OLIVER WYMAN

GLOBAL FLEET AND MRO MARKET FORECAST 2021-2031

Tom Cooper | Ian Reagan | Chad Porter | Carlo Franzoni

FOREWORD

Oliver Wyman's *Global Fleet & MRO Market Forecast Commentary 2021-2031* marks our firm's 21st assessment of the 10-year outlook for the commercial airline transport fleet and the associated maintenance, repair, and overhaul (MRO) market. We're proud to say that this annually produced research, along with our *Airline Economic Analysis*, has become a staple resource of executives in aerospace manufacturing, airlines, MRO, and the financing of the sector through private equity firms and investment banks.

The year's research focuses on airline fleet recovery and growth in the wake of unprecedented challenges from the coronavirus pandemic, as well as related trends affecting aftermarket demand, maintenance costs, technology, and labor supply. The outlook details how COVID-19 has significantly disrupted traffic, fleet dynamics, and MRO. Understanding these marketplace realities are vital to making well-informed business decisions and developing strategic long-term plans for the aviation industry.

As you will see from the report, the next few years hold great challenges for industry recovery as COVID-19, economic forces, traveler sentiment, and government policies compel the industry to reimagine its future.

In conjunction with each year's *Global Fleet & MRO Market Forecast*, we conduct an annual survey on hot topics, critical issues, and new opportunities in MRO. To participate in the 2021 survey, please contact the research team at MROsurvey@oliverwyman.com.

Oliver Wyman's Aviation Competitive and Market Intelligence team, partners, and vice presidents are available to assist with any questions about this forecast, as well as with the *Airline Economic Analysis*, which is scheduled to be released in February. We hope you find the data and insights valuable as you refine your business models and develop strategies for moving forward.

Best regards and wishes for a wonderful 2021,

Tom Cooper
Vice President and Study Leader

January 28, 2021

CONTENTS

EXECUTIVE SUMMARY

A FUTURE OF CHALLENGES AND HOPE

After five years of growth and profitability, the aviation industry is now entering a decade of uncertainty and, for at least the first two to three years, considerable financial pressures. As COVID-19 spread across the world, the industry lost over $118 billion in 2020, according to the International Air Transport Association, and saw dozens of airlines seek bankruptcy protection or stop flying entirely.

2021 is unlikely to be much different. Except for airlines in China, where domestic travel returned to pre-pandemic levels by November 2020, global carriers will still burn millions in cash daily for much of the year — but probably not all of it. Some will face the unsettling prospect of restructuring and consolidation. Losses in the tens of billions of dollars are expected again this year, although the industry will suffer less than half of the hit it sustained the first year of COVID-19.

That means cash preservation will remain a top priority for airlines, which is not good news for aerospace manufacturers and maintenance, repair, and overhaul (MRO) service providers. In 2020, COVID-related pressure on airline cash flow and reduced demand for air travel led global carriers to put thousands of aircraft into storage, retire twice as many as normal, convert some for carrying cargo, and cancel or defer some deliveries of new planes.

At its nadir, the global fleet had only about 13,000 aircraft in service, less than half the number flying in January 2020 before the pandemic was declared. Today, the 2021 fleet is up to more than 23,700 aircraft. By 2031, we forecast the fleet will number more than 36,500. But it's still a far cry from pre-COVID projections, which put the 2021 global fleet at 28,800 and the 2030 fleet at more than 39,000.

PLAYING CATCHUP FOR 10 YEARS

That's the outlook for aviation emerging from Oliver Wyman's *Global Fleet and MRO Forecast 2021-2031*. The 10-year forecast period starts slowly, with growth picking up steam in the second half of 2022, after the fleet finally recovers to its pre-COVID January 2020 level. Still, none of the three segments — airlines, aerospace, and MRO — are expected to catch up with pre-COVID projections by the end of the 10 years.

Given the inventory backlog of new planes that are built but undelivered or still not sold, more aircraft will be delivered to airlines over the next several years than will be produced by aerospace manufacturers. While production and deliveries are closely aligned in normal years, the imbalance reflects conflicting pressures on airframe manufacturers to balance the realities of lower market demand with needs of key suppliers to maintain sufficient production.

Other aerospace revenue also may be in jeopardy. The early retirement of planes may reduce aerospace sales of new parts because of increased competition from the surge in supply of used components and green-time engines harvested from retired aircraft. It will take as much as three years to work through the excess of used serviceable material.

