ALTON AVIATION CONSULTANCY

Market Update: PMA & DER

AACO & IATA Technical Forum

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aaco
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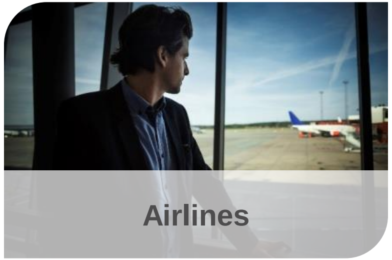

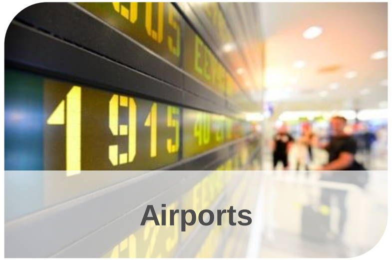

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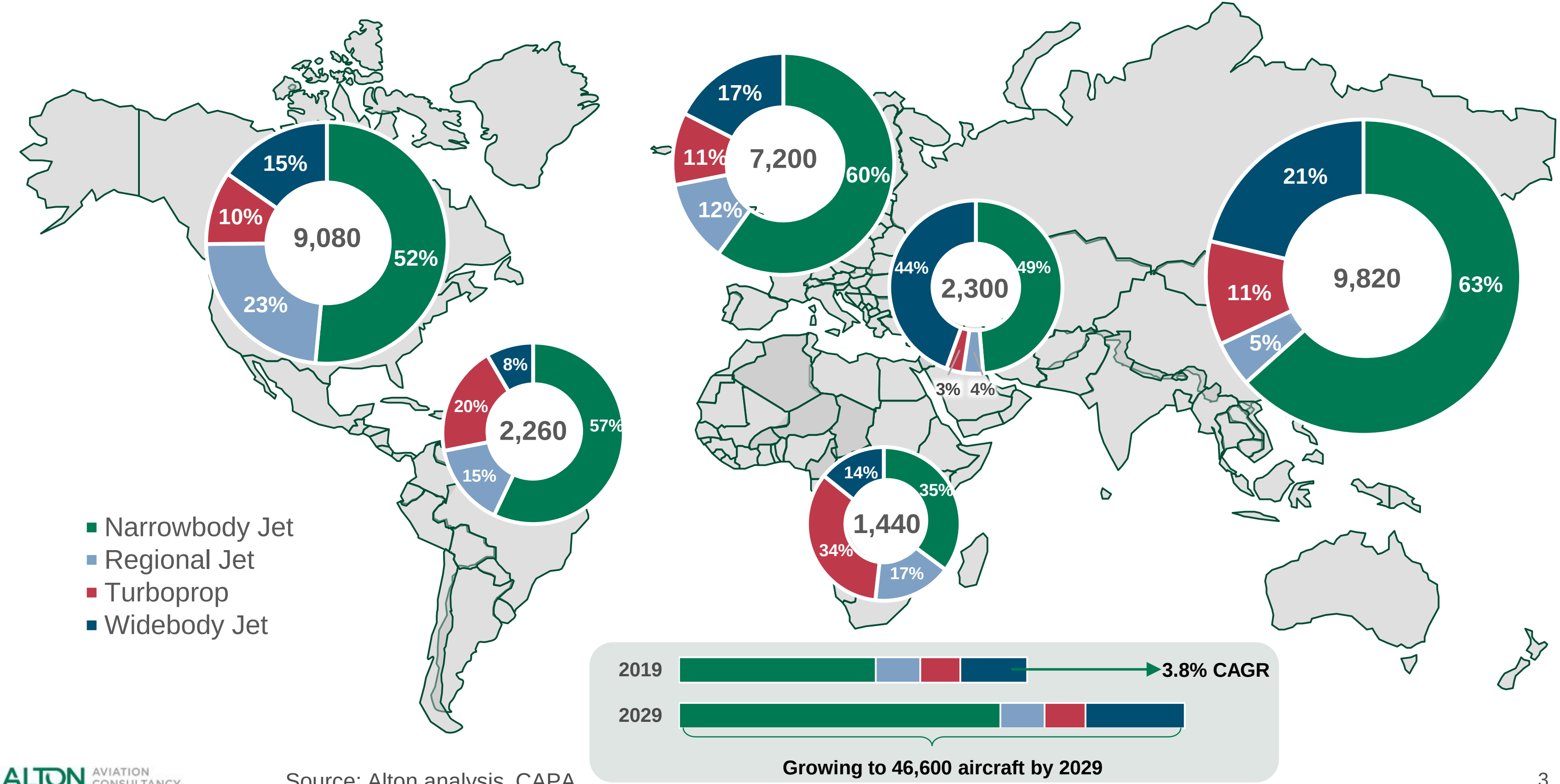
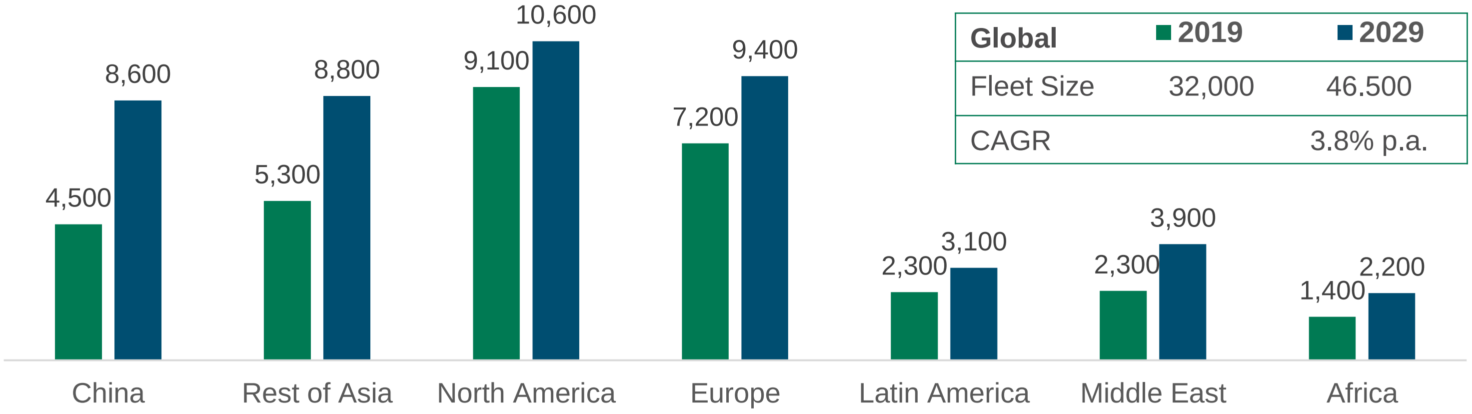
Today's commercial air transport fleet consists of approximately 32,000 aircraft which will grow to over 46,000 in the next 10 years



