



Supply Chain Issues:

Operational and Financial Impacts on Maintenance Activities, Industry Trends

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19th Maintenance Cost Conference (MCC)

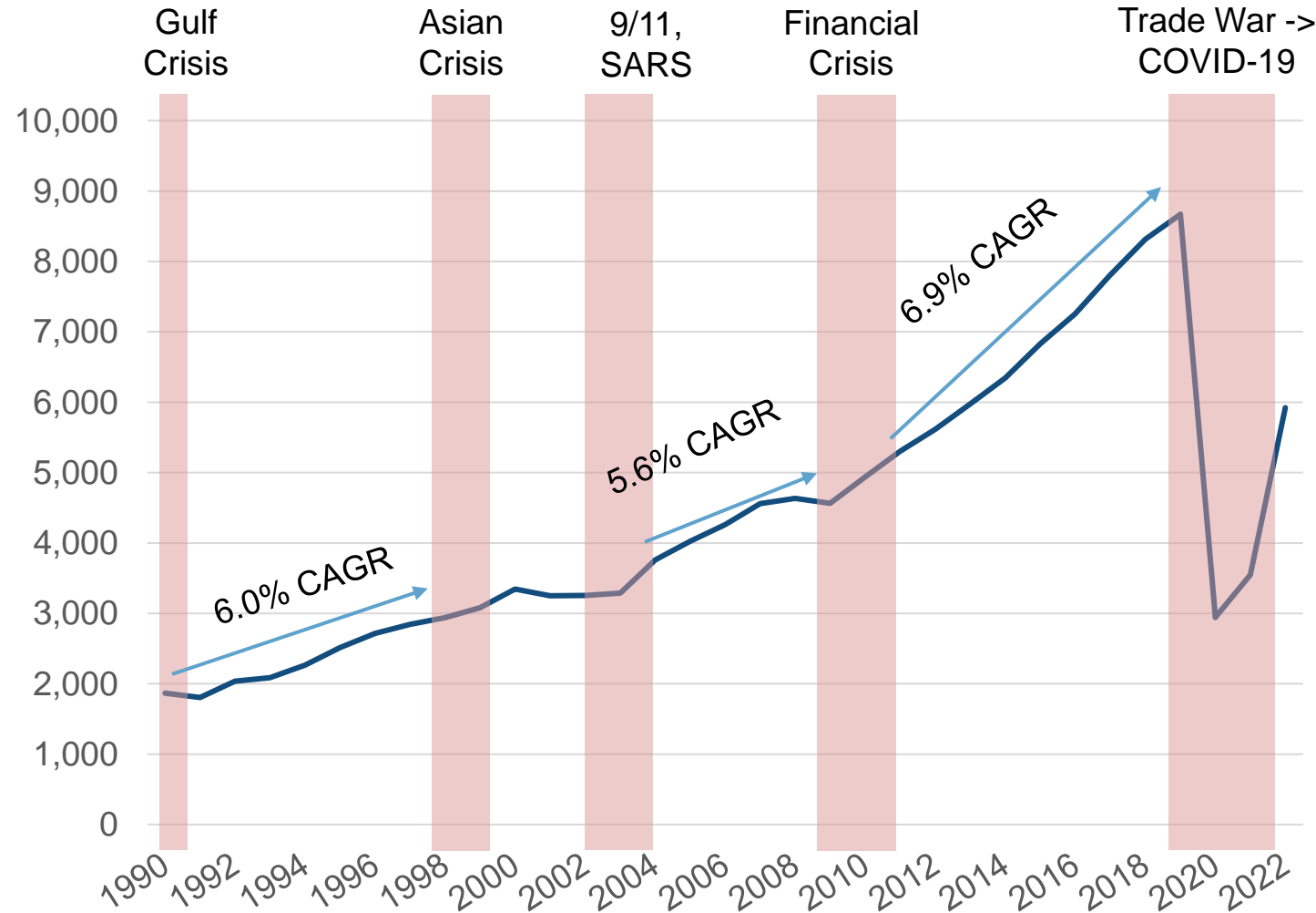
Hanoi, Vietnam

October 4th, 2023



Aviation has gotten used to excess supply – now we are may be in a supply-constrained environment for a long time