For MRO companies, a smaller fleet translates into less work. Demand is expected to be 33 percent, or $60 billion, below combined pre-COVID projections for 2020 and 2021. While the market is beginning to recover, the long-term MRO growth trend is now roughly half of pre-COVID expectations. Cumulatively, MRO demand is expected to be $95 billion lower over the forecast period.

OPPORTUNITIES FOR GROWTH

Despite the reduced expectations for MRO, the compound annual growth of the sector between 2019 and 2031 is projected at three percent. The combination of near-term lower demand and long-term growth prospects has created an attractive environment for private equity investors, and interest in MRO is high.

The popularity of narrowbody aircraft is also on the rise. For years, the narrowbody share of the total fleet has increased as the improving range capability and attractive seat mile efficiency of the class have made the aircraft the choice of low-cost carriers. This trend is expected to continue as more airlines align fleets to the demand realities of COVID-19.

While forecasts for narrowbody production are 40 percent below 2018 levels for 2021, we expect the aircraft class to recover to within 10 percent of our original pre-COVID projections for the final years of the forecast period. One bright spot has been sales of A321LR, which remain strong even in the face of the pandemic. The aircraft offers sufficient range to serve routes that were previously flown with Boeing 757s or widebody aircraft, as well as providing airlines increased flexibility in their scheduling.

Deliveries of narrowbodies in 2021 will also be bolstered by decisions by the Federal Aviation Administration and European Union Aviation Safety Agency to recertify the Boeing 737 MAX for commercial service. More than 20 737s have already made it back into carrier fleets since the recertification, but there are 400 to 450 more MAX aircraft, built in 2020, that are sitting in Boeing's inventory undelivered or not sold. In addition, the number of narrowbodies in the fleet will be expanded by the almost 400 737s that airlines have had in storage since the plane's grounding in March 2019.

THE IMPACT OF LESS BUSINESS AND INTERNATIONAL TRAVEL

In contrast, widebody aircraft production has seen a significant decline because of COVID-19's impact on long-haul travel demand. Over the forecast period, we expect widebody production to be as much as 40 percent below pre-COVID expectations unless there's a faster-than-expected recovery in long-haul routes.

International travel — which accounts for the bulk of long-haul — evaporated in the early days of COVID-19 and continues to be hard-hit, which has had implications for widebodies. Over the last year, nations around the world have been tightly regulating cross-border travel in an effort to keep out or at least contain the pandemic. Border closings and sudden requirements to quarantine for 14 days have discouraged travel between countries, with passengers fearful of being stranded or unable to get home. Under a new executive order from President Joe Biden, travelers entering the United States must provide proof of a recent negative COVID-19 test prior to entry — a requirement that already exists in some other countries.

Contributing to the decline in international long-haul travel has been the fall in business travel, the most profitable category for airlines. This is especially true on long-haul flights, on which executives often opt for premium seating.

Videoconferencing and teleconferencing have become attractive substitutes that allow companies to cut travel budgets, particularly for intracompany trips. COVID-19 has also forced many business conferences and trade shows to go virtual or be canceled entirely, eliminating another reason for executive travel. While most of this travel will eventually return as more people get COVID-19 vaccinations, it is unlikely to recover fully over the midterm.

REGIONAL JETS

Meanwhile, the regional jet class is facing multiyear delays for some of its latest models as new platforms encounter development problems and as clauses in US pilot contracts limit their use. Given that many regional jets will reach typical retirement age or cumulative utilization during the forecast period, we expect many to end up flying beyond historical thresholds to cover some of the demand for smaller commercial aircraft.

It’s no exaggeration to say that modern commercial aviation has never faced such a long list of challenges as COVID-19 has created. It will likely take several years to adjust the fleet to new realities, and even then, the industry will not regain over the next 10 years all that it has lost with the pandemic.

