

CLINGING TO THE PAST

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- Deep aviation knowledge and capabilities allow the practice to deliver data-driven solutions and provide strategic, operational, and organizational advice

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- We have worked with more than $\frac{3}{4}$ of the industry's Fortune 500 companies, including:
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 - Leading airlines, MROs, OEMs, and independent parts manufacturers in the Americas, Europe, and Asia
 - Dominant aerospace and defense firms

OUR APPROACH

- Data-driven:** unbiased benchmarking and forecasting tools to establish problems and identify solutions
Innovative: ideas that are forward-thinking
Actionable: results-oriented recommendations
Collaborative: an emphasis on working with our clients, alongside executives, management, and support teams

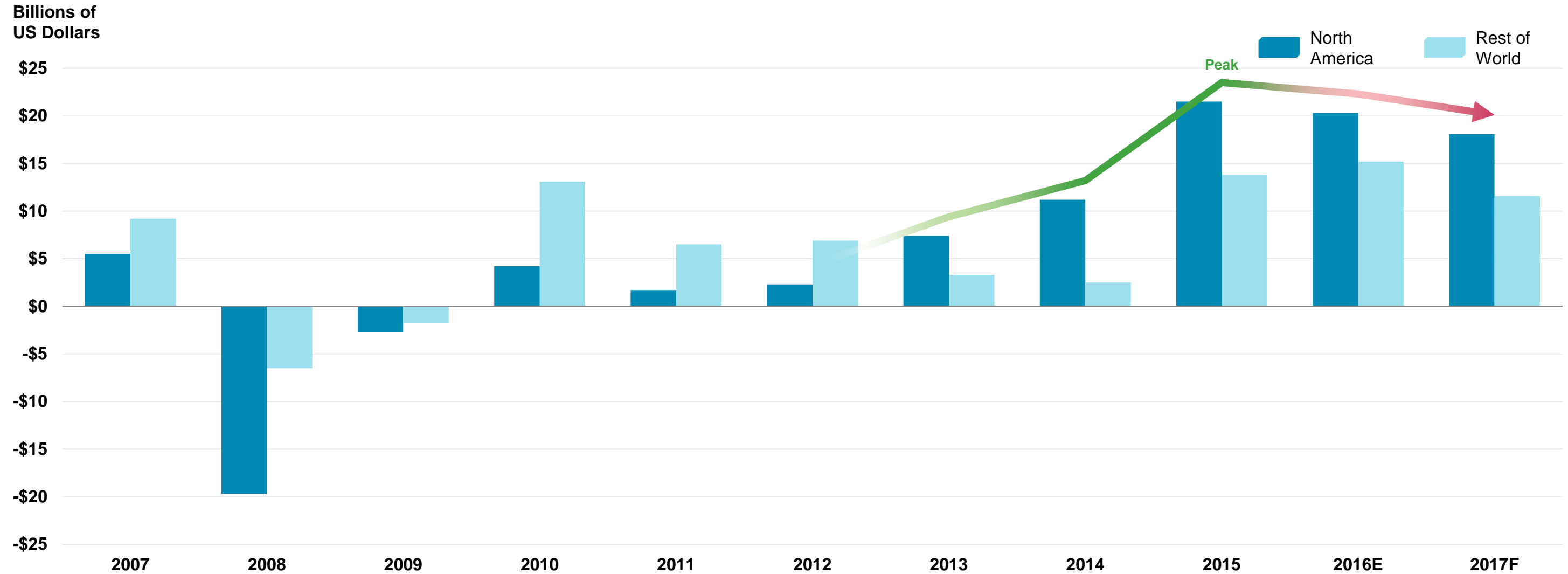
This presentation incorporates Oliver Wyman's 2017-2027 Global Fleet & MRO Market Forecast and 2017 MRO Survey, both of which are available at www.oliverwyman.com



1 | Taking Care of Business

In the face of softening revenue and rising costs, North American operators are continuing to deliver the global commercial air transport industry's strongest financial performance

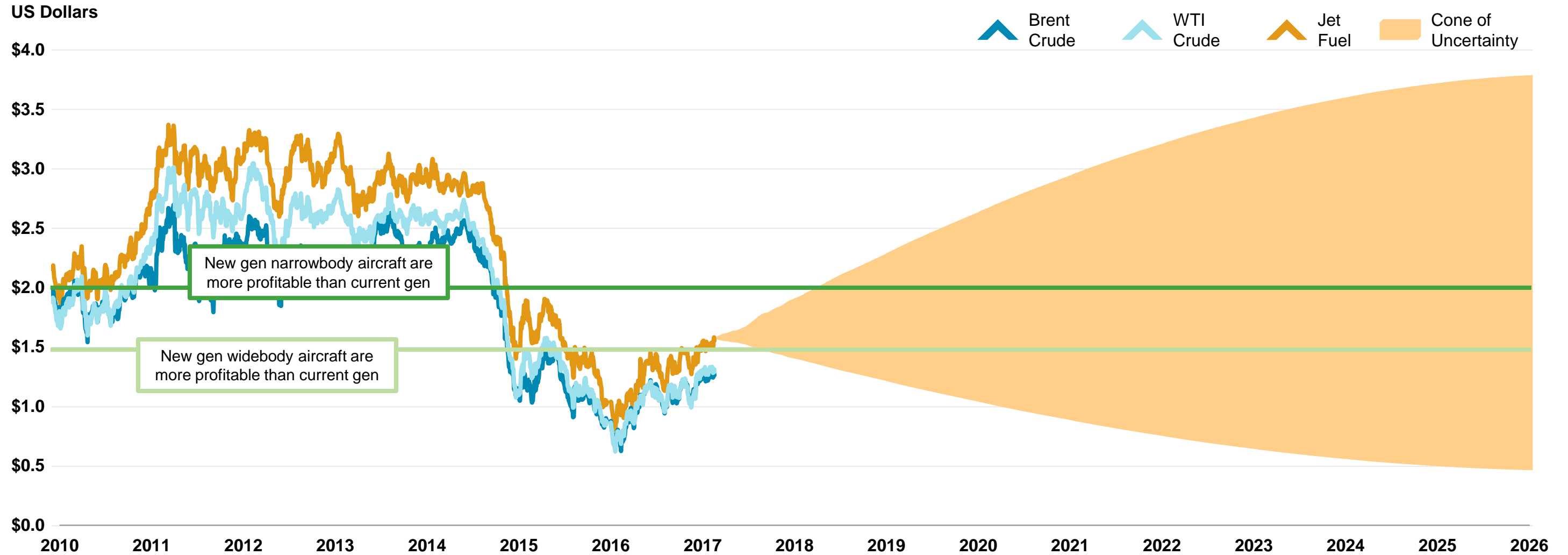
Global Commercial Air Transport Industry Net Profit by Year



Continued growth in revenue from ancillaries, widespread capacity discipline, and a lack of new entrants are helping the North American operators mitigate the impact of shifting economics

Three years of record profits have allowed operators to invest heavily in the passenger experience and adopt new, more expensive labor contracts, which may be a possible source of turbulence in the near future amid a changing economic landscape as the oil market begins to recover from the glut

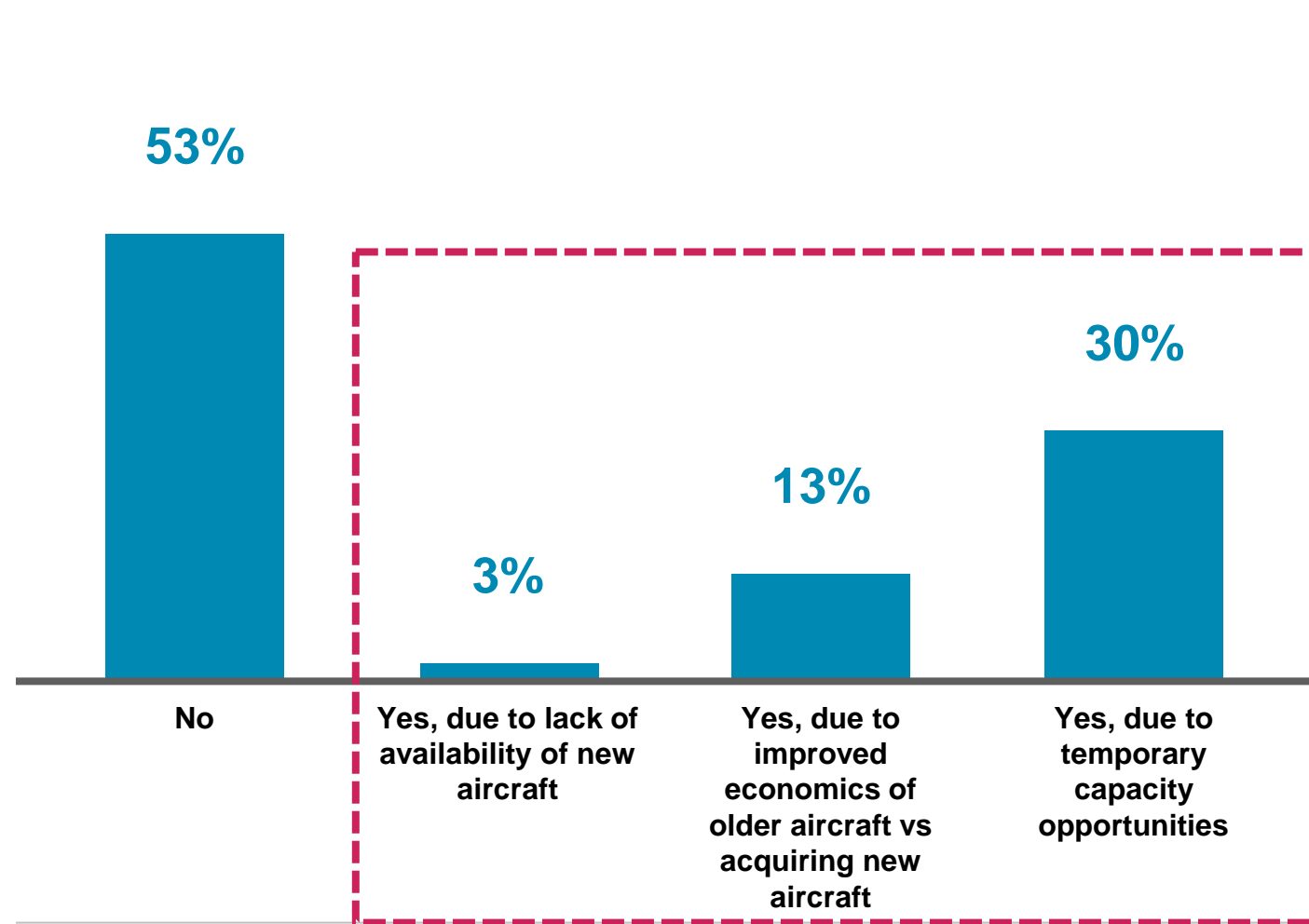
Crude Oil and Jet Fuel Spot Prices per Gallon by Year



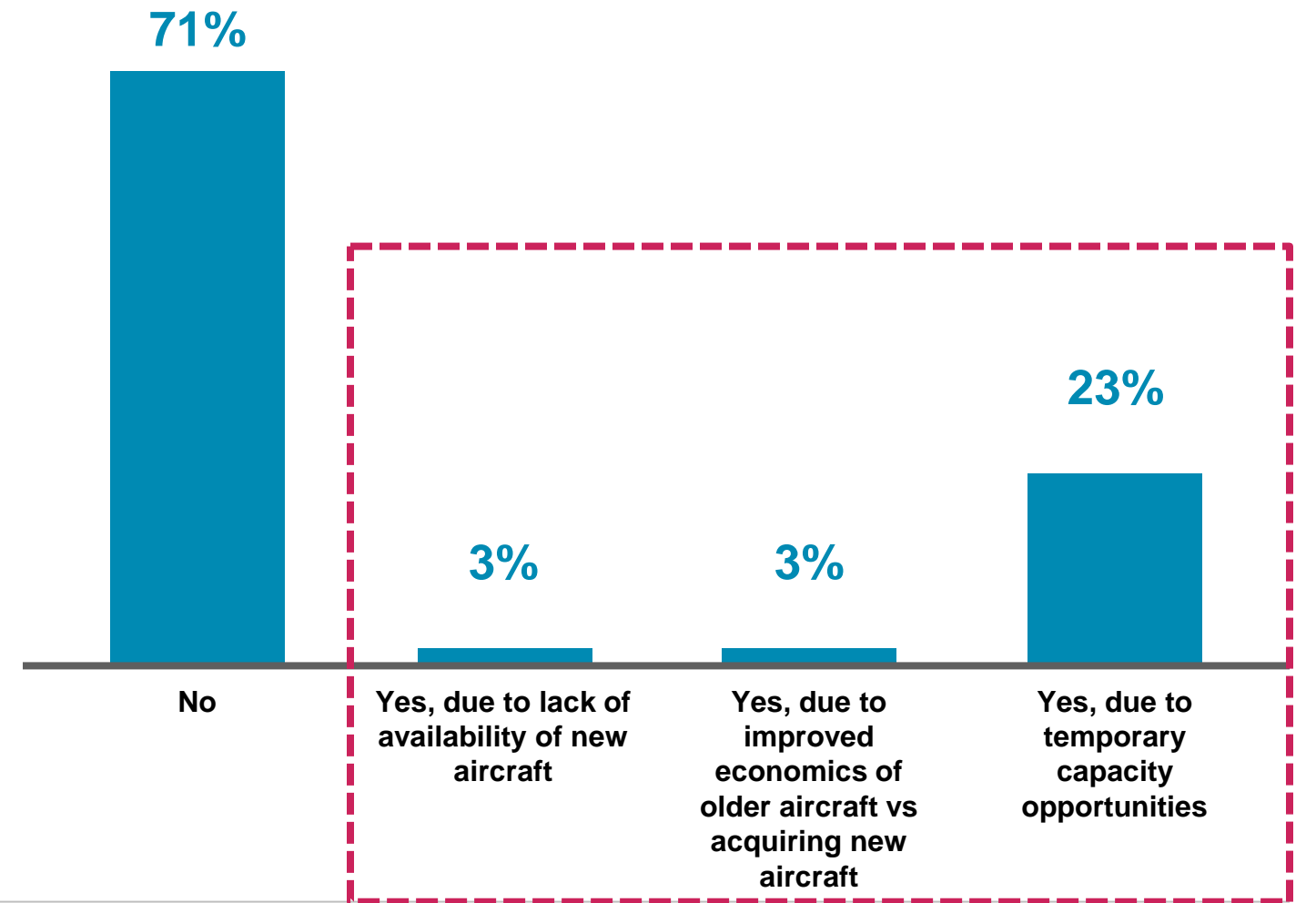
Notwithstanding some operators have altered fleet plans over the past year to take advantage of current market conditions, OEM order books remain strong, and new aircraft deliveries are occurring at record rates