Source: Alton analysis, CAPA

Over the coming decade, the Middle East is estimated to add more than 1,600 aircraft to the fleet; a 5.3% annual growth rate

2019 - 2029 Fleet Forecast by Region

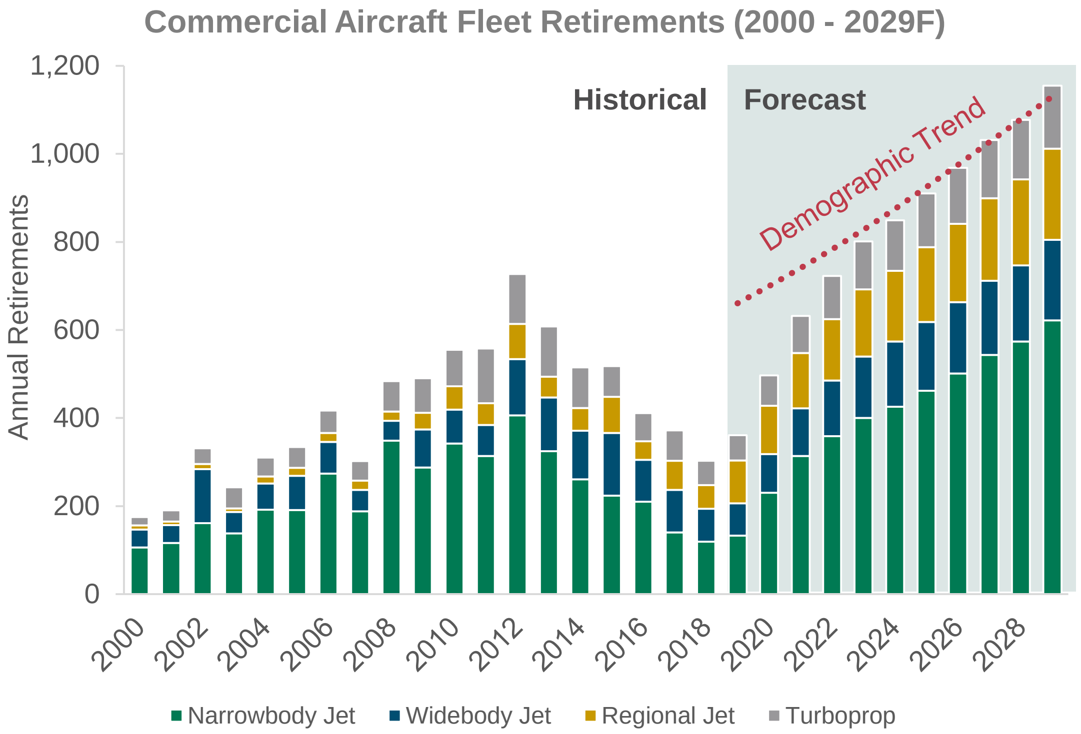


Global	2019	2029
Fleet Size	32,000	46.500
CAGR		3.8% p.a.

	China	Rest of Asia	North America	Europe	Latin America	Middle East	Africa
2019-2029 Net Fleet Growth	**+4,100**	**+3,500**	**+1,500**	**+2,200**	**+800**	**+1,600**	**+800**
Annual Growth Rate	**6.7%**	**5.2%**	**1.6%**	**2.7%**	**3.1%**	**5.3%**	**4.5%**

Fleet numbers rounded to nearest hundred
Source: Alton analysis

Globally, total fleet retirements peaked at over 700 events in 2012 as oil prices spiked; retirements will steadily increase in the coming decade



Alton Insight

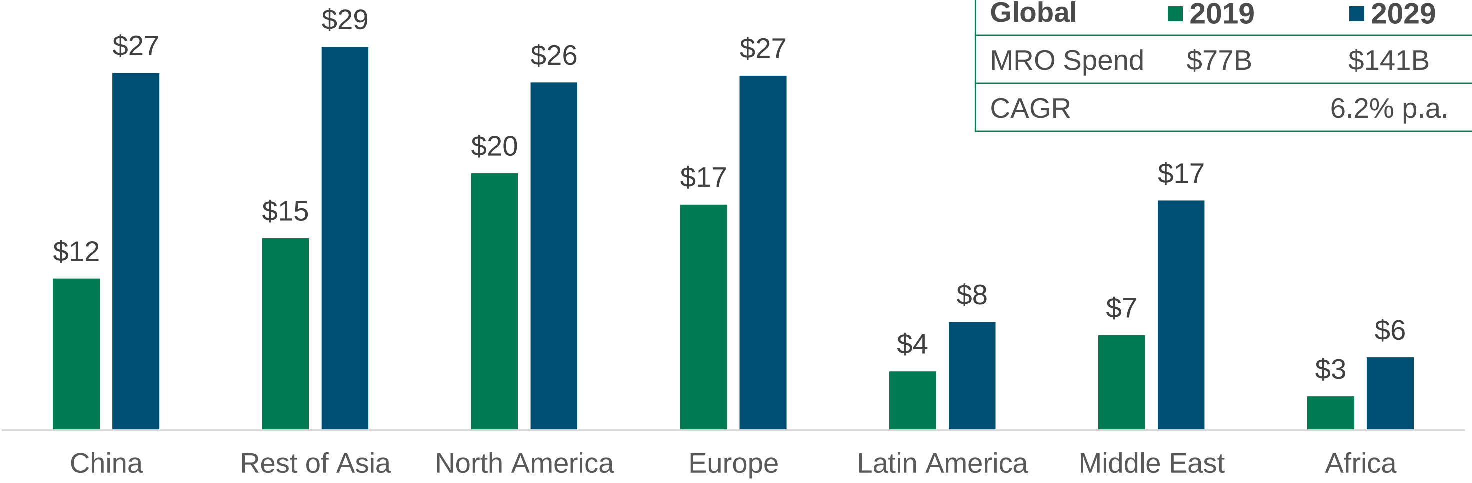
- **Typical aircraft life is approx. 25 years; there was a large spike in aircraft deliveries in the late 1980s**
- **Airline retirement decisions are primarily driven by fuel prices and airline financial health**
- **In the early 2000s, the surge in retirements spawned the aircraft tear-down/part-out industry; was very disruptive to OEM new parts sales**
- **Growth of the used surplus material (USM) market has had a negative impact on PMA growth**

Source: Alton analysis, CAPA

Given the fleet age demographics and outsized proportion of widebody aircraft, the Middle East's MRO demand growth rate will be world's fastest

2019 - 2029 MRO Forecast by Region
(USD billion)

Global	2019	2029
MRO Spend	$77B	$141B
CAGR		6.2% p.a.

