AHM can be viewed as a subset of data management value chain...

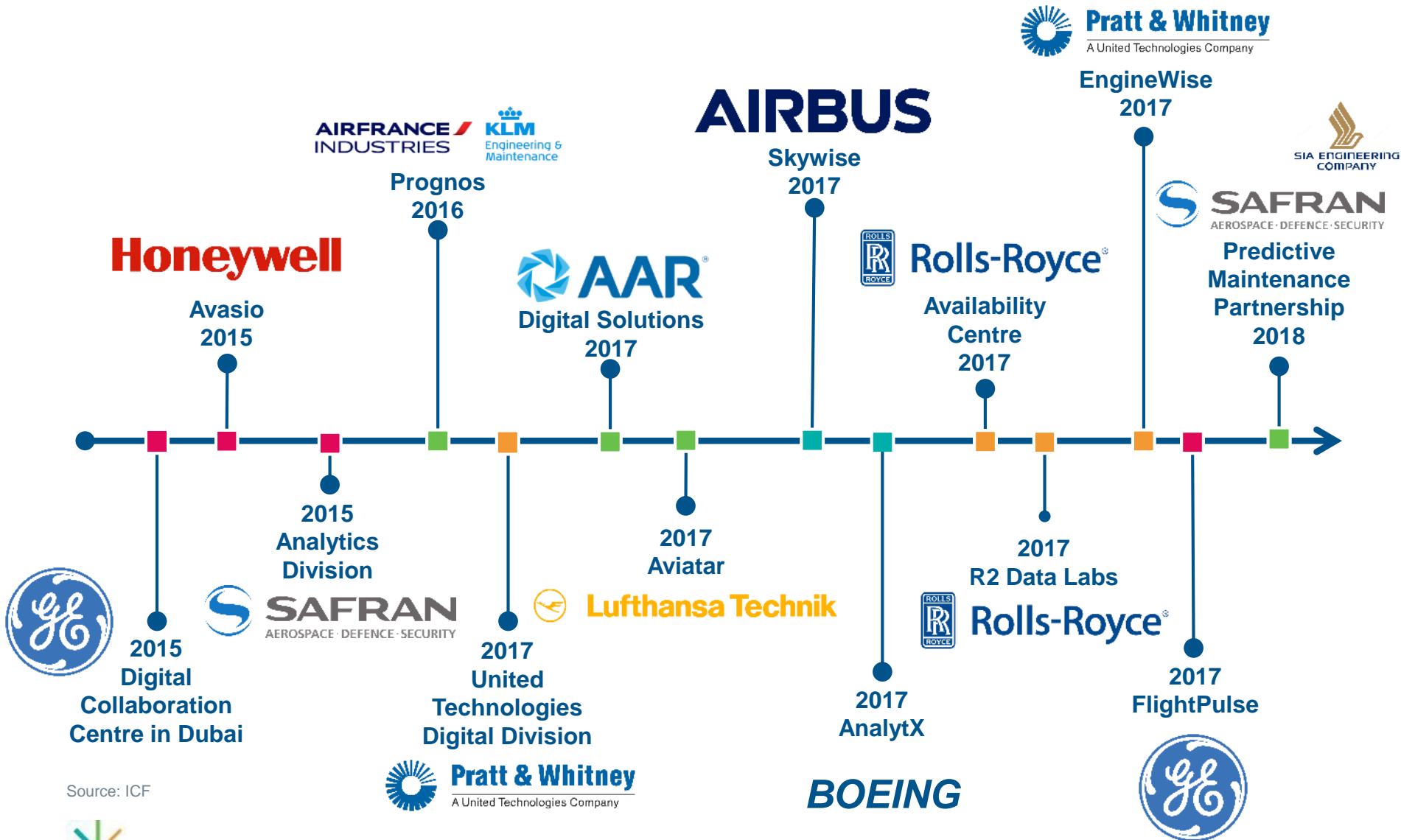
Aircraft Data Management Value Chain



Source: ICF



The race is on... new battlegrounds are emerging across the MRO market



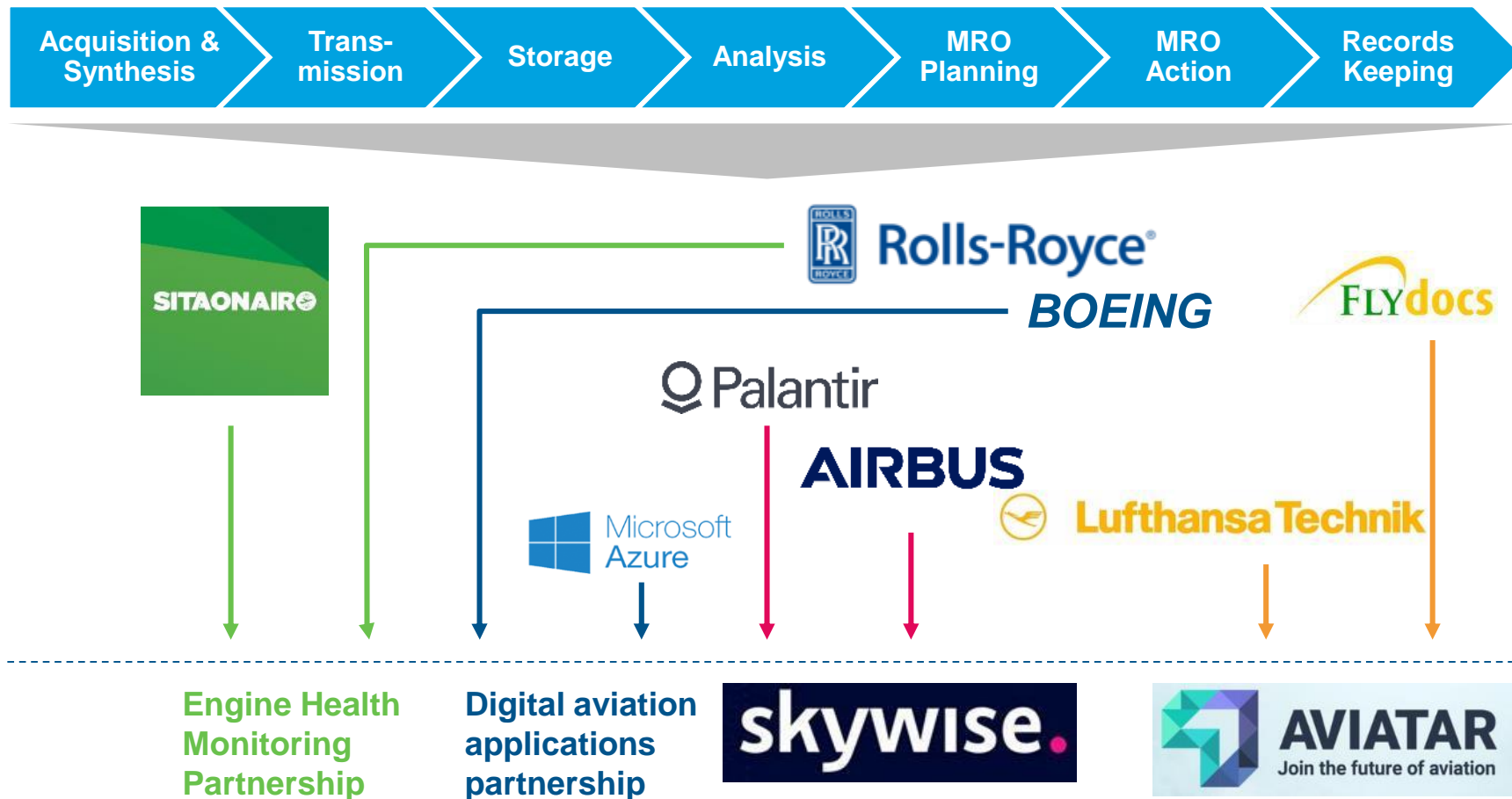
Source: ICF



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OEMs & MROs are embracing partnerships to cover the MRO data value chain...

DATA VALUE CHAIN PARTNERSHIP EXAMPLES



Source: ICF

... Though the level of partnership varies across the various parts of the data value chain

OVERVIEW OF AIRCRAFT DATA VALUE CHAIN PARTNERSHIPS



	Acquisition & Synthesis	Transmission	Storage	Analysis	MRO Planning	MRO Action	Records Keeping
AIRBUS	Rockwell Collins	transatel	IBM	Palantir	AIRBUS	AIRBUS MRO Alliance	-
BOEING	TELEDYNE Honeywell	ACARS / Gate Wi-Fi	Microsoft Azure	BOEING AnalytX	BOEING	BOEING	AERDATA A Boeing Company
Lufthansa Technik	-	ACARS / Gate Wi-Fi	IBM	IBM	SWISS AviationSoftware	Lufthansa Technik	FLYdocs
AIRFRANCE INDUSTRIES / KLM Engineering & Maintenance	-	ACARS / Gate Wi-Fi		AIRFRANCE INDUSTRIES / KLM Engineering & Maintenance	AIRFRANCE INDUSTRIES / KLM Engineering & Maintenance	AIRFRANCE INDUSTRIES / KLM Engineering & Maintenance	-
AAR	-	ACARS / Gate Wi-Fi	ORACLE CLOUD	ORACLE CLOUD	AAR	AAR	-

Source: ICF



Digitisation could enable airlines to save in excess of \$5B/year through lower fuel, maintenance and delay costs

Health Monitoring and Predictive Maintenance

- > Airline Industry savings: **~\$3B** (*conservative estimate*)
- > Driven by improved dispatch reliability, No Fault Found reduction, Inventory reduction and Improved labour productivity

Fuel Cost Savings

- > Airline Industry savings: **~\$1.7B** (*conservative estimate*)
- > Continuous flight optimisation through live weather updates, speed and altitude optimisation...