Global RPKs (billion): 1990 - 2022



Previously

- › Geopolitical consolidation
- › More countries plugged into global trade, adding raw materials and labor
- › Sophisticated global supply chains
- › Aviation was a well-oiled machine



Now

- › Geopolitical fragmentation
- › Demographic shifts
- › Reorientation of supply chains
- › Hickups everywhere

Technology shifts and demographics are making it challenging to hire good staff



- › Talent brain drain as buy-out and early retirement packages during pandemic targeted most experienced workers
- › Other industries continue to compete for aerospace talent with pay and flexibility, especially appealing for younger cohorts
- › While shortfall is broad-based, there are acute shortages of specific trades (e.g. welders)
- › Ageing demographics in several regions

“Only 20 percent of technicians finish their technical training with us”

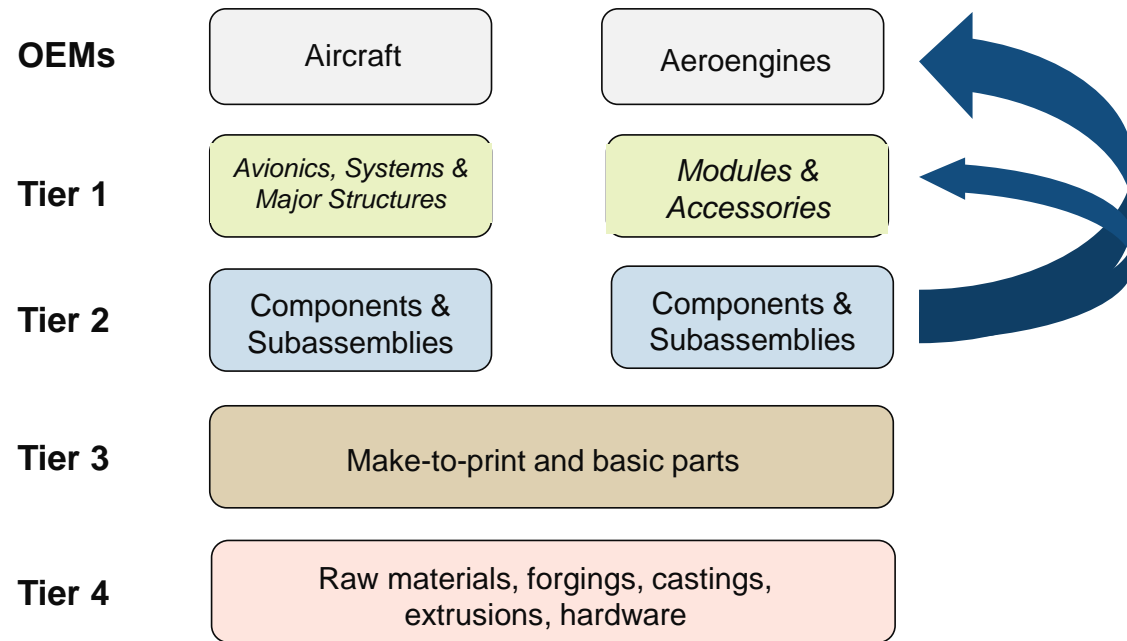
Medium-sized airline

“Risk in the next ten years when we have a wave of retirement, there may not be a new generation renewing the personnel work force.”