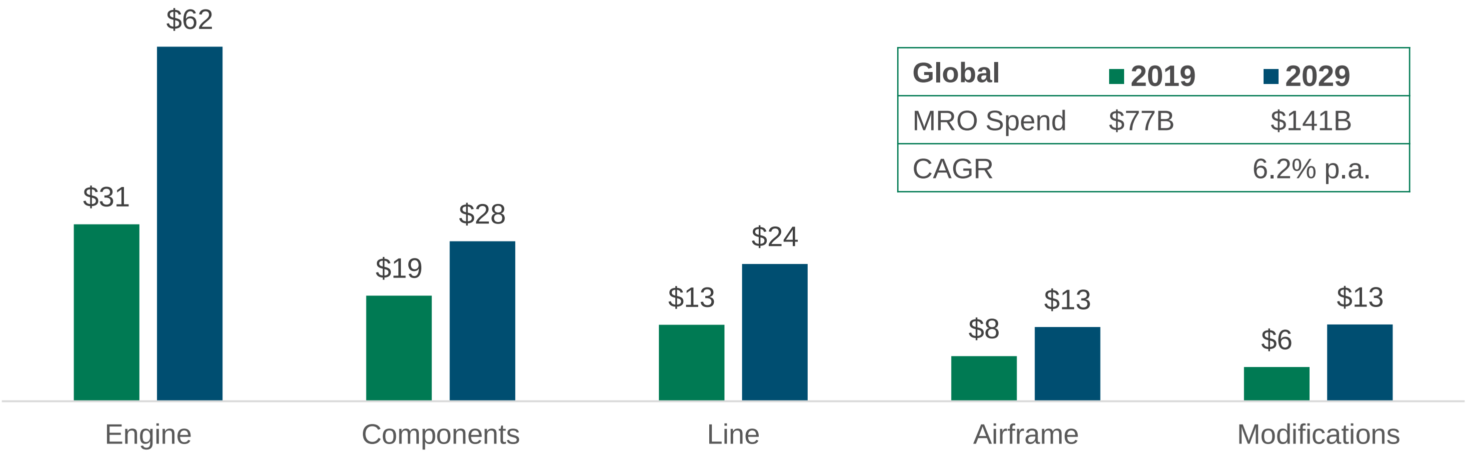


	China	Rest of Asia	North America	Europe	Latin America	Middle East	Africa
2019-2029 Growth Rate	**9.0%**	**7.2%**	**3.1%**	**4.6%**	**6.3%**	**9.2%**	**8.0%**

Source: Alton analysis

Engine and component MRO represents the largest MRO segments by spend; modifications will experience the largest CAGR

2019 - 2029 MRO Forecast by Region (USD billion)



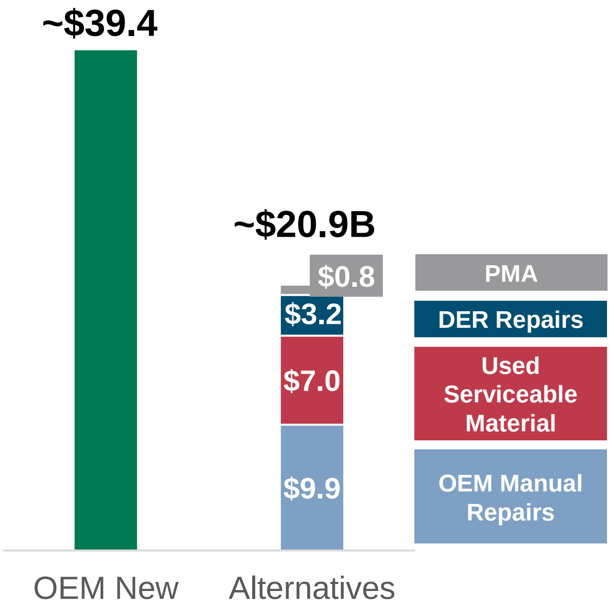
Global	2019	2029
MRO Spend	$77B	$141B
CAGR		6.2% p.a.