FLEET AND MRO FORECAST SUMMARY

Region	Africa	Middle East	Asia Pacific	China	India	Latin America	North America	Eastern Europe	Western Europe	World
2021 Fleet										
Narrowbody	380	425	1,816	2,999	524	785	3,742	874	2,654	14,199
Widebody	149	579	1,051	459	43	139	1,085	152	789	4,446
Regional jet	143	48	203	134	2	181	1,654	243	330	2,938
Turboprop	258	25	591	0	81	203	514	102	358	2,132
TOTAL	**930**	**1,077**	**3,661**	**3,592**	**650**	**1,308**	**6,995**	**1,371**	**4,131**	**23,715**
2031 Fleet										
Narrowbody	566	1,289	3,753	4,451	1,300	1,357	5,435	1,648	3,913	23,712
Widebody	255	921	1,656	766	88	153	1,532	259	1,175	6,805
Regional jet	171	69	221	413	25	194	1,713	378	448	3,632
Turboprop	250	59	520	146	109	138	716	108	375	2,421
TOTAL	**1,242**	**2,338**	**6,150**	**5,776**	**1,522**	**1,842**	**9,396**	**2,393**	**5,911**	**36,570**
Fleet growth rates										
2020-2026	1.8%	2.5%	4.3%	5.1%	10.3%	-0.3%	4.3%	1.0%	0.7%	2.2%
2026-2031	-0.3%	3.2%	4.8%	3.7%	6.7%	1.4%	5.3%	1.9%	1.2%	2.8%
2020-2031	**0.8%**	**2.8%**	**4.5%**	**4.5%**	**8.7%**	**0.5%**	**4.7%**	**1.4%**	**0.9%**	**2.5%**
2021 MRO (US$ in billions)										
Airframe	$0.6	$0.8	$2.8	$2.0	$0.3	$0.7	$4.6	$1.0	$3.3	$16.2
Engine	$0.8	$4.2	$5.1	$3.0	$0.8	$1.2	$6.9	$1.8	$5.6	$29.5
Component	$0.3	$0.6	$1.8	$1.8	$0.3	$0.6	$3.7	$0.7	$2.3	$12.1
Line	$0.2	$0.5	$1.6	$1.6	$0.3	$0.5	$2.8	$0.6	$2.6	$10.7
TOTAL	**$1.9**	**$6.2**	**$11.3**	**$8.3**	**$1.7**	**$3.0**	**$18.1**	**$4.1**	**$13.8**	**$68.4**
2031 MRO (US$ in billions)										
Airframe	$0.8	$1.5	$4.3	$3.4	$0.6	$1.0	$5.1	$1.3	$4.3	$22.3
Engine	$1.5	$8.7	$11.5	$9.9	$2.0	$1.8	$9.4	$2.1	$9.7	$56.6
Component	$0.6	$1.4	$3.9	$3.5	$0.8	$1.0	$5.0	$1.3	$3.9	$21.3
Line	$0.3	$1.2	$3.0	$2.7	$0.6	$0.7	$3.8	$1.1	$3.8	$17.4
TOTAL	**$3.3**	**$12.9**	**$22.7**	**$19.4**	**$4.0**	**$4.5**	**$23.3**	**$5.9**	**$21.7**	**$117.7**
MRO growth rates										
2019-2026	3.0%	4.1%	4.9%	11.1%	6.5%	-1.1%	2.4%	6.1%	1.5%	4.0%
2026-2031	0.7%	1.8%	1.6%	3.6%	6.4%	1.3%	-0.3%	0.7%	1.3%	1.5%
2019-2031	**2.0%**	**3.1%**	**3.5%**	**7.9%**	**6.4%**	**-0.1%**	**1.3%**	**3.8%**	**1.4%**	**3.0%**