Nearly half of aircraft operator respondents in our MRO Survey are delaying retirements and nearly one third of respondents are reactivating aircraft they have pulled from long term storage

Q: Are you delaying aircraft retirements?*



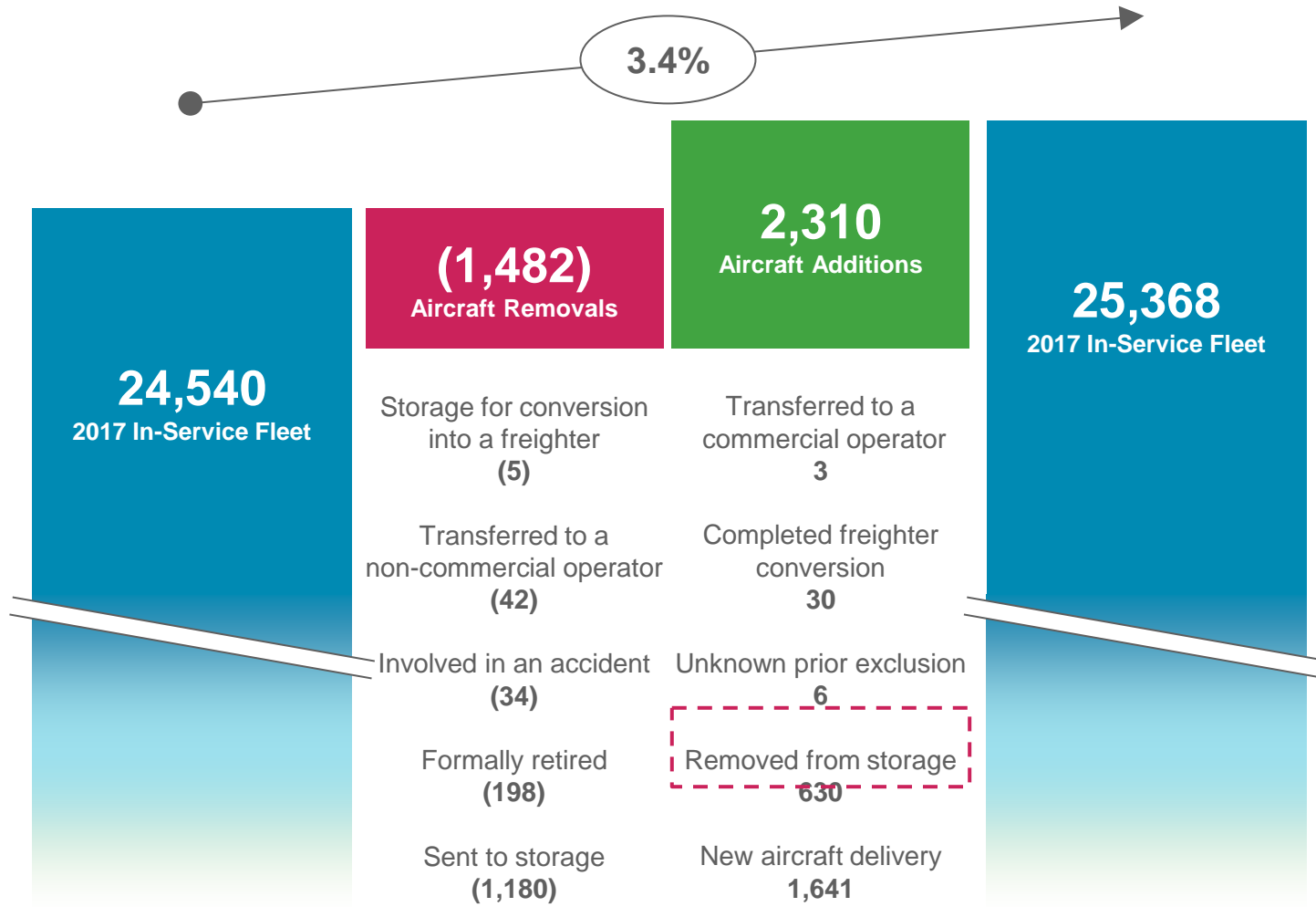
Q: Have you pulled an aircraft out of storage and pressed it into service within the past 12 months? If so, why?*



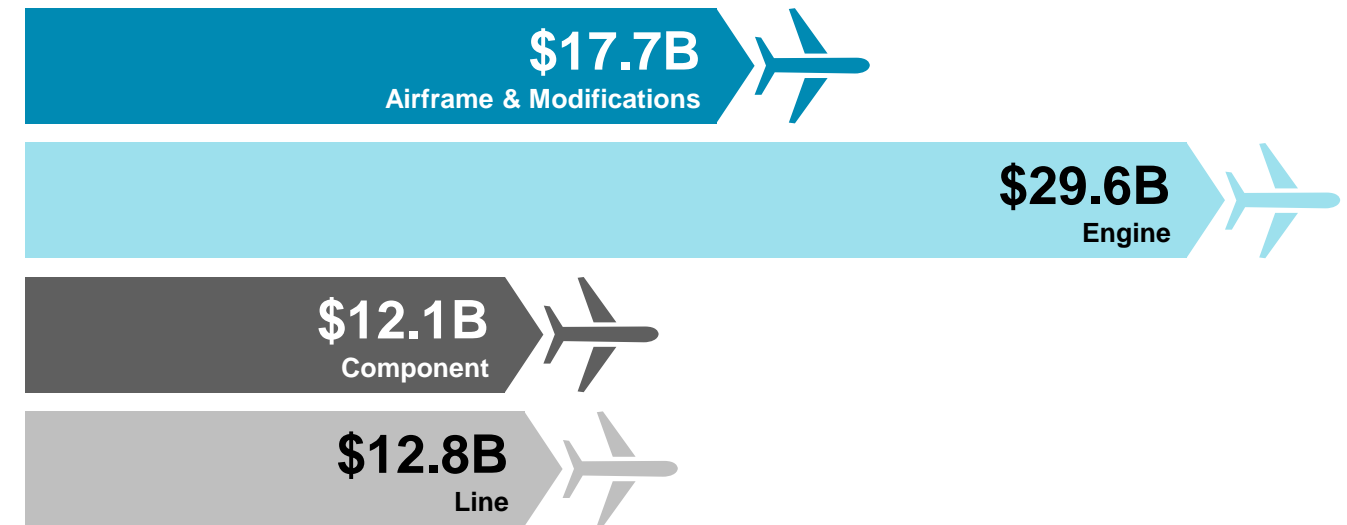
Nearly three quarters of respondents also said they are not deferring new aircraft deliveries, while the remaining respondents by equal measure cited improved operating economics of older aircraft and weakening economic conditions as reasons for deferrals

Over the past year, status changes to 3,792 aircraft have lead the global in-service fleet to experience a net growth of 828 aircraft, representing a 3.4% annual growth rate

Year Over Year Changes to the Global Commercial Air Transport In-Service Fleet
by Transaction Type



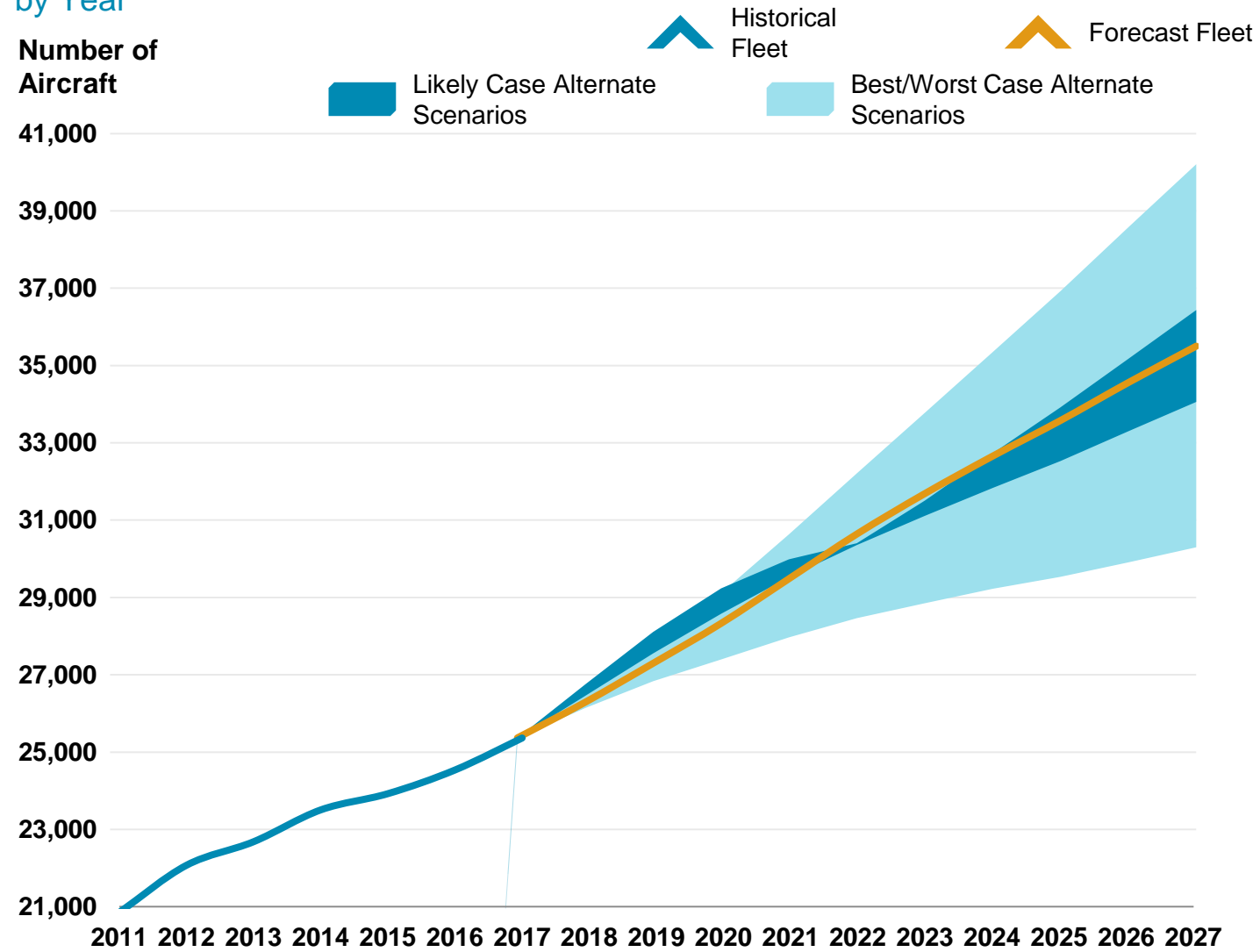
2017 Global Commercial Air Transport MRO Market Forecast
by MRO Segment