MRO

...and aerospace labor appears to be moving further downstream

Aerospace Employees Migration

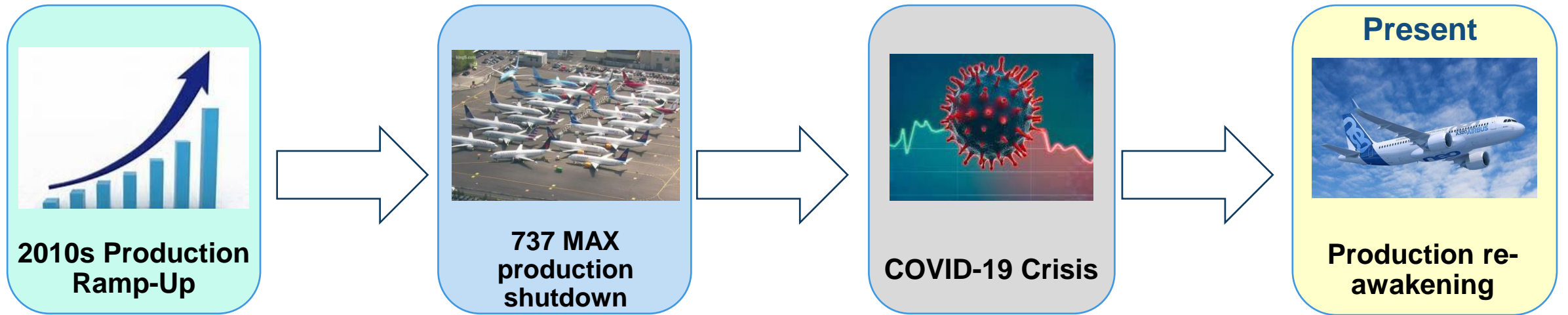


- › Anecdotal evidence of aerospace employees migrating downstream in supply chain to larger suppliers and OEMs
- › Similar phenomenon as regional airline pilots or mechanics migrating to mainline airlines
- › Likely most prominent in tight geographic aerospace clusters
- › Talent vacuum is further contributing to difficulties in meeting delivery schedules

“Since hiring me, the company hired some of my close 10+ colleagues from my former employer. Now, these suppliers are lacking labor in every corner of their business and the OEM team recognized that the delivery towards the final assembly line is delayed in many cases.”

Aerospace suppliers have been coping with the impacts of supply chain initiatives over the past decade

Events Impacting Commercial Aerospace Supplier Working Capital



- › OEM price reductions
- › Significant CAPEX
- › Working capital requirements increase
- › Payment terms increase from 30 days to 60-90 days

- › Revenue decreases
- › Layoffs begin
- › CAPEX for ramp up wasted

- › Survival mode
- › Burn down remaining working capital
- › Major layoffs
- › Government support + lenient lenders

- › Payment terms 90 – 120 days
- › More working capital required
- › Higher inflation
- › Many lenders unwilling to renew lines of credit

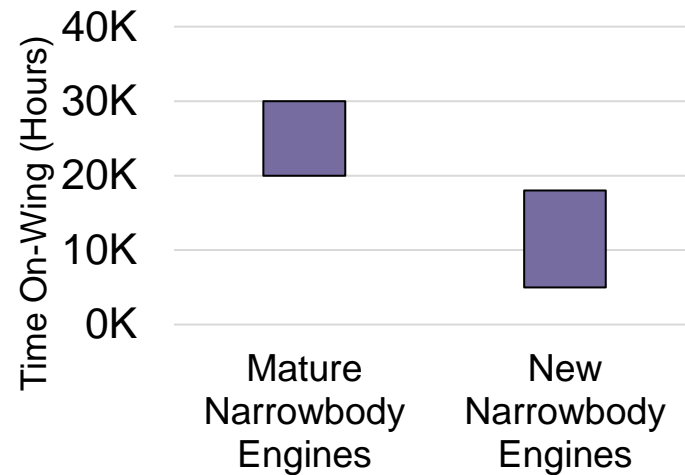
Engines face a trifecta of challenges on the demand side that are amplifying supply chain bottlenecks

New Engine Teething Problems



- › Teething problems in new generation narrowbody engines are sparking retrofits to provide long-term fix
- › Corrective actions yet to be established for some issues

Lower Reliability of New Engines



- › New generation engines are entering shops for performance restorations earlier than expected
- › Lack of repair options means nearly all material demand is fulfilled via new parts