GET INTERACTIVE WITH THE FORECAST DASHBOARD

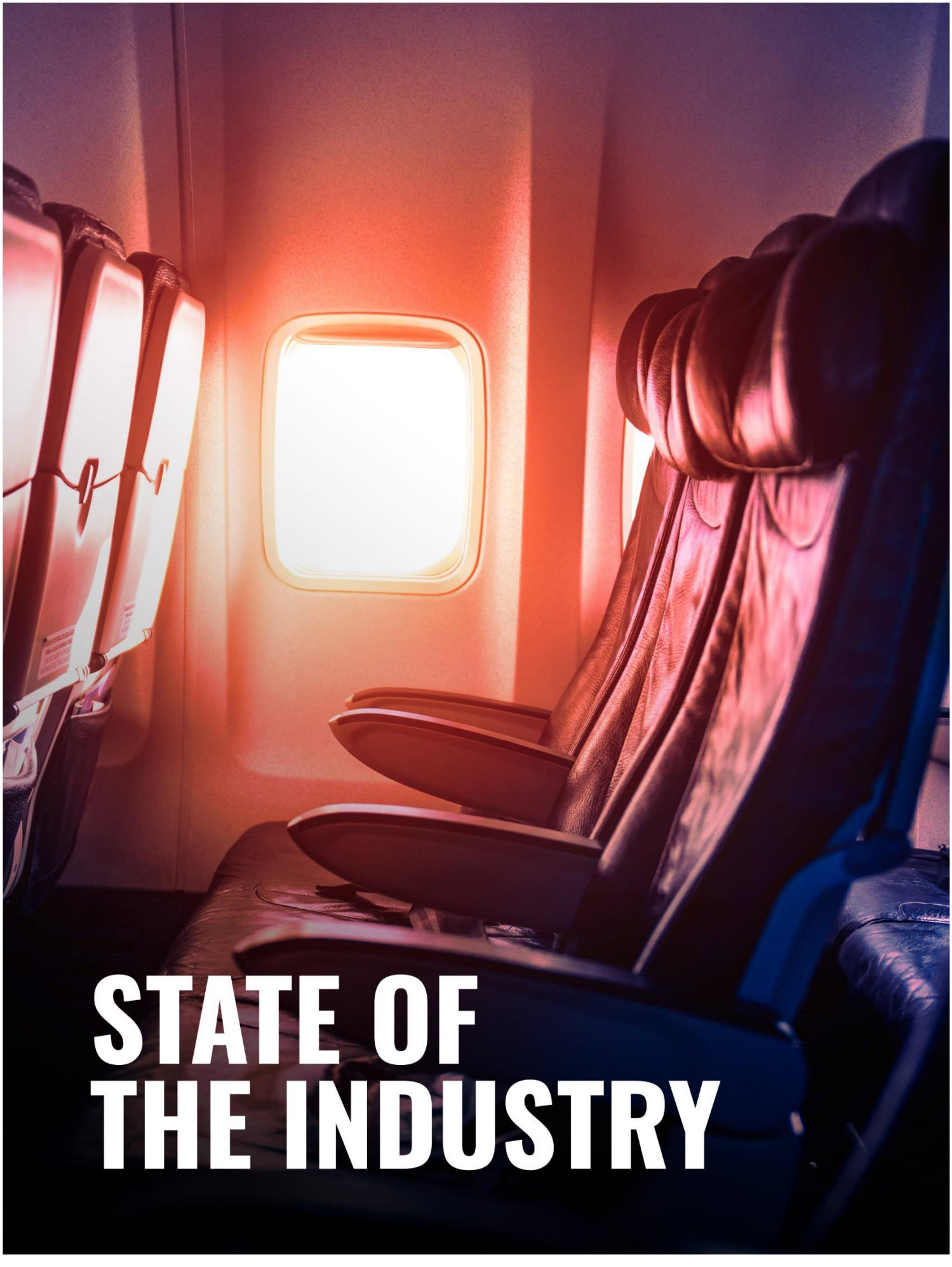
To enhance the *Global Fleet & MRO Market Forecast 2021-2031*, we have created an interactive dashboard that lets users explore online the results of the forecast in a deeper fashion. Employing a filter of their choice, report readers can view the data from Oliver Wyman's forecast in ways most relevant to them.

The dashboard is made up of two views. The first is a summary view that looks at the size, growth, and share of the global MRO market. With the ability to filter by aircraft class and specific MRO segments, users can identify changing trends and the relative size of MRO demand by market.

The second view provides more granular insight into the size of the MRO market by year and growth by geographical region. A breakdown of fleet growth in terms of deliveries, retirements, and removals from storage is also provided. By filtering for region or MRO segment, users are allowed to identify growth trends and potential vulnerabilities for various geographies and sectors.

This dashboard highlights the strength and flexibility of the Oliver Wyman *Global Fleet & MRO Forecast* models. For questions on the report or how to get the most out of the dashboard, please reach out to AviationMarketIntelligence@oliverywyman.com.

To view the Fleet & MRO Forecast Interactive Dashboard, please click here.



STATE OF THE INDUSTRY

AN INDUSTRY IN UPHEAVAL

For most of the past decade, the aviation industry has been supported by a solid foundation of positive economic trends, including global growth, low unemployment, low inflation, and strong consumer buying power. Together they helped create a burgeoning middle class worldwide and a corresponding increase in demand for air travel. Coupled with the period's low interest rates, rising financial markets, and stable operating costs, the environment enabled airlines, aircraft manufacturers, and service providers to steadily expand between 2010 and 2019 while also maintaining profitability.