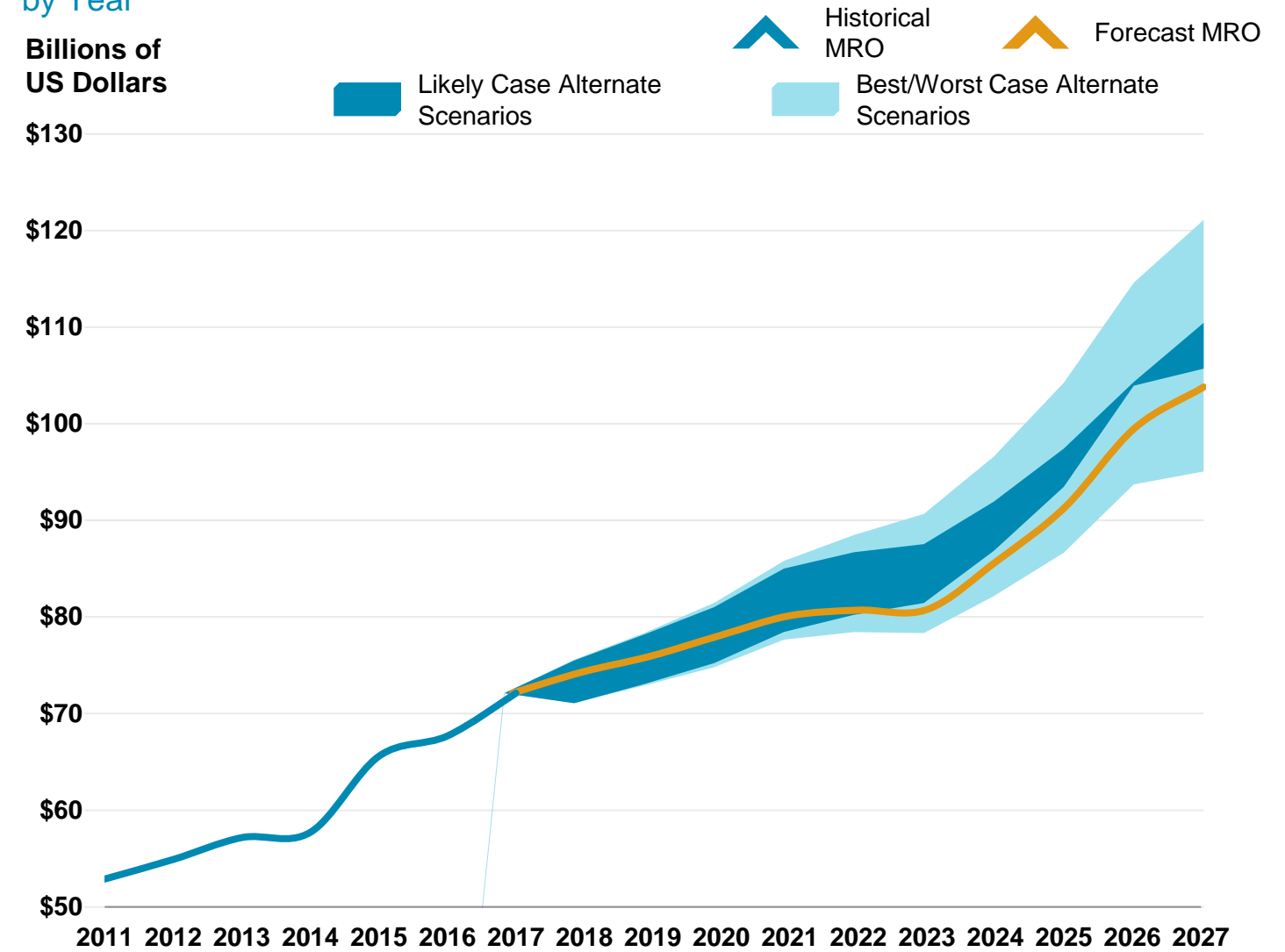
Translating the changing fleet dynamics into MRO, the 2017 market is forecast to be \$72.1B, with engine MRO continuing to be the driver of growth

While the fleet continues to grow at a healthy rate, and the industry is still recording near historic net profits, uncertainties surrounding economic growth, interest rates, and oil could disrupt and hinder growth and stability of the global commercial air transport industry

Global Commercial Air Transport Fleet Forecast by Year



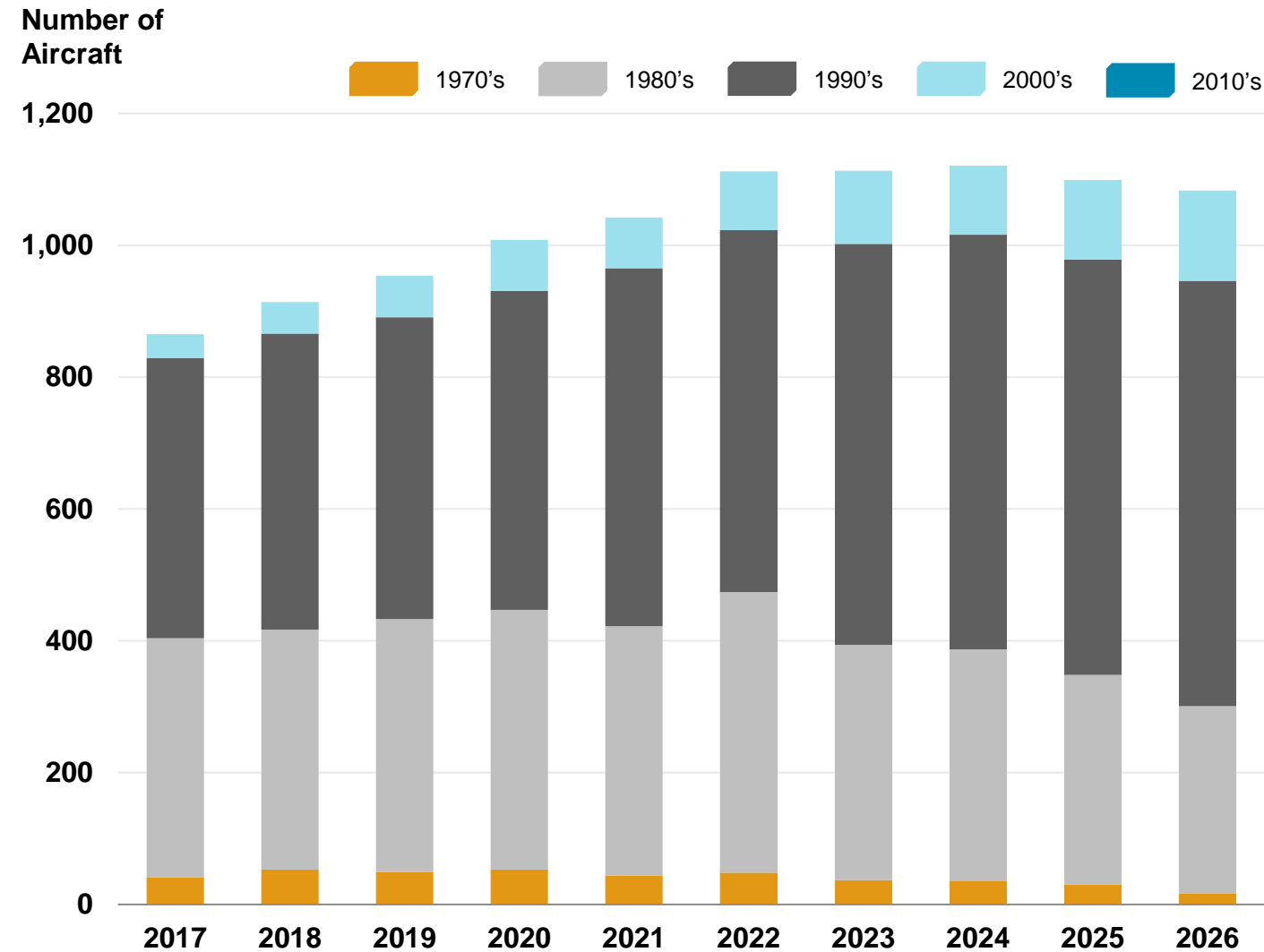
Global Commercial Air Transport MRO Market Forecast by Year



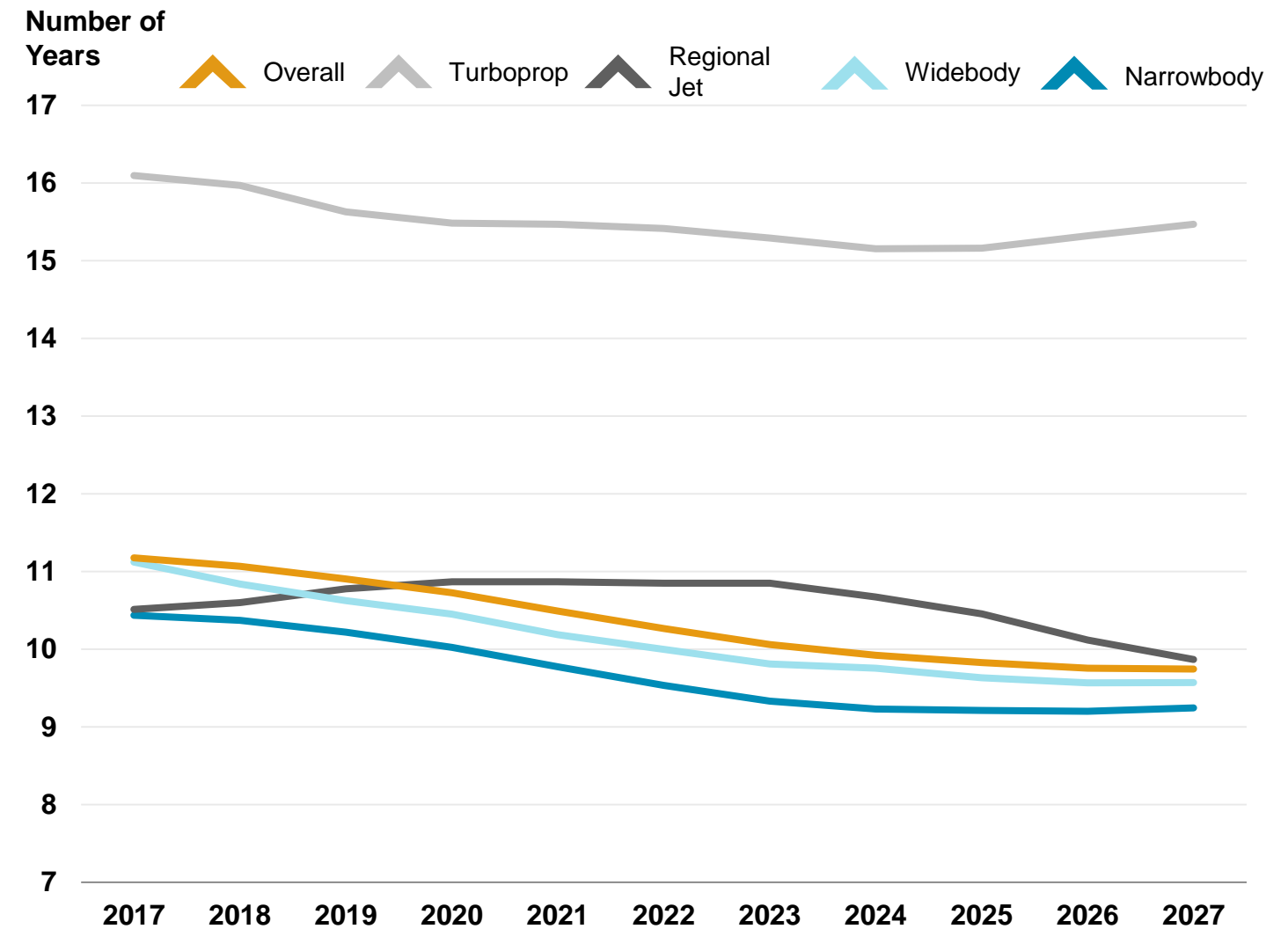
The commercial air transport fleet is forecast to increase by 10,133 aircraft over the next 10 years driving the \$72.1B commercial air transport MRO market to go grow at an average annual rate of 3.7% per year, topping out at \$103.8B in 2027

Even though many have altered fleet plans to take advantage of current market conditions, the number of aircraft removed from the fleet is expected to reach historic levels over the next 10 years

Global Commercial Air Transport Retirement Forecast
by Aircraft Vintage

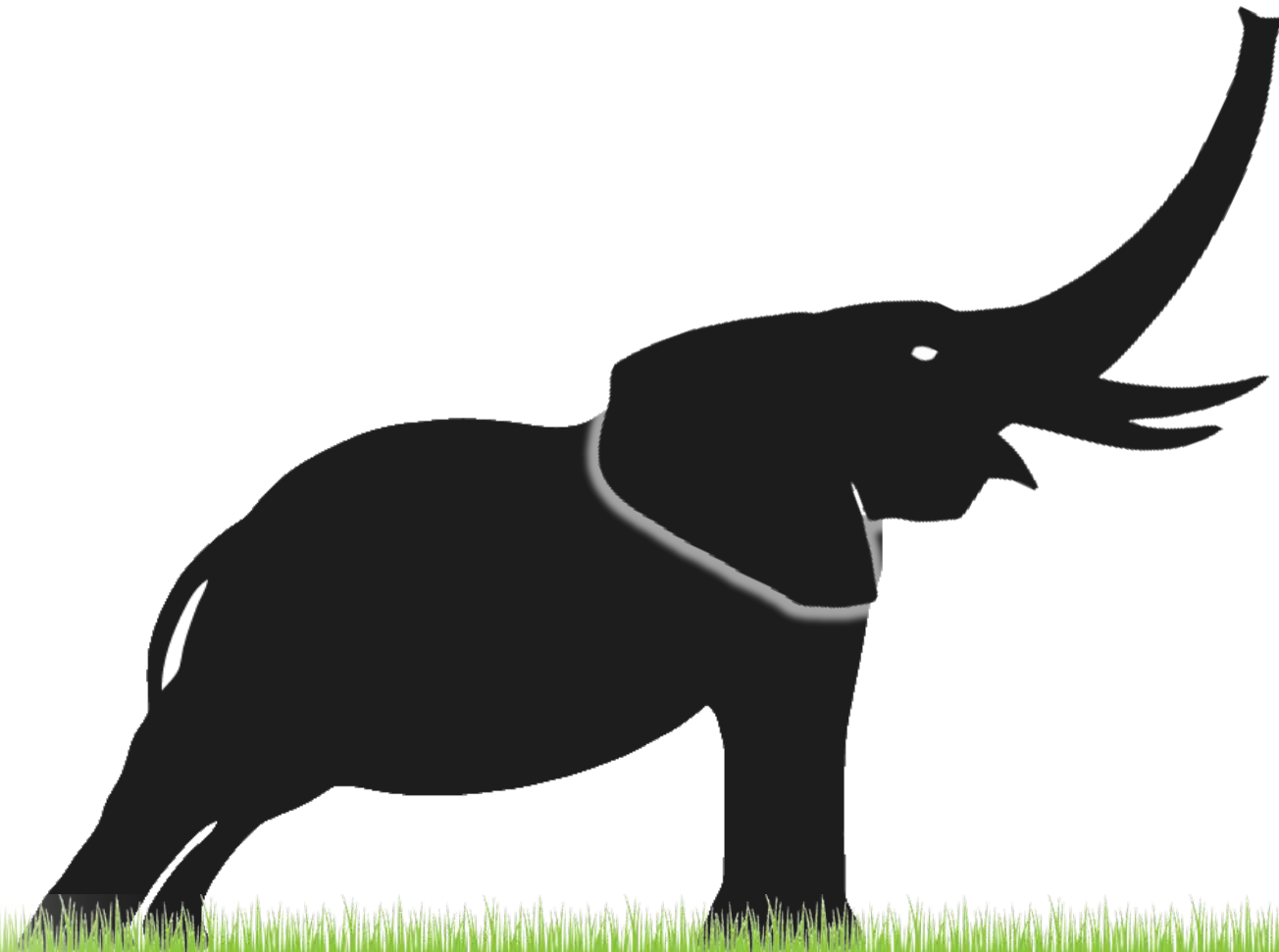


Global Commercial Air Transport Fleet Age
by Aircraft Class



Approximately 40% of the in-service fleet is forecast to retire by 2027, reducing the average age of the in-service fleet to 9.7