Strong Aftermarket Demand for Mature Engines

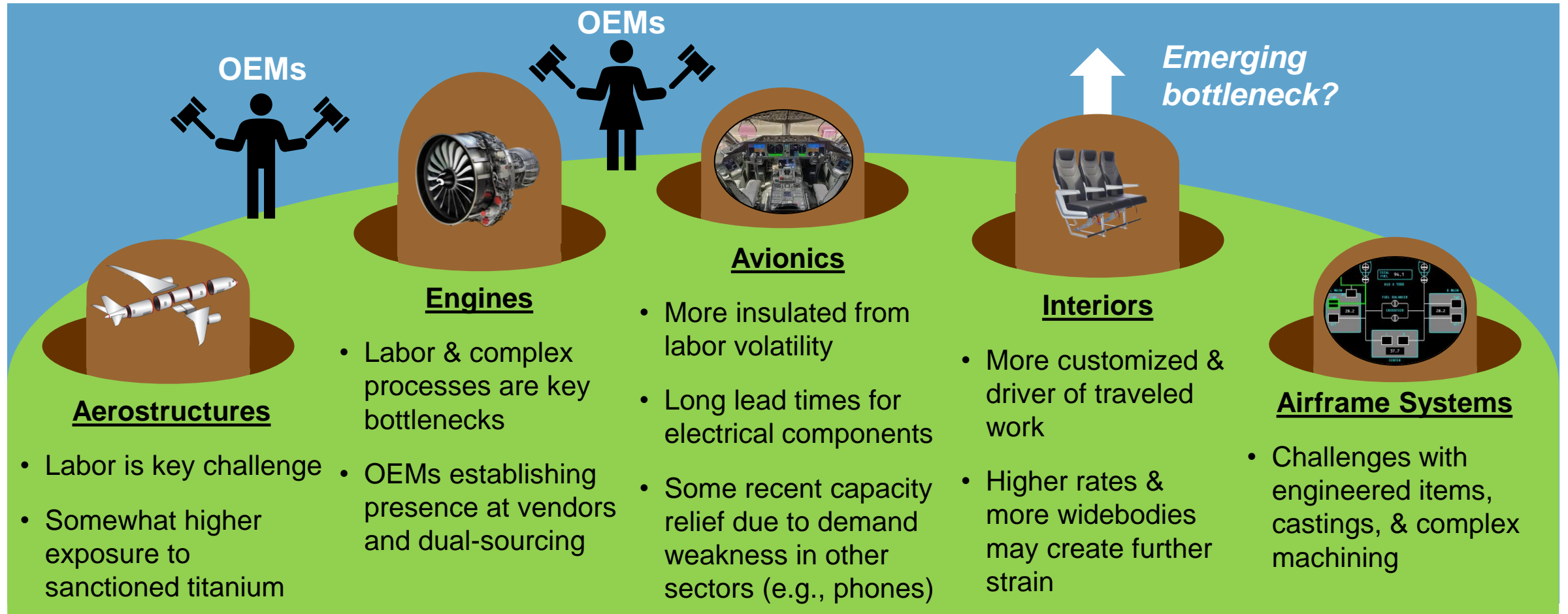


- › Airlines keeping older aircraft longer due to uncertainty in new aircraft delivery schedules
- › Assets are consequently undergoing more maintenance and generating more material demand

At the same time, forgings, castings, and extrusions all bedevil supply chain integrity