2019-2029 Growth Rate	Engine	Components	Line	Airframe	Modifications
	7.2%	4.2%	6.0%	5.1%	8.4%

Note (1): Figures are escalated based on Alton's view of new/USM mix as well as OEM new and USM price escalation
Source: Alton analysis

In 2019, Alton estimates that operators spend ~$39B in OEM new parts and an additional $21B on alternative material solutions

2019 OEM New Material Demand vs. Alternatives *(USD$ Billion)*

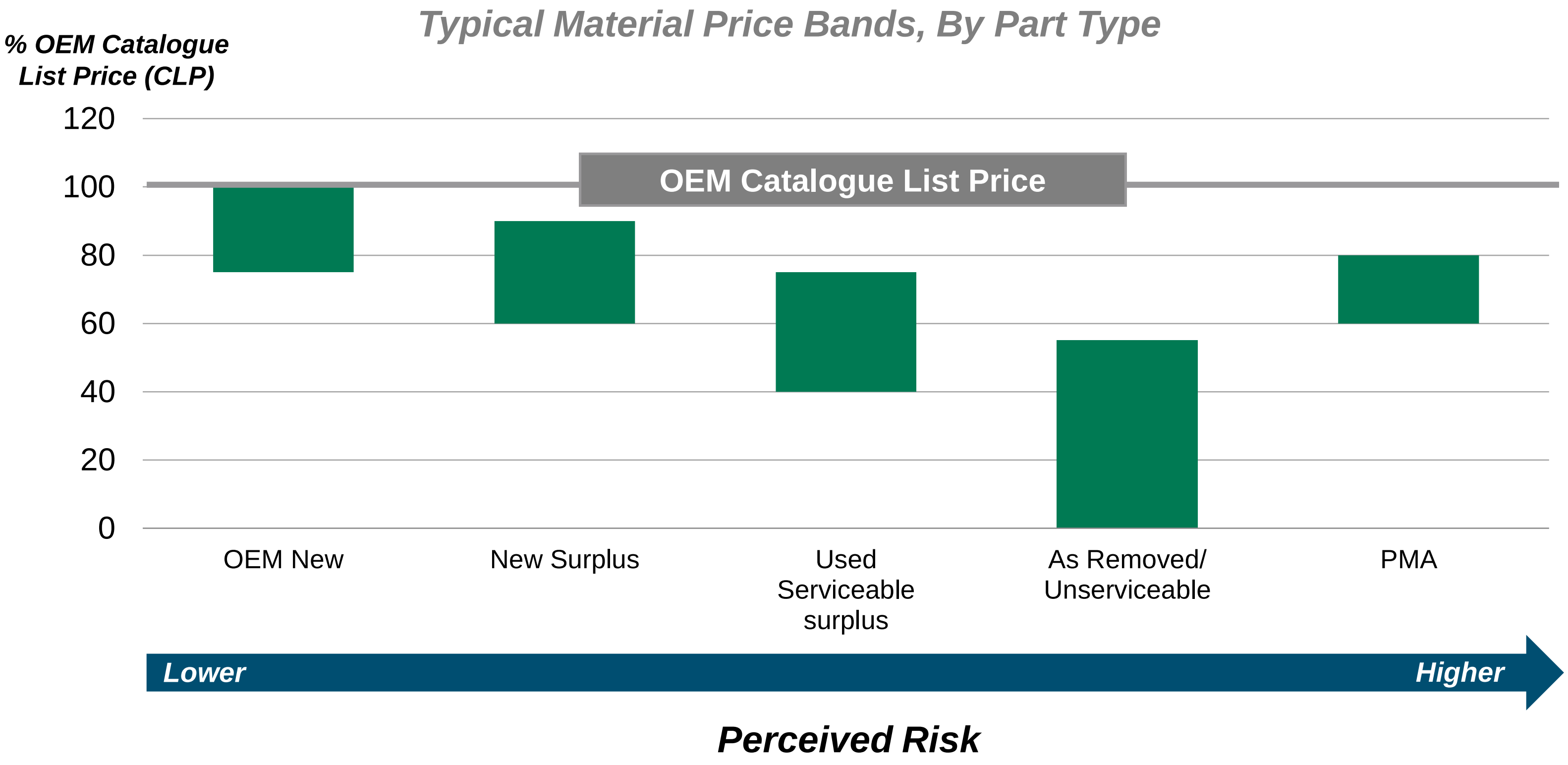


Alton Insight

- In order to control and reduce material spend, airlines must have a comprehensive OEM alternative strategy
- PMA parts, DER repairs, and surplus material are valuable material sourcing solutions that drive tangible cost savings and improve part availability
- Recent IATA & CFM/GE agreement have provided protections against OEM alternative material solution discriminatory practices
- As long as certain airlines continue to have restrictive PMA/DER policies, Lessors will continue to include conservative language in their lease agreements