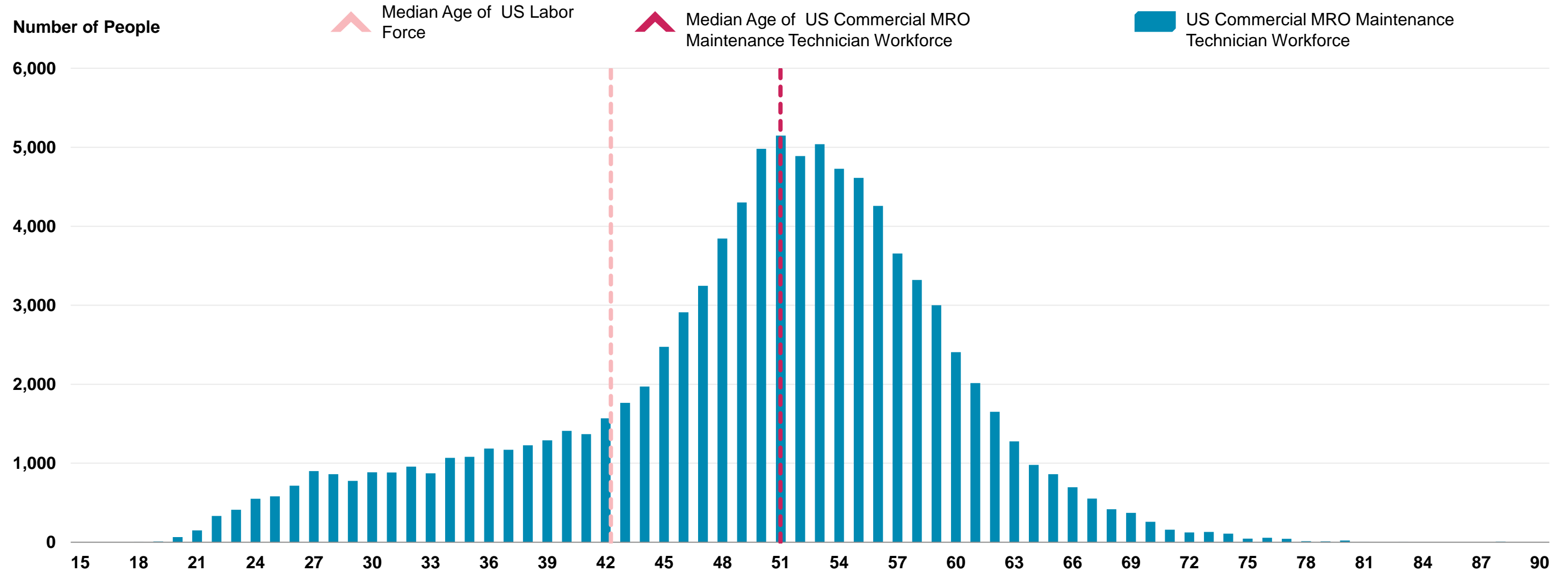
2 | Bulls, Bears, Swans, and... Elephants



**Let's talk
about the
BLACK ELEPHANT
in the room**

The US commercial MRO workforce is comprised of approximately 86,000 maintenance technicians with a median age of 51, nearly 9 years older than the median age of the US labor force

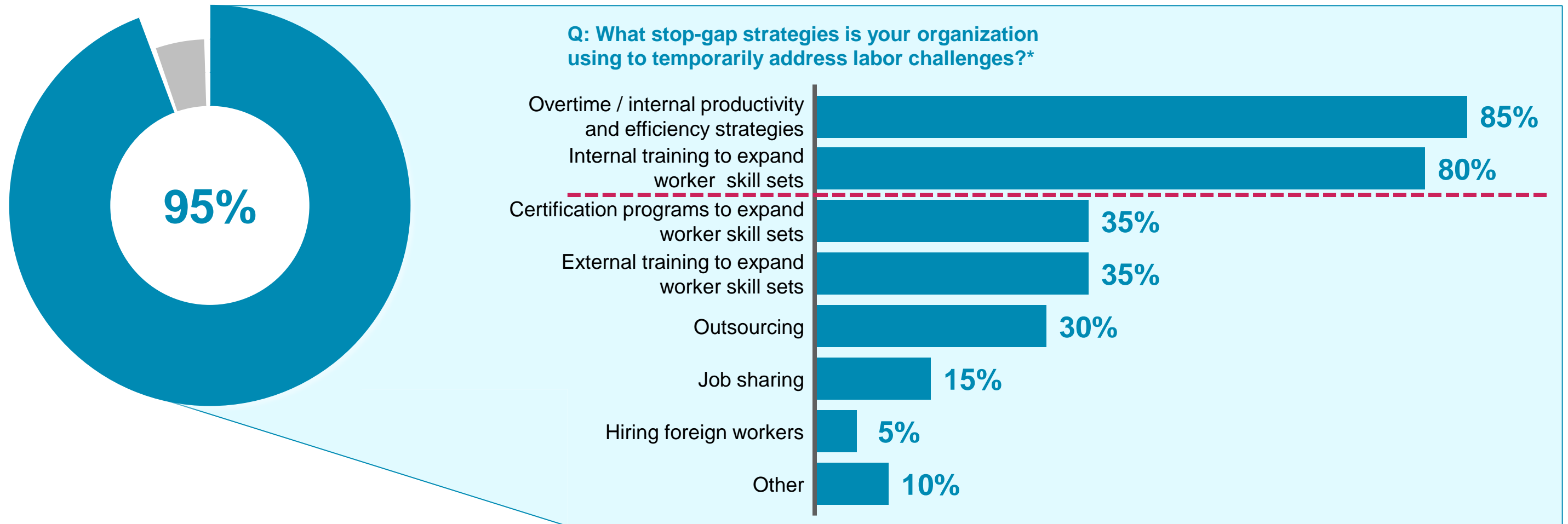
US Commercial MRO Maintenance Technician Workforce
by Age



With a record number of maintenance technicians becoming eligible for retirement, US commercial MRO providers will face an increasingly difficult challenge over the next 10 years

In fact, the Oliver Wyman 2017 MRO Survey found that 95% of respondents in North America are already experiencing labor imbalances, choosing to mitigate shortcomings primarily through the use of overtime / internal productivity and efficiency strategies, and internal training to expand skill sets

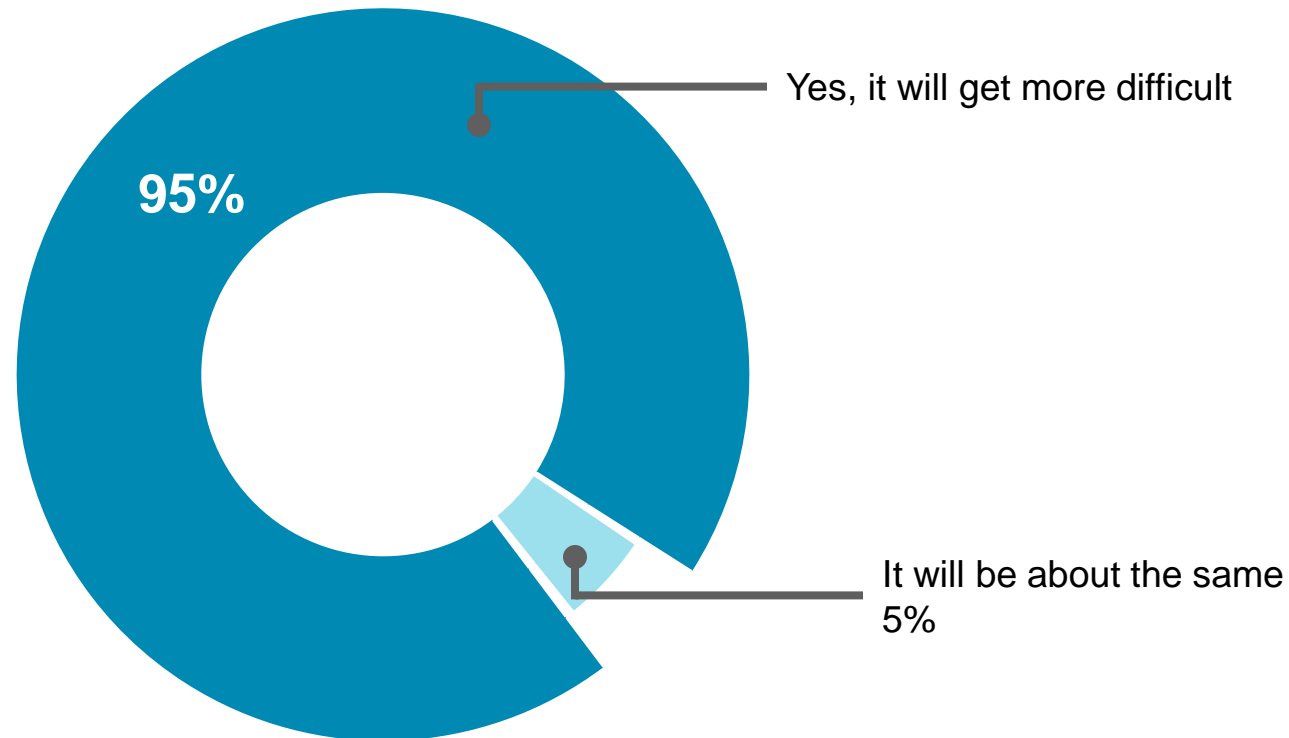
Percent of organizations using stop-gap strategies to temporarily address labor challenges:*



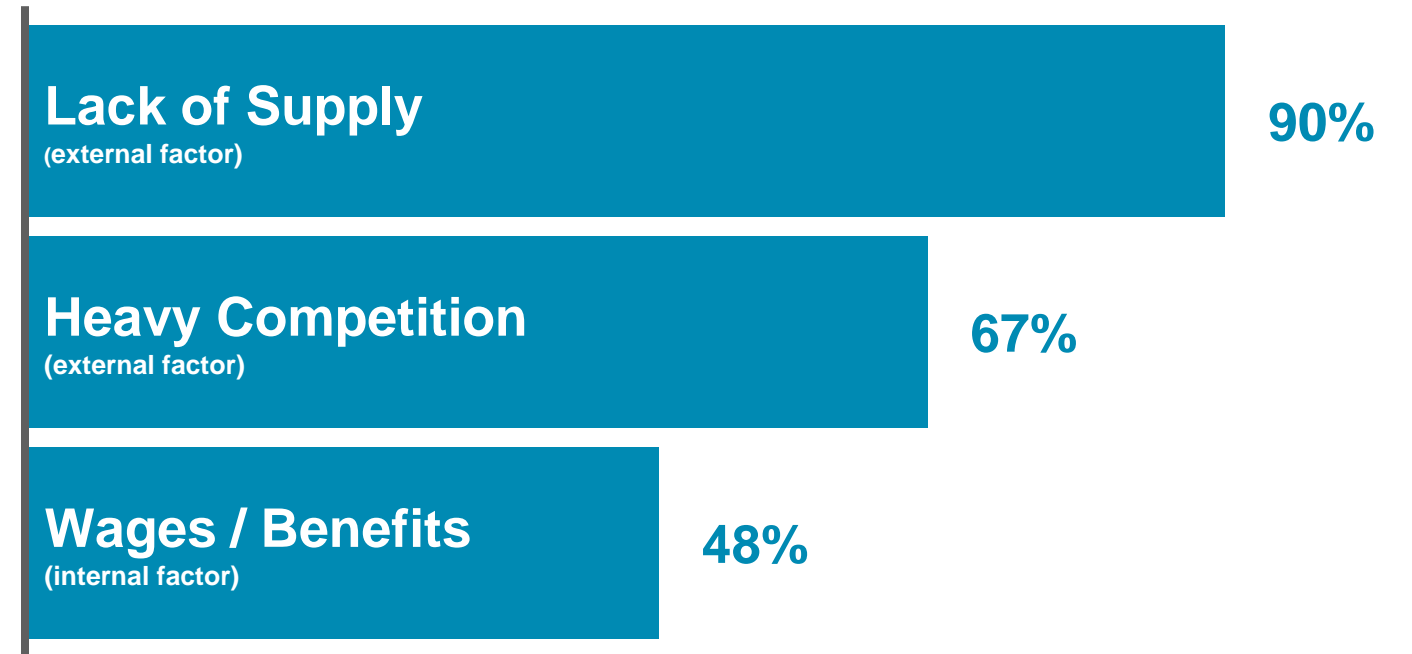
Over the long term, reliance on large amounts of overtime is costly, can reduce overall productivity, and unsustainable