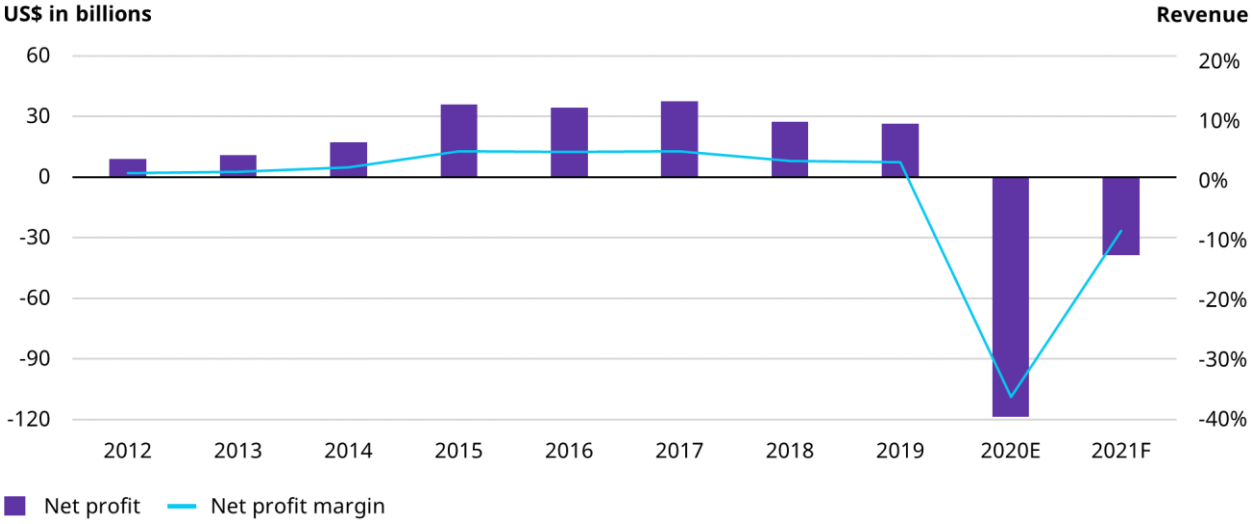
All that ended in 2020, as the coronavirus pandemic demolished once predictable growth and wreaked havoc on the industry and global economy. While some impacts like nearly empty airports and the months-long grounding of over half of the global fleet seemed unimaginable before COVID-19, they became realities airlines struggled with last year. While passengers eventually began to travel again as the year progressed, particularly around the holidays, 2020 ended with the pandemic setting daily records in deaths, hospitalizations, and cases in the United States and forcing lockdowns in some European nations. The biggest symbol of hope was the fast development of COVID-19 vaccines, with inoculations first going into arms at the yearend in the United Kingdom, the US, and elsewhere.

Even before the pandemic, global aviation was expected to see reduced growth and fewer profits in the current decade because of a slowdown in the global economy. The upward trend in revenue passenger kilometers (RPK) would slip across all regions, particularly in mature aviation markets like Europe and the United States. From a cargo standpoint, global tensions between the US and China and, to a lesser extent, the US and the European Union had made the outlook uncertain. As a result, in 2019, freight tonne kilometers (FTKs) fell below 2017 levels. This top-line slowdown — in conjunction with rising labor costs — was already pressuring global airline profits. The final projection for 2019 profits from the International Air Transport Association (IATA) was 30 percent lower than its projection made at the beginning of that year. COVID-19 significantly exacerbated the developing cracks in the industry's business model.

PROFITS TO LOSSES

The $26 billion in 2019 airline profits will not be seen again for some time. Losses for 2020 are expected to exceed $118 billion globally, according to IATA. Air travel demand, particularly in the international market, has been decimated by concerns about travel and restrictions imposed by various governments to contain COVID-19. International revenue passenger kilometers have plummeted at least 85 percent year-over-year in every month since April.

Exhibit 1: Global airline industry financial performance, 2012-2021F



Note: The net profit totals have been rounded to the nearest whole number; E stands for estimate, F for forecast
Source: IATA

To mitigate losses and stabilize the industry, governments across the world have provided more than $170 billion in relief funds and other financial support for airlines. With global demand still about half of what it was in 2019, additional support is still needed.

Exploring potential short-term relief, IATA has identified numerous ways that governments can help stimulate demand, including temporary suspension of government charges, taxes and fees for both carriers and passengers; subsidies for domestic routes, especially to rural areas, as demand recovers; advance ticket purchases by governments or public vouchers, which can be used for future trips; and passenger travel subsidies through vouchers.

SIMMERING ISSUES

Meanwhile, as the industry struggles to recover, external challenges at the forefront in 2019 were moved to the backburner. That should begin to change this year as COVID-19 vaccines are distributed and case counts decline. At that point, concerns about aircraft carbon dioxide emissions are likely to be heard again, particularly in Europe.

First, the issue will be brought to the fore with President Joe Biden's decision to rejoin the Paris Climate Accord, as one of his first executive orders, as well as his selection of John Kerry to lead international climate efforts. Concern over COVID-19 may also inadvertently encourage governments to be more proactive about climate change. After seeing how quickly the pandemic got out of control because of a lack of international coordination, many expect officials to address this new global risk with a heightened sense of urgency.