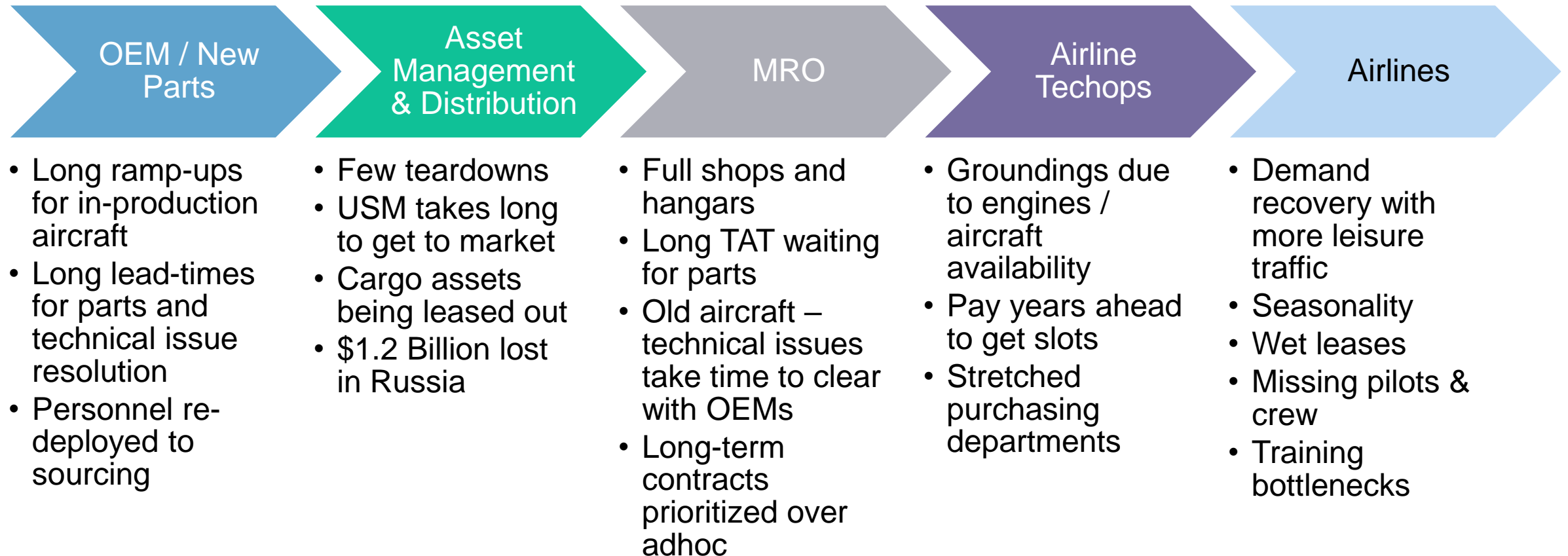
OEMs are attempting to ramp-up production but are facing several supply chain constraints; engines are the key today but other flashpoints may be emerging

Aerospace Supply Chain Challenges – by Category



The issues cascade through the MRO supply chain, creating a gordian knot that will take a while to solve

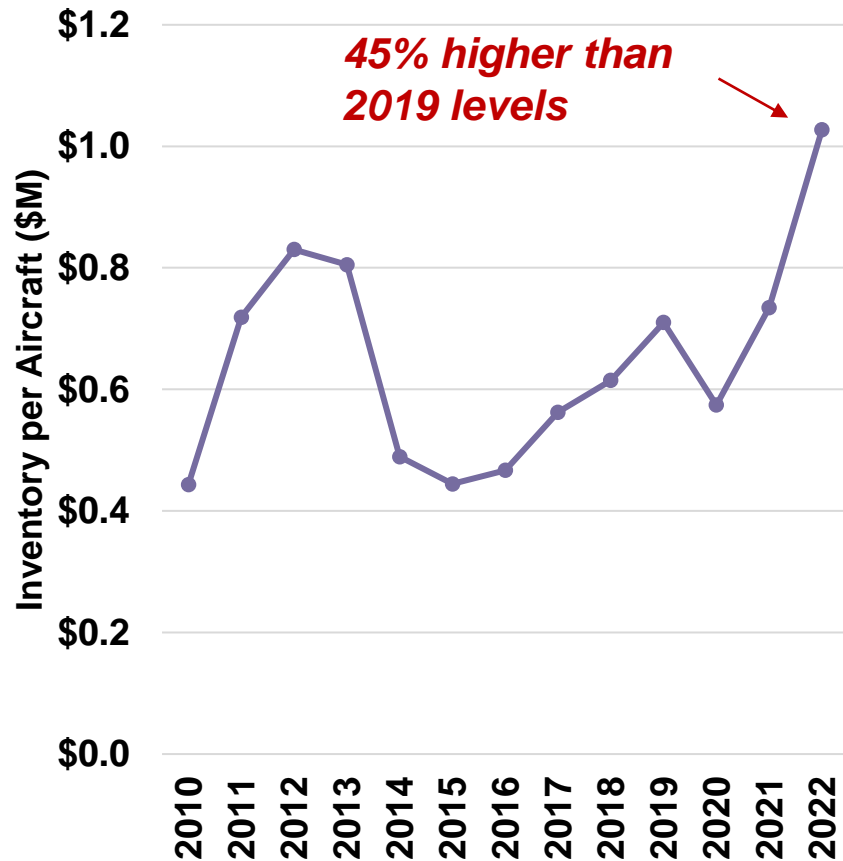
Observations Across Air Transport MRO Supply Chain (Not Exhaustive)