Notwithstanding current labor imbalances, the MRO Survey found that 95% of respondents in North America plan on hiring to increase or maintain headcount over the next three years, and the same percent of respondents agree that recruiting will become even more difficult than it is today

Q: Versus today, do you expect recruiting maintenance technicians to get more difficult over the next 3 years?*



Q: Are there internal or external factors that are affecting your company's ability to recruit maintenance technicians?*



33% Cost of Living at Maintenance Facility Locations | 24% Recruitment Policy / Recruitment Marketing | 19% Low Unemployment Rate | 10% Poor Manpower Planning | 10% Small Size of the Organization | 5% Political / Social / Legal Environment | 5% High Cost of Recruitment | 5% Company Image

Lack of labor supply, heavy competition, and concern about wages / benefits being offered to potential maintenance technician candidates could hinder plans for growth and indicate tightening in the commercial MRO labor market is underway

2017

2018

2019

2020

2021

2022

2023

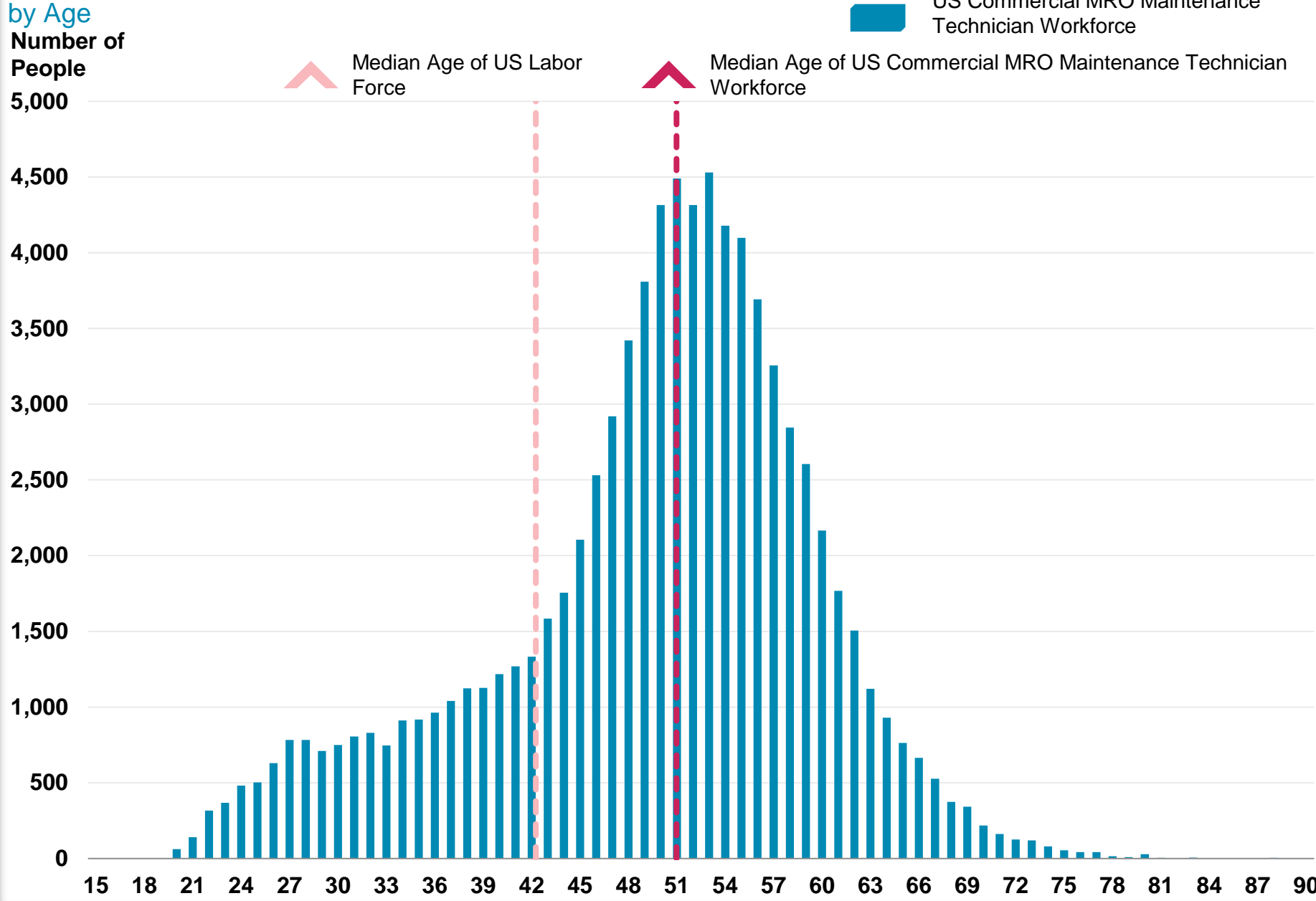
2024

2025

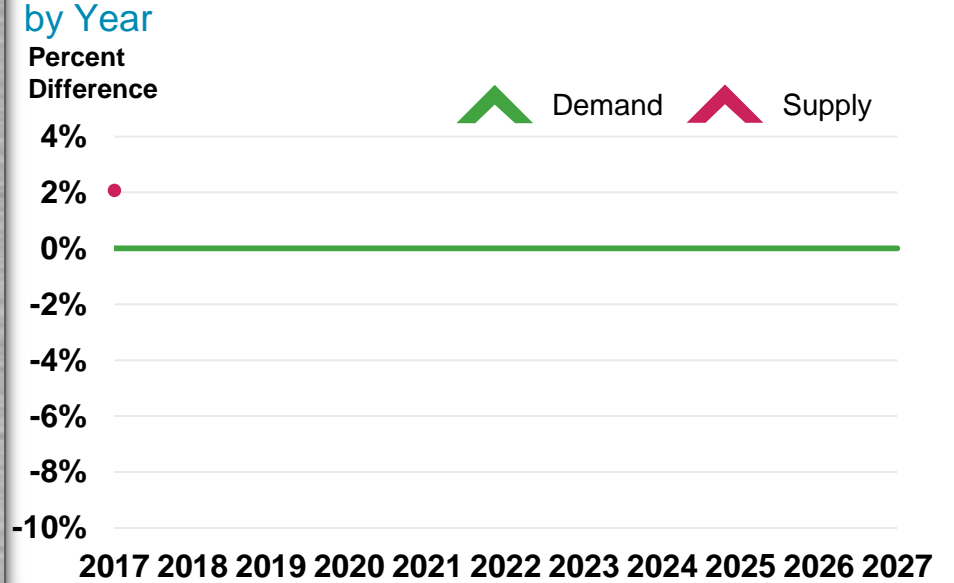
2026

2027

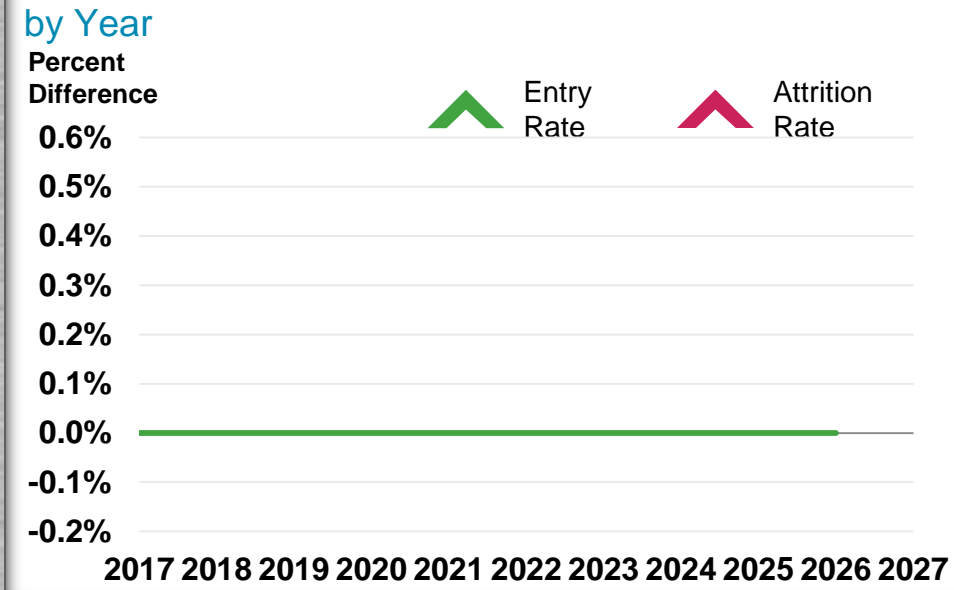
US Commercial MRO Maintenance Technician Workforce