Already, aerospace manufacturers are pushing forward on projects to create commercial aircraft that do not rely solely on internal combustion engines. For instance, in September 2020, Airbus announced three concepts for the world's first zero-emissions aircraft.

Another issue that topped 2019 concerns was the future of the 737 MAX, which was grounded by aviation regulators in March of that year. While the worry at the start of 2020 was whether airlines would have sufficient capacity without the 737 MAX, those fears quickly evaporated as demand plunged with COVID-19.

As the industry begins to contemplate recovery, the 737s are a factor again. An important hurdle was cleared in November 2020 — 20 months after the grounding order — when the US Federal Aviation Administration cleared the plane to return to service. The European Union Aviation Safety Agency followed suit at the end of January of this year.

There's a backlog of between 400 and 450 already built but undelivered 737 MAXs, which is expected to take at least two years to clear. Beyond that, global aerospace production needs to be rescaled to better align with lower demand levels. Meanwhile, Boeing, the 737 MAX manufacturer, is evaluating whether to develop a new midsize aircraft.

Finally, the industry also must contend with an anticipated slowdown in global economic growth as well as backsliding on reducing global poverty — both of which will in turn make it more difficult for aviation to recover. The International Monetary Fund's October 2020 global outlook predicted that the economic recovery from COVID-19 would be "long, uneven, and uncertain" for almost all countries. Between 2022 and 2025, global growth in gross domestic product (GDP) will be 3.5 percent annually. The IMF also lowered its GDP growth projections for 2021 to 5.2 percent from 5.4 percent. In October, the IMF expected 2020's global GDP to contract 4.4 percent.

THE BIG PICTURE

For the industry, the global slowdown means the expansion of the global middle class will also be limited. In turn, these trends are likely to temper the growth of air travel demand.

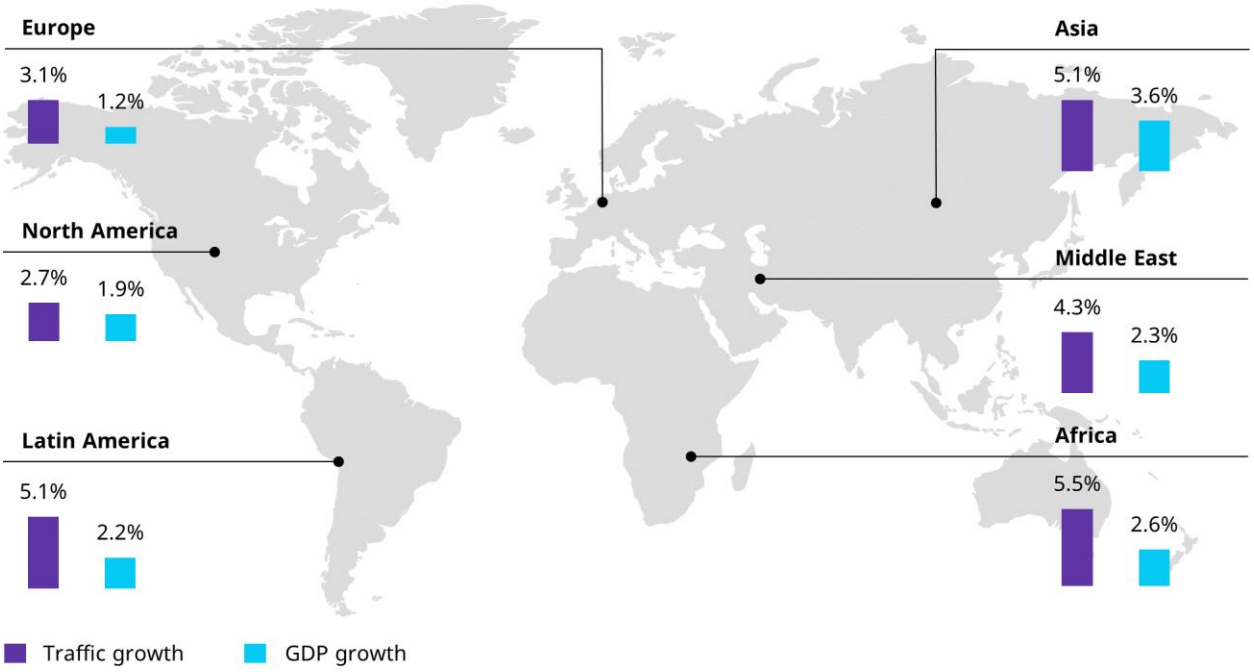
While demand for air travel has been closely tied to GDP trends for most of the past 50 years, growth in passenger traffic during the last decade significantly outpaced global economic expansion. For 2020, the drop in air travel demand is expected to be far greater than global GDP declines in the face of what initially was a virtual shutdown of the industry by COVID-19. In 2019, air transportation, with $855 billion in revenue, represented roughly one percent of global GDP, according to IATA; global revenue is expected to drop almost 60 percent in 2020.