Delay Reduction

- > Airline Industry savings: **~\$0.8B** (*conservative estimate*)
- > Improved turnaround process, in-flight routing optimisation

Source: ICF



Several airlines are seeing the first tangible benefits of their aircraft health monitoring trials

Results of Delta's Predictive Maintenance approach

Avoided Engine Events

1,000

(Over 1-year timespan)

Delta achieved a 100% completion factor for 241 days in 2017, with a 98% reduction in maintenance-related cancellations

Cancellation reduction

98%

(Over 2010 - 2016)

easyJet

31 Events

31 instances of Skywise correctly predicting faults before they occurred in service, allowing the carrier to intervene and remove components before they failed

Cathay Pacific

51%

Cathay Pacific reduced APU-related delay minutes by 51% using Honeywell's predictive maintenance trial program

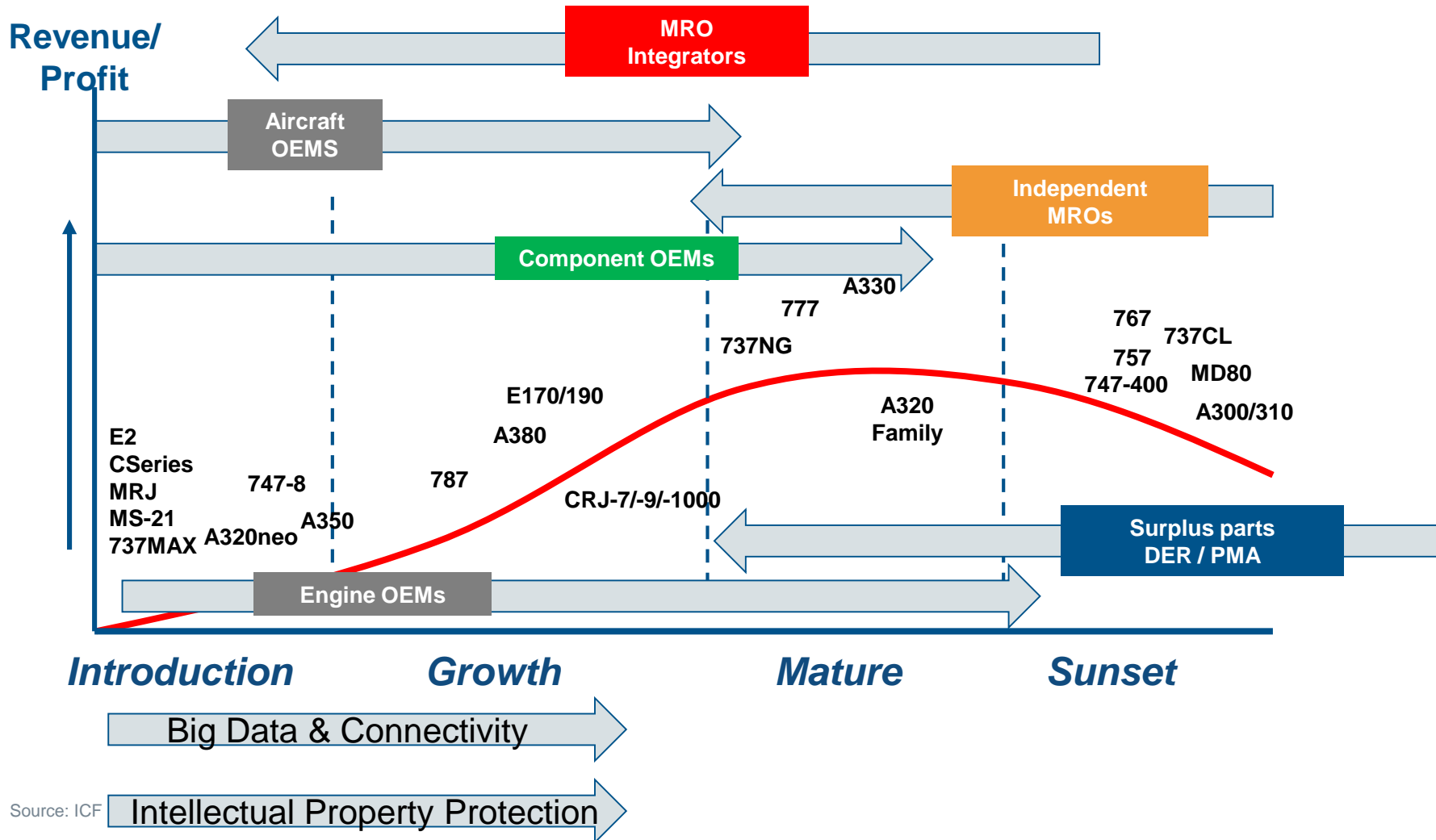
Source: MRO-Network



Lifecycle Strategies



Finally, Aftermarket strategies vary across the aircraft lifecycle



Source: ICF



Considerations



In Conclusion...

- The Global Air Transport MRO market outlook remains robust at \$76B growing to \$118B over the next decade (an expected growth of 4.6% per annum)
- European MRO generates \$19.4B of MRO demand and will grow to \$26.5B by 2027 at 3.3% CAGR
- New technology aircraft and engines are creating both new challenges and opportunities for aviation stakeholders including how best to leverage big data to reduce operator costs, help increase efficiency and increase reliability





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