Labor Supply vs Labor Demand



Rate of Attrition vs Rate of Entry



2017

2018

2019

2020

2021

2022

2023

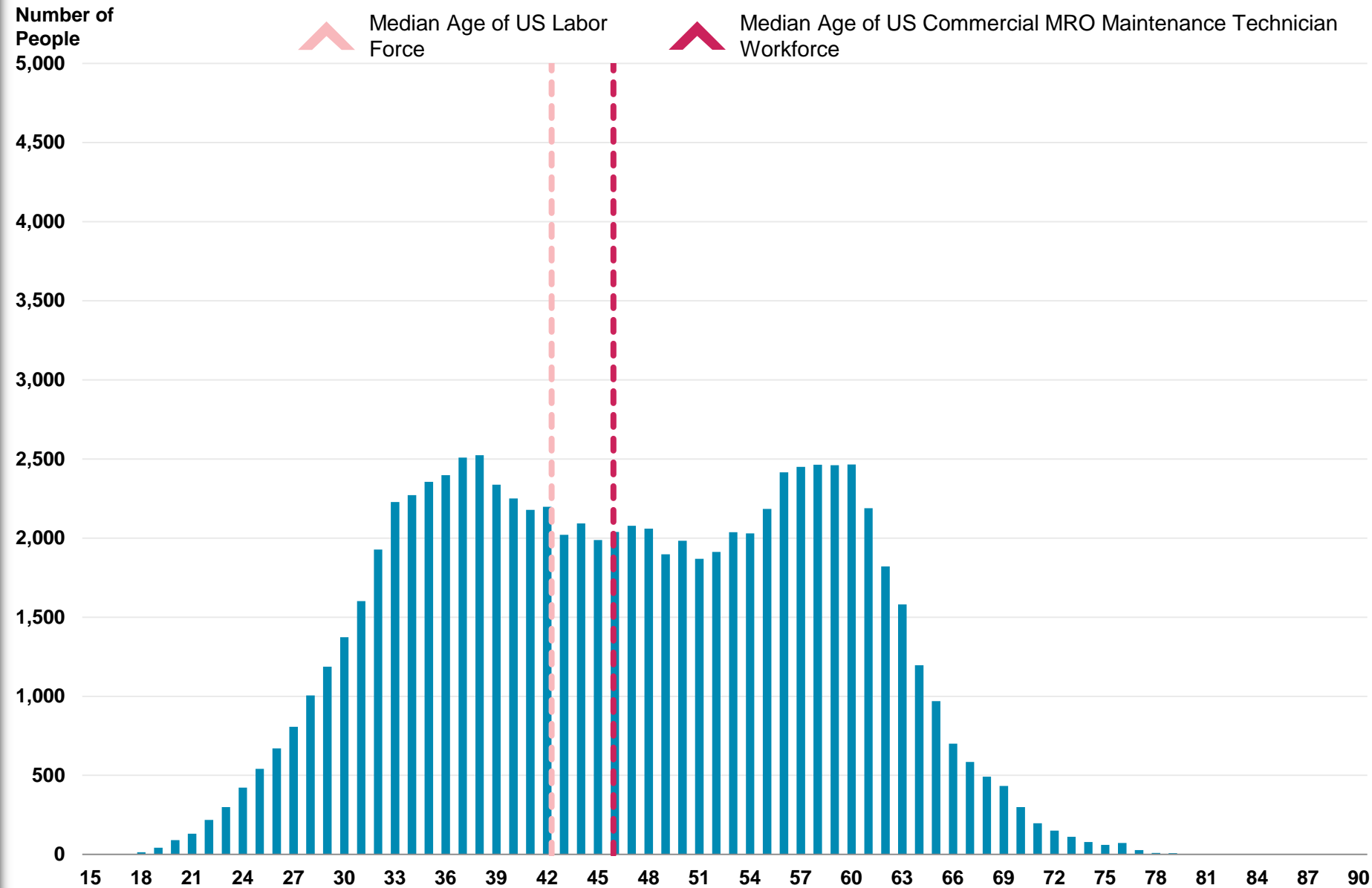
2024

2025

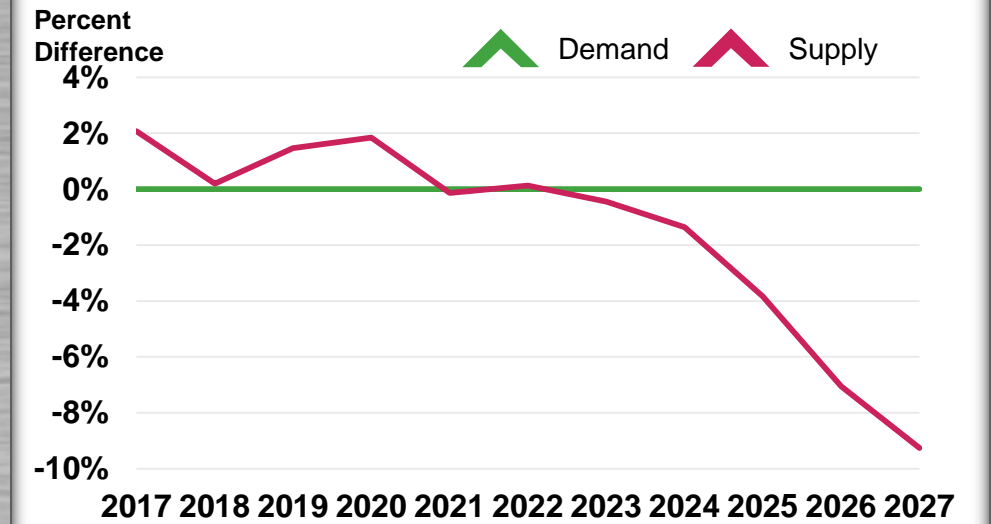
2026

2027

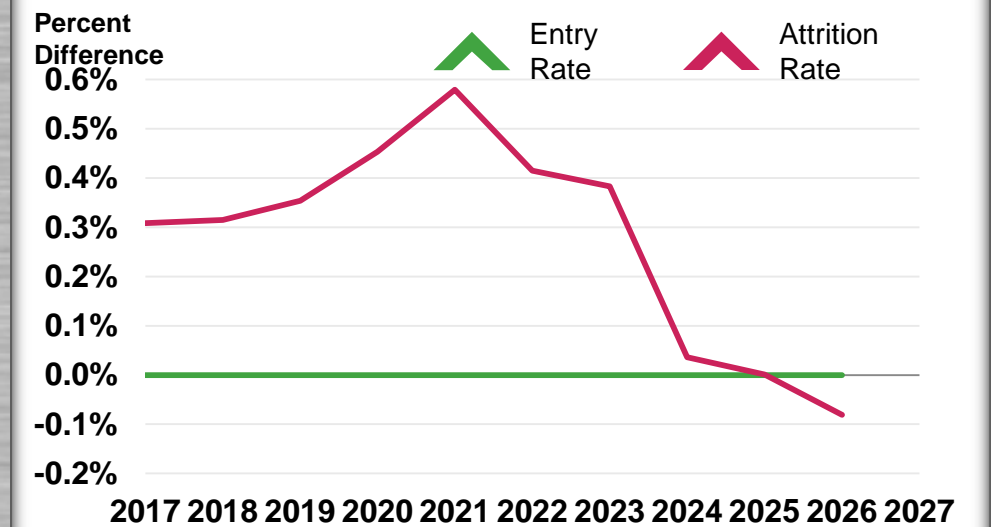
US Commercial MRO Maintenance Technician Workforce by Age



Labor Supply vs Labor Demand by Year



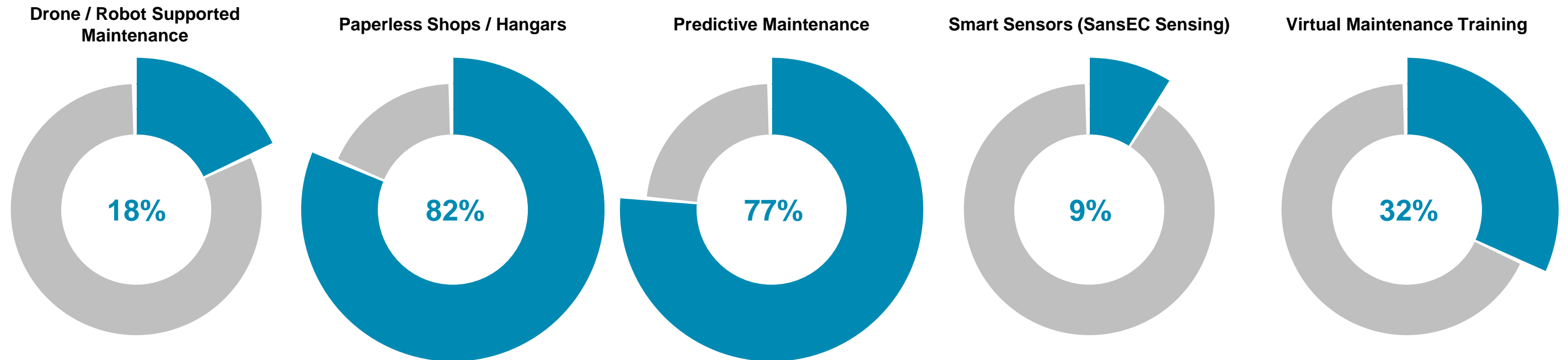
Rate of Attrition vs Rate of Entry by Year



3 | Moore Changes Required

The maintenance technician shortage will make performing maintenance at just the right time, and as efficiently as possible more important than it ever has been

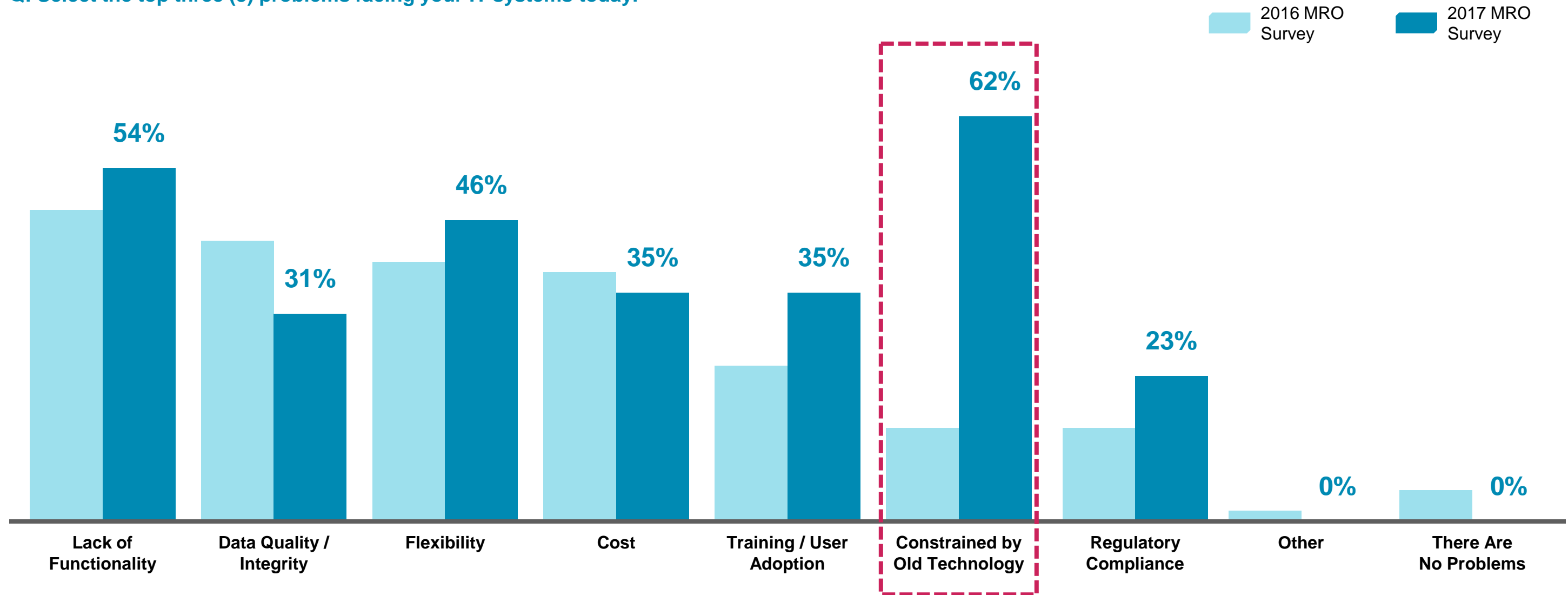
Q: Which of the following game changing technologies for the shop / hangar floor are you planning on implementing within the next 3 years?



More than three quarters of MRO Survey respondents plan on implementing paperless shops/hangars and predictive maintenance over the next three years – technologies aimed at increasing technician efficiency and productivity and maximizing aircraft availability

While respondents express interest in predictive maintenance, big data, and advanced analytics, there is limited evidence so far as to the benefits, largely due to the industry being plagued with major inefficiencies and a lack of innovation when it comes to information technology

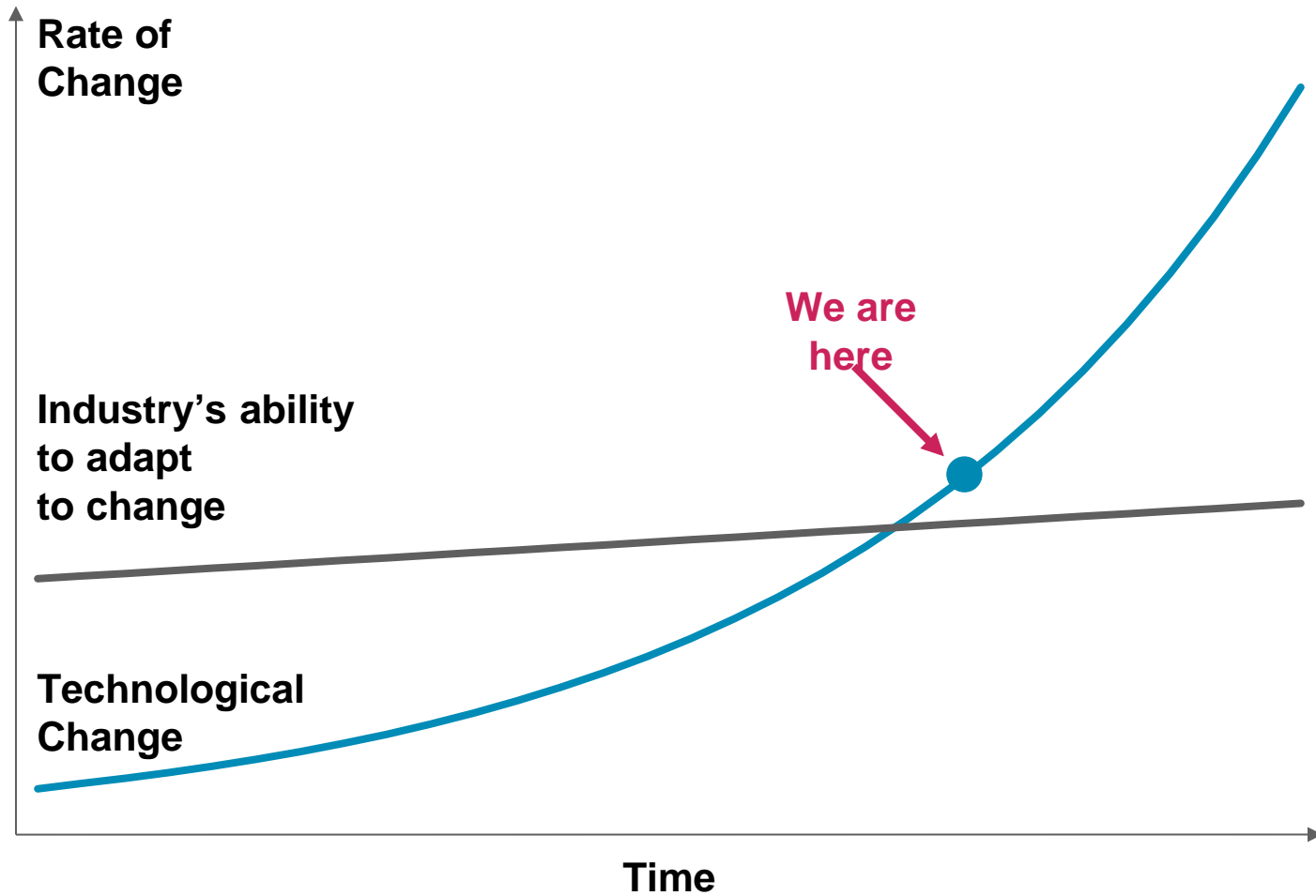
Q: Select the top three (3) problems facing your IT systems today:



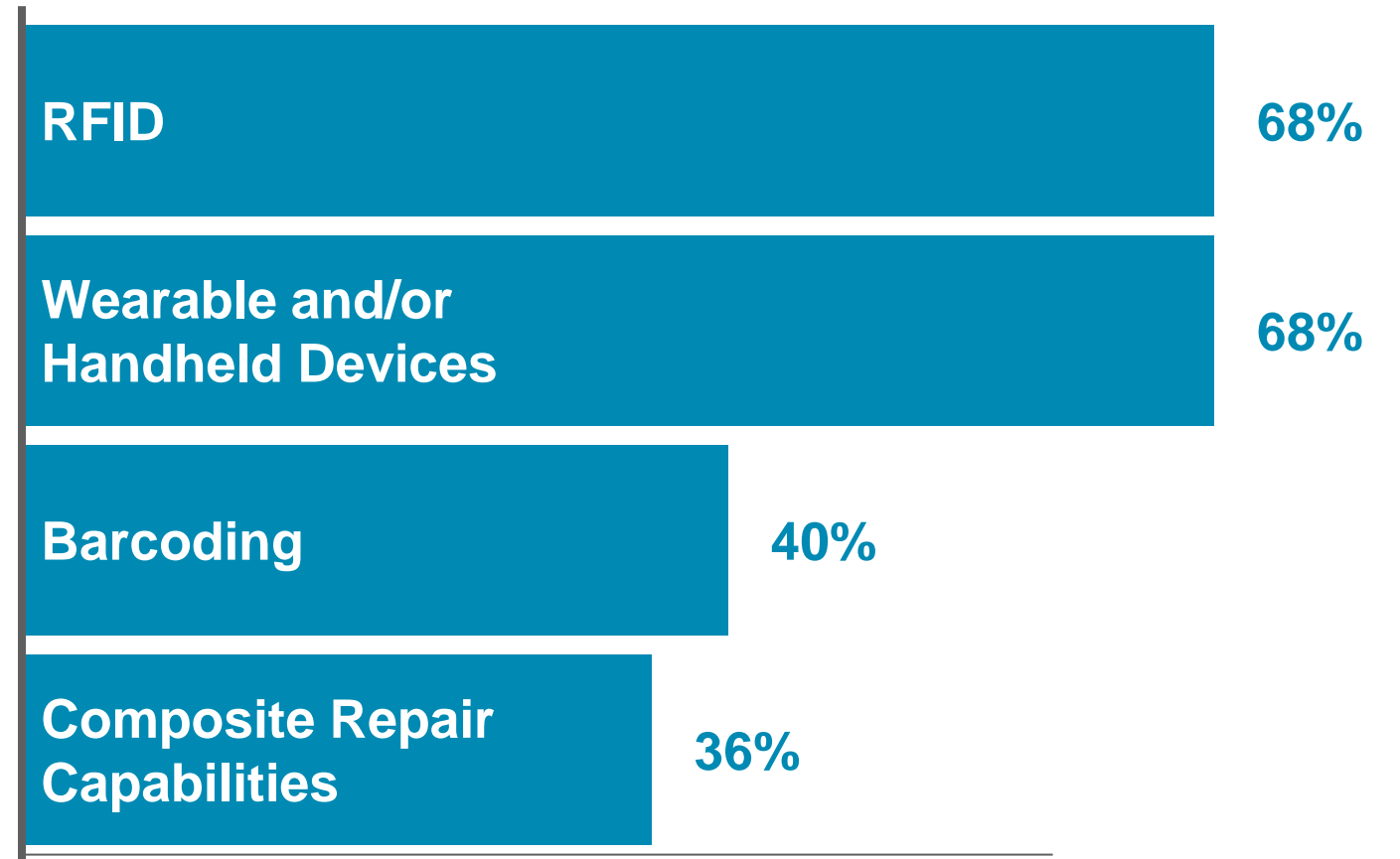
Aircraft designed in 2017 are being maintained by systems designed in 1970 and it's starting to show