Aviation industry growth over the past five years has been fueled by a combination of improved living standards, particularly in developing regions; an expanding middle class in countries such as China and India; and a proliferation of low-cost airlines. The economic impact of COVID-19 has been less severe in developing regions, with the IMF projecting a decline in GDP of 3.3 percent for these economies versus a drop of 5.8 percent for advanced economies.

Developing economies are also seeing the first signs of recovery in airline traffic, albeit in its early stage. In November 2020, RPKs in Asia reached 40 percent of October 2019 levels, compared with 33 percent in North America and 18 percent in Europe.

While North America and Europe have historically housed the biggest fleets, the largest gains over the next decade are expected in the developing economies of Asia and the Middle East. As of early January, these regions had recovered to 87 percent of their pre-COVID fleet size, compared with the rest of the world at 80 percent. Looking ahead, over half of total fleet growth through 2031 will happen because of increased travel in these developing regions that currently make up less than one-third of the global fleet.

Exhibit 2: 20-year projections for traffic growth and gross domestic product, 2020-2039



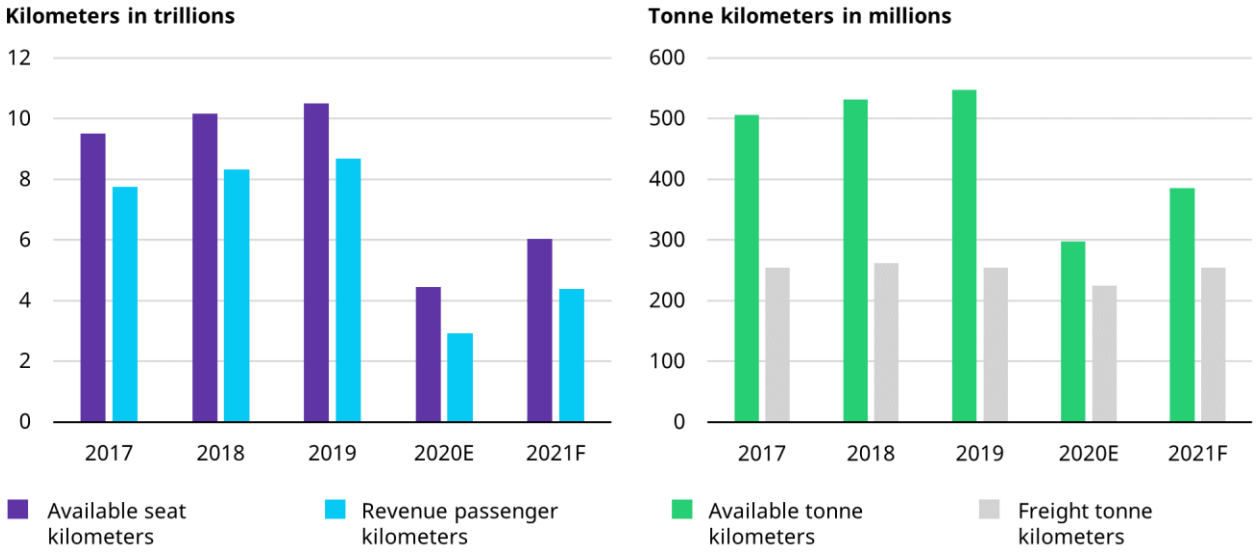
Source: Boeing Commercial Market Outlook

TRAFFIC AND GLOBAL DEMAND IMPACT

As global demand began to plummet in March, airlines reduced capacity by canceling flights, temporarily parking some aircraft, and permanently retiring others. Still, passenger load factors — which measure the percentage of available seats that are sold — fell 17 percentage points, as revenue passenger kilometers dropped 66 percent and available seat kilometers were down

58 percent. The combination of lower demand levels and preventive measures by airlines — including the blocking of middle seats to enable social distancing — made it common on certain routes for planes to fly less than half full.