Source: Alton analysis

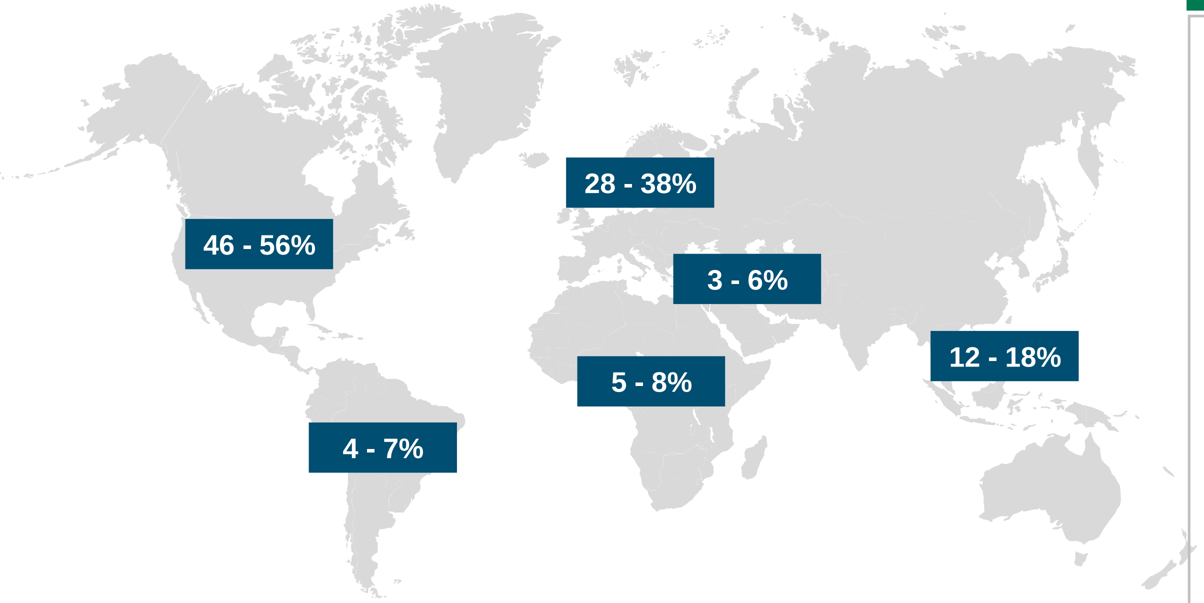
Surplus material usage has risen sharply over the past decade, driven by tangible cost savings and minimal perceived risk



Source: Alton analysis

Numerous regional factors influence operator PMA/DER acceptance, demand and consumption

Estimated PMA/DER Demand by Global Region



Alton Insight

- Virtually every major carrier in each global region leverages PMA/DER as an OEM alternative to some extent
- Key consumption factors include the following:
  1. Fleet age (operators of older fleets tend to consume more)
  2. Mix of lease vs owned (operators of owned fleets tend to consume more)
  3. Airline technical capability & experience
  4. Historic airline technical procurement practices and company culture

Source: Alton analysis

Revenge of the Engine PMA: *“The perfect storm”*

1

New engine teething pains driving high volume of unscheduled shop visits

2

Mature engine routine shop visits at an all time high

3

Reduced retirements and part-outs limiting surplus part availability

4

Engine piece part supply chain unable to meet demand to support production and MRO

Industry Impact

1. **Engine piece parts shortages (MRO and production)**
2. **Limited MRO slot availability**
3. **Engine shop visit TAT delays**
4. **New aircraft delivery delays**
5. **Lack of surplus engine material**
6. **Higher shop visit costs**
7. **Higher spare engine lease costs**
8. **Grounded aircraft (gliders)**

Source: Alton analysis

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