All steps in the chain suffering from lack of qualified experienced personnel

With on-going supply chain uncertainties, airlines and MROs are moving away from “just-in-time” to “just-in-case” inventory

Southwest Airlines – Inventory per Aircraft



Current Industry Circumstances

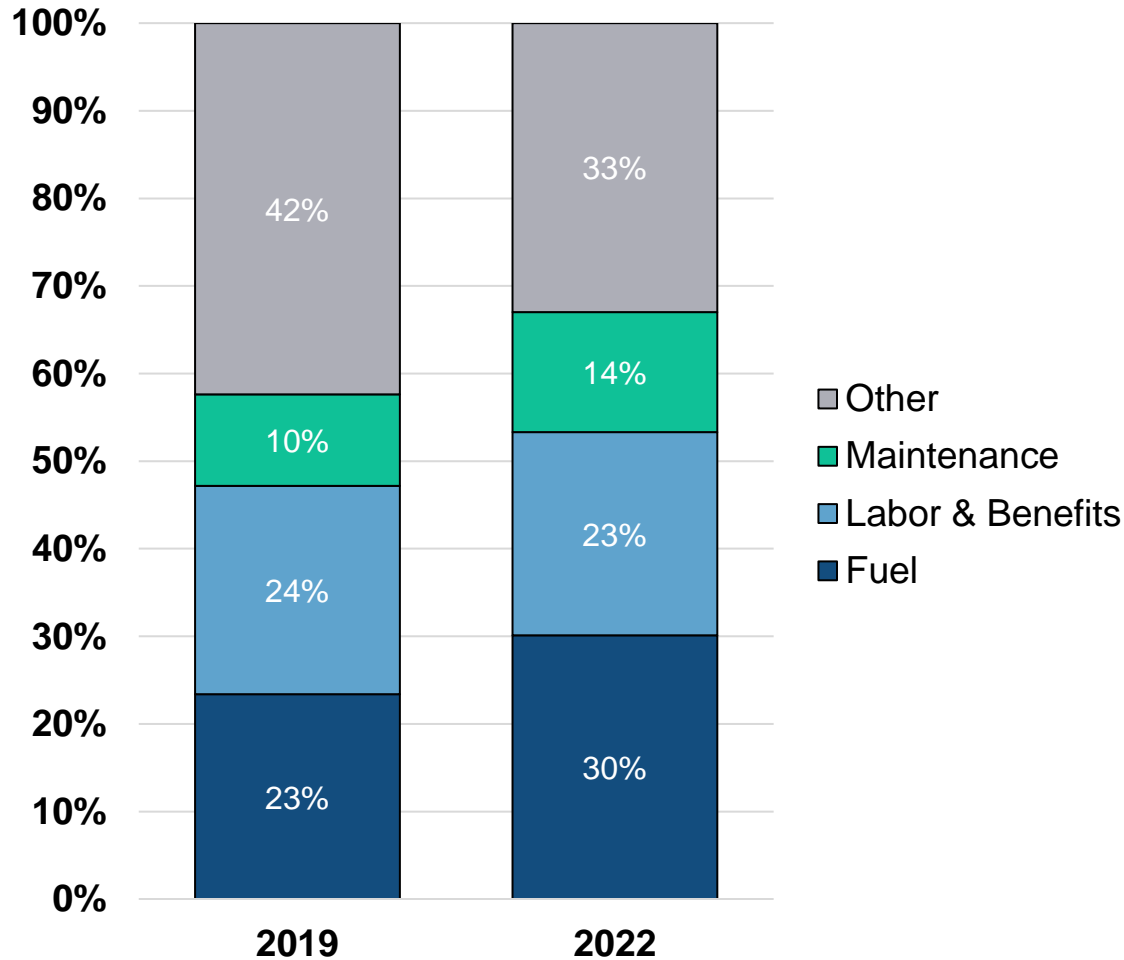
- › Low USM availability due to low retirements
- › Long lead times from OEMs due to broad-based supply chain constraints
- › Recovering MRO activity creating demand pressure for materials
- › Inventory re-stocking following burn-down to preserve cash during pandemic
- › Engine teething problems adding to supply chain pressures & material availability challenges