Today, the rate of technological change is accelerating so fast that it has risen above the average rate at which our industry can adapt to change, preventing us from fully benefiting from all of the new technology that is coming along

Adaptability to Technological Change
Astro Teller Illustrative Graphic



Q: Indicate which new technologies your company is planning to deploy in the next three (3) years?

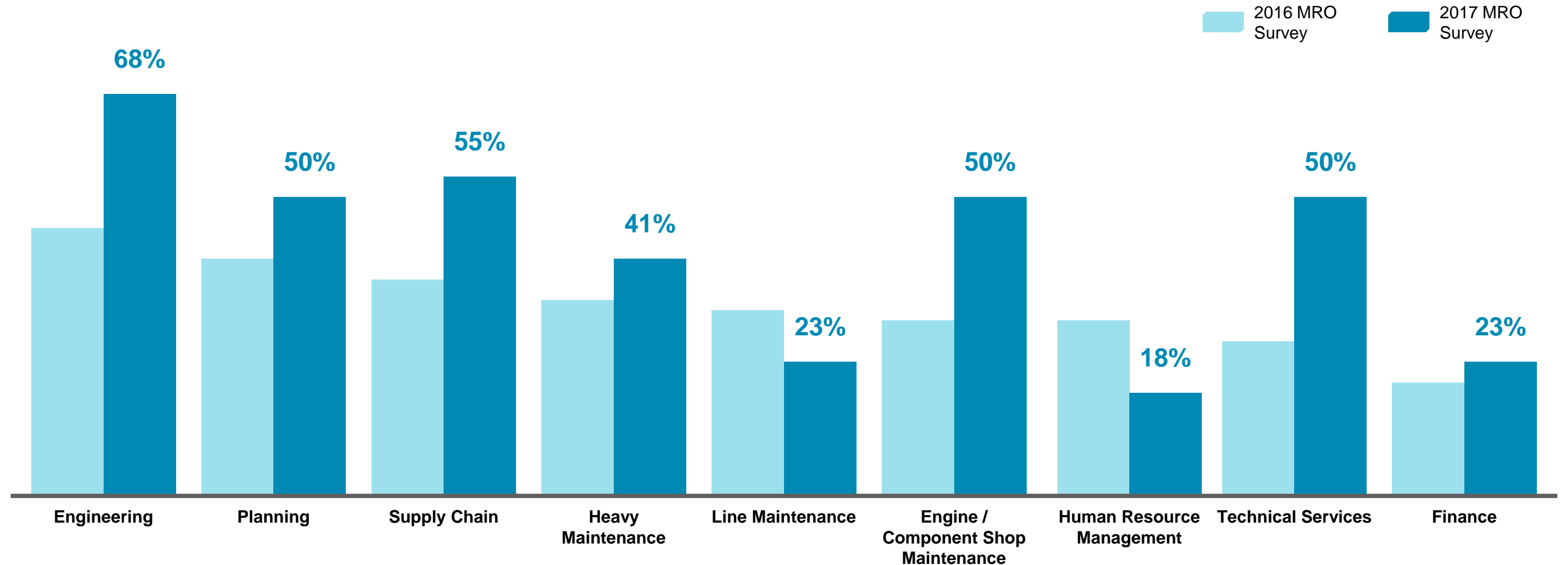


28% New Repair Technology | 24% Additive Manufacturing | 20% Artificial Intelligence (Machine Learning) | 20% Robotics | 12% Drone-Supported Maintenance

This is evident by the fact that the new technologies planning on being deployed over the next 3 years are RFID and wearable and/or handheld devices such as tablets – technologies other industries adapted to several years ago

Most have recognized that they are behind the technology curve and plan to make significant changes to their IT systems over the next few years

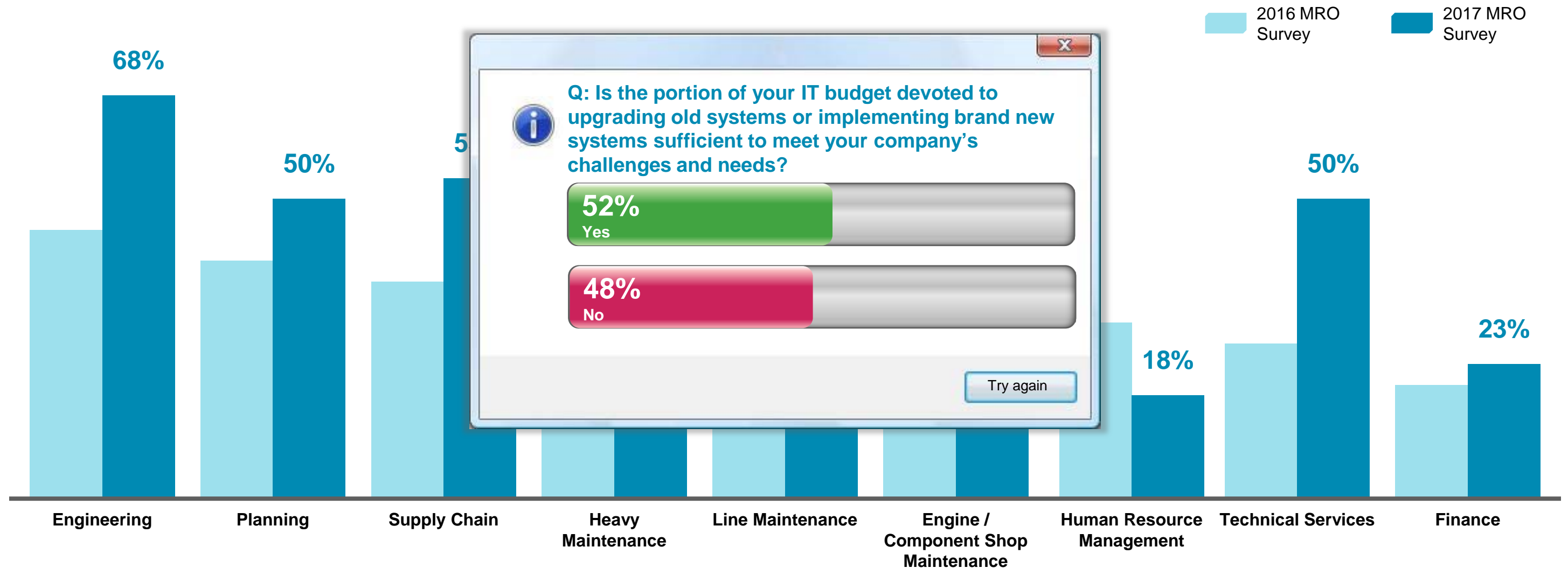
Q: Indicate which IT systems have a migration or major upgrade planned within the next three (3) years?



An ever aging IT infrastructure, competing for limited resources, needs to be given higher priority because not only is the fleet getting larger, it is becoming more technologically advanced - fast

Most have recognized that they are behind the technology curve and plan to make significant changes to their IT systems over the next few years

Q: Indicate which IT systems have a migration or major upgrade planned within the next three (3) years?



Q: Is the portion of your IT budget devoted to upgrading old systems or implementing brand new systems sufficient to meet your company's challenges and needs?

52% Yes

48% No

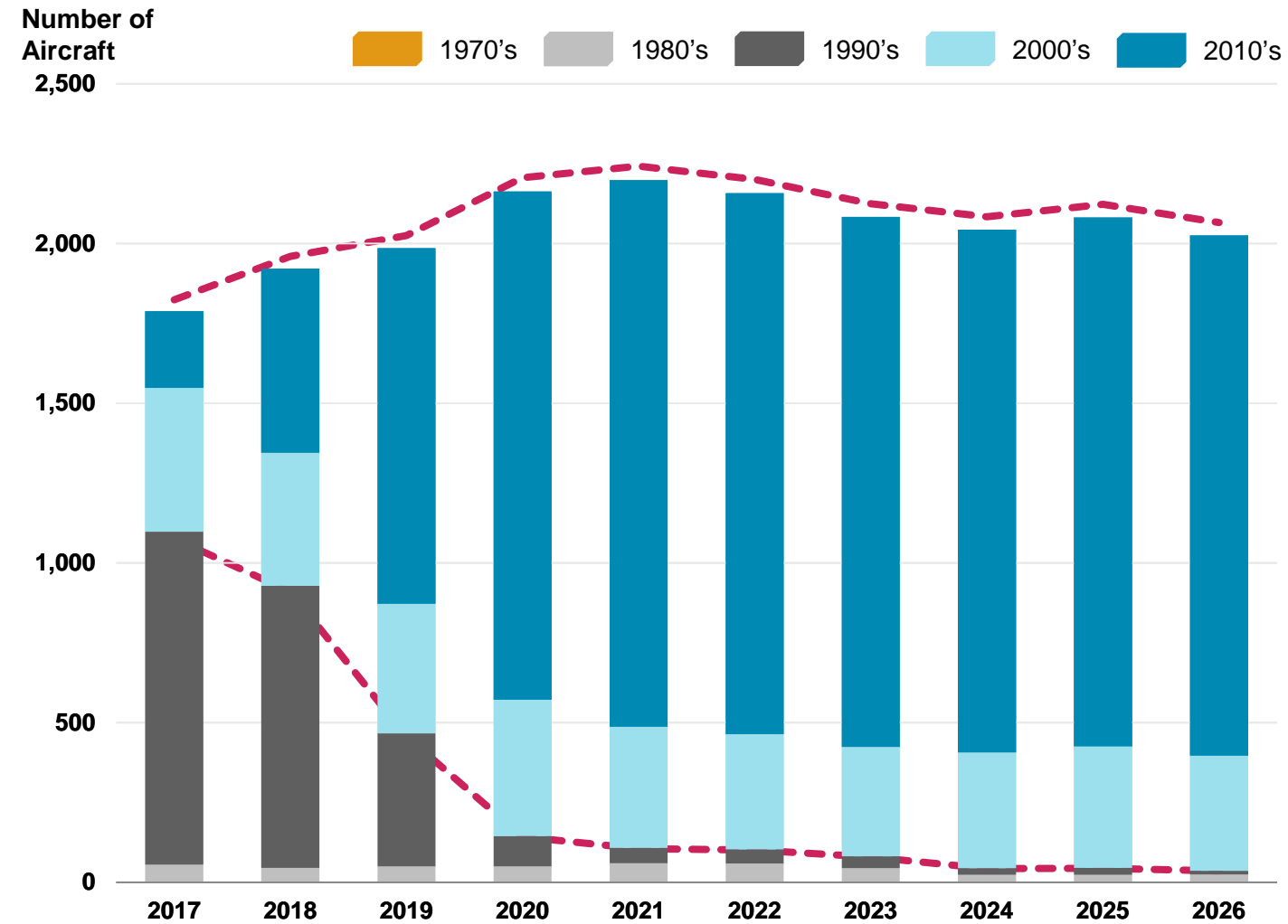
Try again

An ever aging IT infrastructure, competing for limited resources, needs to be given higher priority because not only is the fleet getting larger, it is becoming more technologically advanced - fast