Implications for the Future

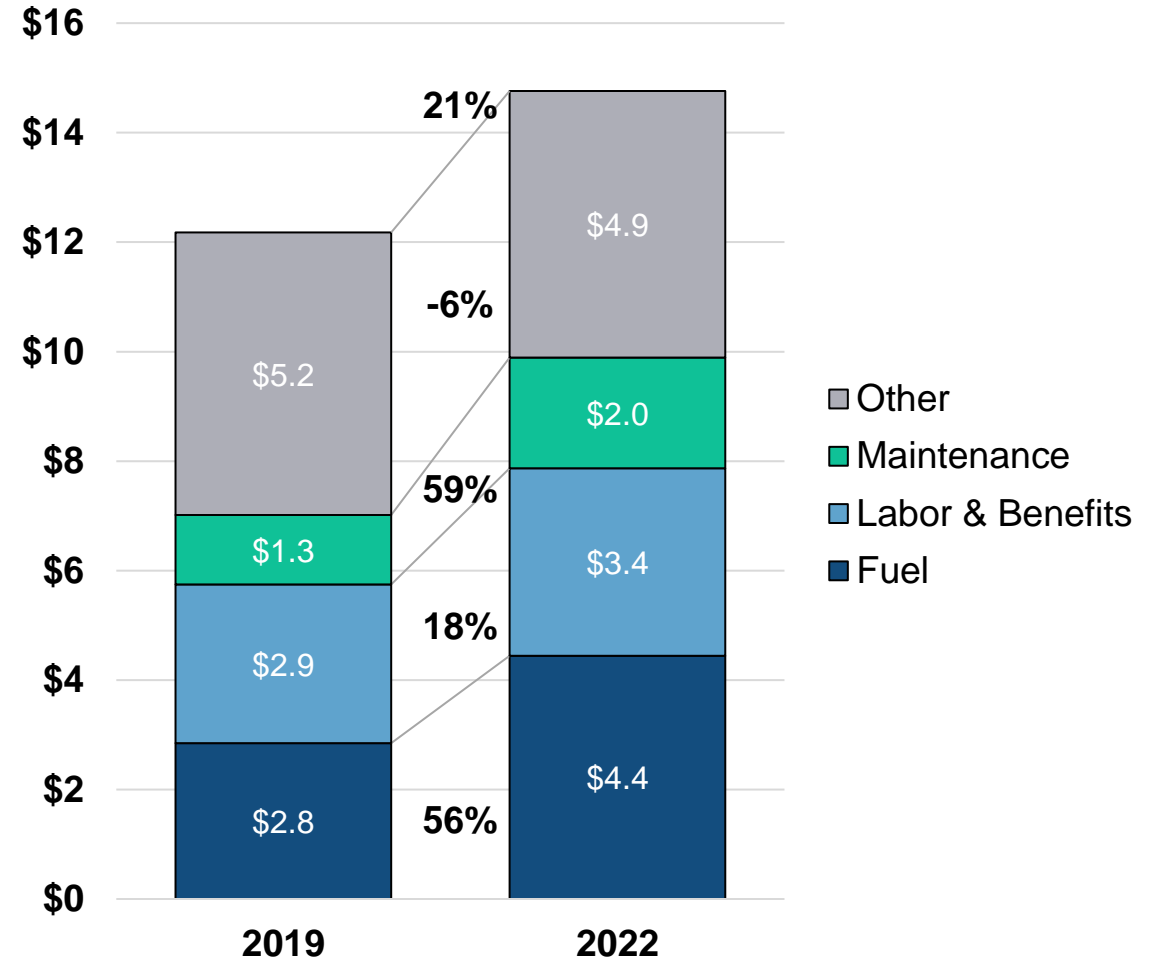
- › Aftermarket material purchases are strong now, coupled with a strong pricing environment, a boon for OEMs and distributors
- › These conditions are likely to persist for the near-term
- › However, an acceleration in retirements and USM availability, or a faster resolution to supply chain constraints could lead to a supply glut as customers eventually right-size their inventory levels

Like the passengers they serve, airlines are also facing significant inflation that is hampering the recovery in profitability

2019 vs. 2022 Airline Cost Structure



2019 vs. 2022 Airline Unit Cost (cents)





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Thank You!



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