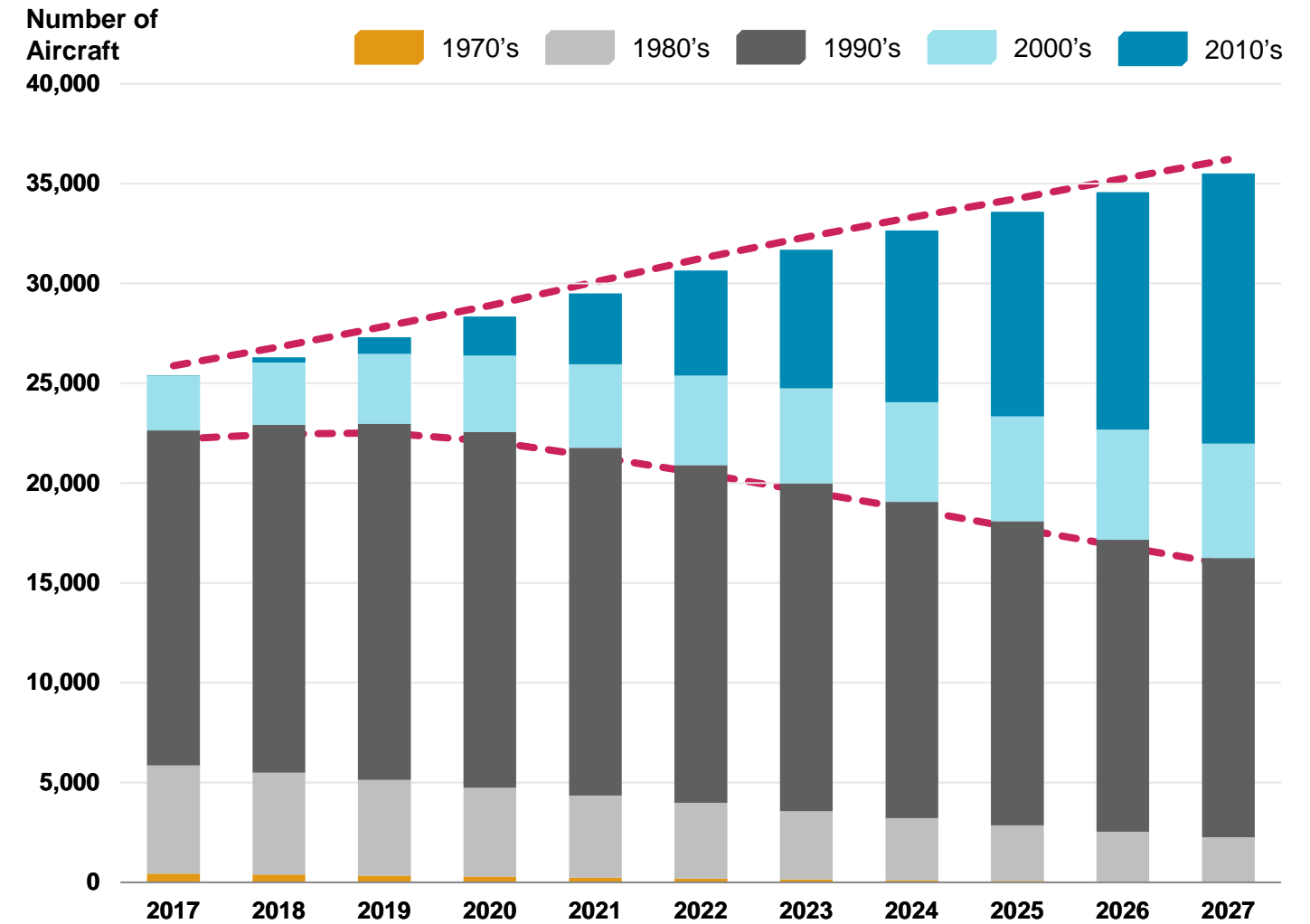
4 | The Lean, Digitally Mean Airline Fleet of the Future Takes Off

As the in-service fleet grows to over 35,000 by 2027, the rapid deployment of aircraft incorporating next generation technology will be the primary agent of change

Global Commercial Air Transport Delivery Forecast
by Aircraft Vintage



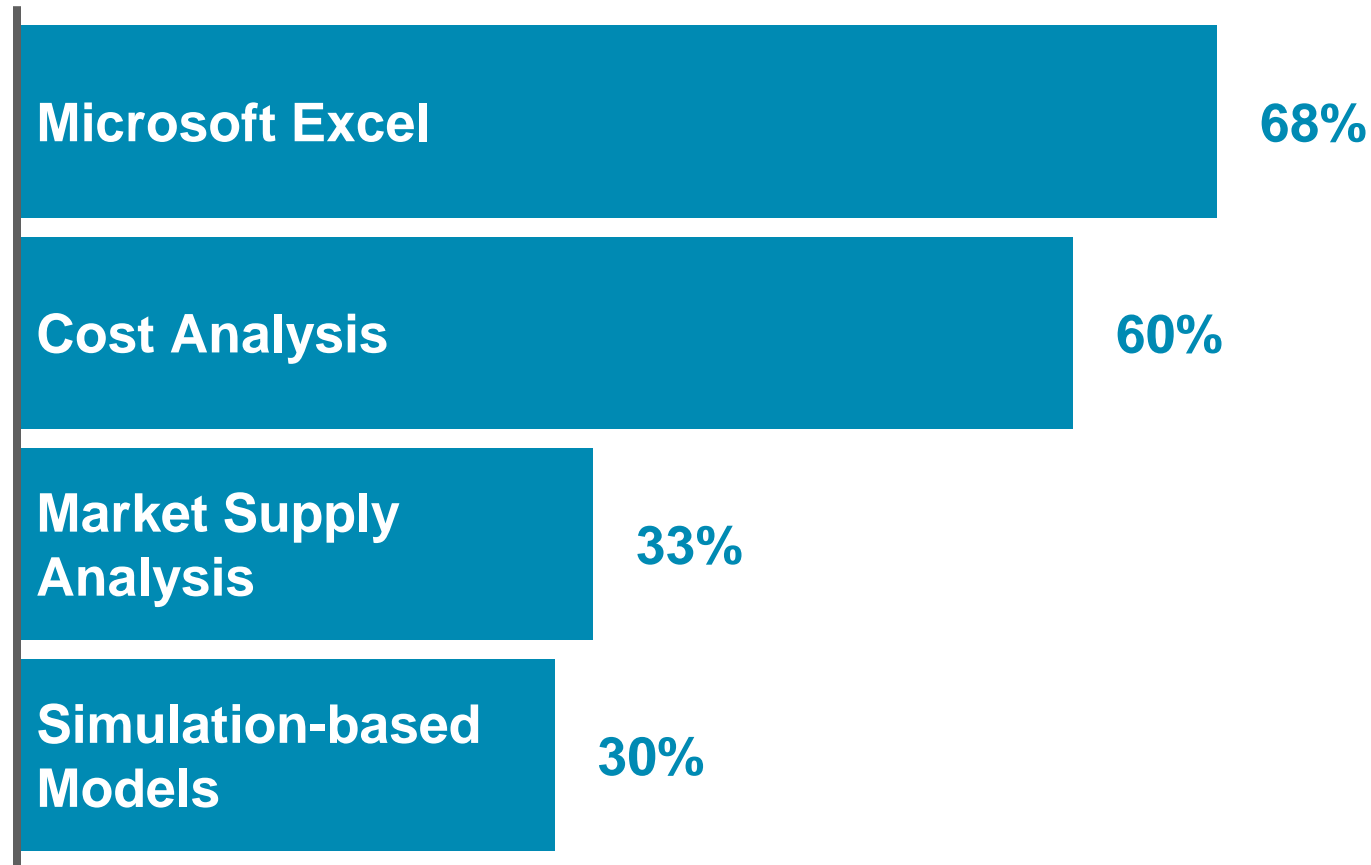
Global Commercial Air Transport Fleet Forecast
by Aircraft Vintage



Dealing with the technological shift in the fleet will be an enormous challenge as the new fleets will bring new complexity to the market and further change the skill requirements of the workforce maintaining the fleet

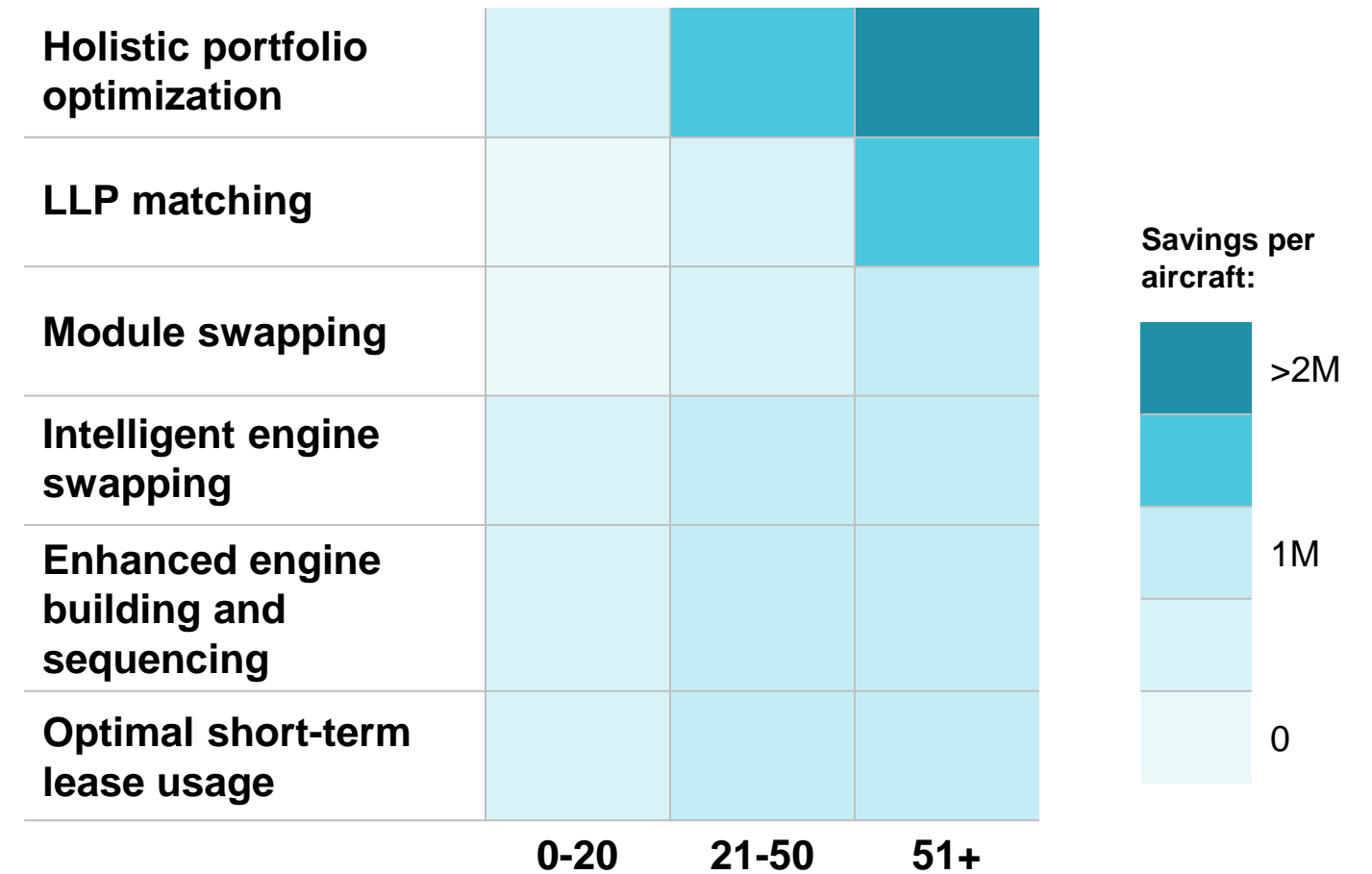
Moreover, the sheer number of retirements over the next 10 years will strain the Excel based processes and methods most use to manage the last six to twelve months of an aircraft's useful life. This approach narrows down the options available to optimize use and can also be a recipe for wasting millions of dollars

Q: What tools do you use to manage the end-of-life?



20% Third-party analysis | 5% Other

End of Life / End of Lease Value Creation



End of life planning needs to move into the digital age – utilizing integrated, holistic modeling approach and big data tools and techniques to fully account of the complexity of aircraft with different requirement requirements

It's time to break free of antiquated thinking, processes, and systems holding us back from fully benefiting from new technologies.

- The industry has passed the peak of this current financial cycle.
- The aging of the mechanic workforce and rash of anticipated retirements could not come at a worse time for the industry.
- An ever aging IT infrastructure, competing for increasingly limited resources, needs to be given higher priority.
- The sheer number of retirements over the next 10 years will strain the processes and methods currently use to manage the end an aircraft's useful life. End of life planning needs to move into the digital age.

Related content



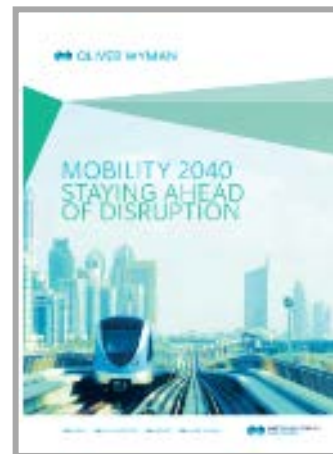
2017-2027 FLEET AND MARKET FORECAST

A 10-year outlook for the commercial airline transport fleet and the associated maintenance, repair, and overhaul (MRO) market.



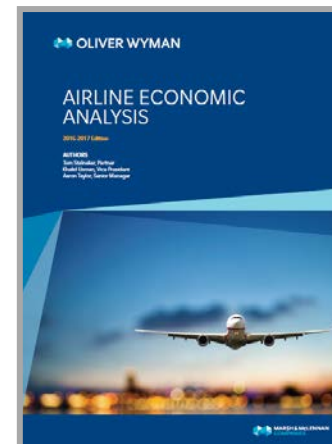
2017 MRO SURVEY FINDINGS

In its second decade, the annual MRO survey samples a range of executives from across the aviation industry addressing key trends and emerging issues in the MRO sector.



MOBILITY 2040: STAYING AHEAD OF DISRUPTION

Our new research study of emerging trends and the future of passenger transport.



2016-2017 AIRLINE ECONOMIC ANALYSIS

In its eighth year, this report covers a range of aviation industry-specific economic and performance data as well as global capacity growth by region.