Exhibit 3: Passenger and cargo traffic, 2017-2021F



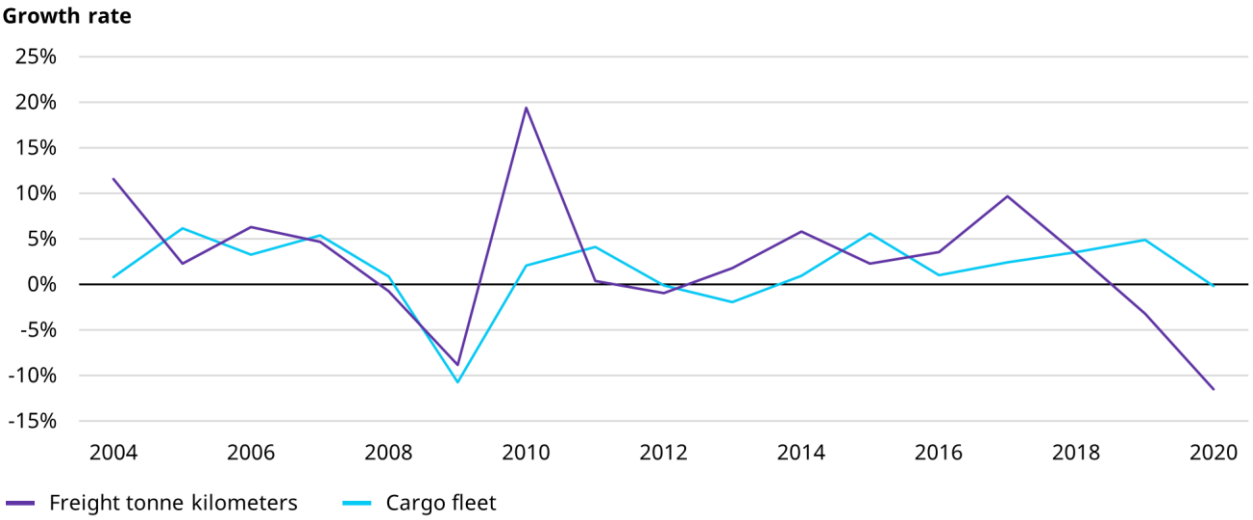
Note: E stands for estimate, F for forecast; 2020 year-end data are estimated; tonne is the equivalent of a metric ton
Source: IATA

From a cargo perspective, demand as measured by freight tonne kilometers declined 11 percent, while capacity as measured by available tonne kilometers fell 24 percent. The drastic reduction in passenger travel in 2020, specifically involving widebodies on long-haul routes that usually offer belly-cargo space, seriously cut into available cargo capacity.

Historically, passenger and cargo demand have grown with economic expansion. But this pattern was disrupted in 2019 when FTKs declined, even as passenger travel continued to inch up. This in part reflected mounting trade tensions, particularly between the US and China.

The decline is also a byproduct of the rise in e-commerce deliveries and decline in traditional cargo. E-commerce deliveries are, by nature, lighter and less dense but often require significantly more space because of their volume. This shifting cargo profile, in combination with other factors, helped drive a five percent increase in the global cargo fleet in 2019, even as the industry saw a reduction in FTKs. Take the situation in the US: In 2020 — a year when passenger airlines were reducing capacity wherever possible — both UPS and FedEx saw continued growth in their fleets and spikes in their cargo volumes. Growth in e-commerce is expected to continue this year and next because of COVID-19, the need to social distance and stay at home, and changes in consumer behavior.

Exhibit 4: Cargo fleet and freight tonne kilometer growth trends, 2004-2020



Note: 2020 FTK is an estimated value
Source: Aviation Week Intelligence Network's Fleet Discovery, Cirium Fleets Analyzer, Oliver Wyman analysis, IATA

Cargo carriers will also have a significant impact on the global path to recovery in the year ahead as they play a key role in vaccine distribution. IATA estimated in a September 2020 report that providing a single vaccine dose to each person across the world would fill 8,000 747 cargo aircraft. Ground freight will inevitably carry a significant portion within certain countries — reducing the true air cargo capacity required — but the temperature sensitivity will add complexity to the logistical puzzle for carriers. During the storage and transport, vaccine temperatures will need to be as low as negative 80 degrees Celsius, depending on the manufacturer.

With this surge in air cargo demand expected to precede passenger demand recovery, the lack of belly-cargo capacity on passenger flights could become even more apparent. General air cargo commodities could see transportation delays as vaccine delivery is likely to be prioritized over these shipments. In anticipation of this surge, passenger carriers including United Airlines, American Airlines and Delta Air Lines have invested in equipment to support vaccine transport. In working closely with IATA and regulatory agencies to align on procedures and conduct trial flights, passenger carriers are positioning themselves to provide significant relief to an already stressed cargo market.

REGIONAL RECOVERIES

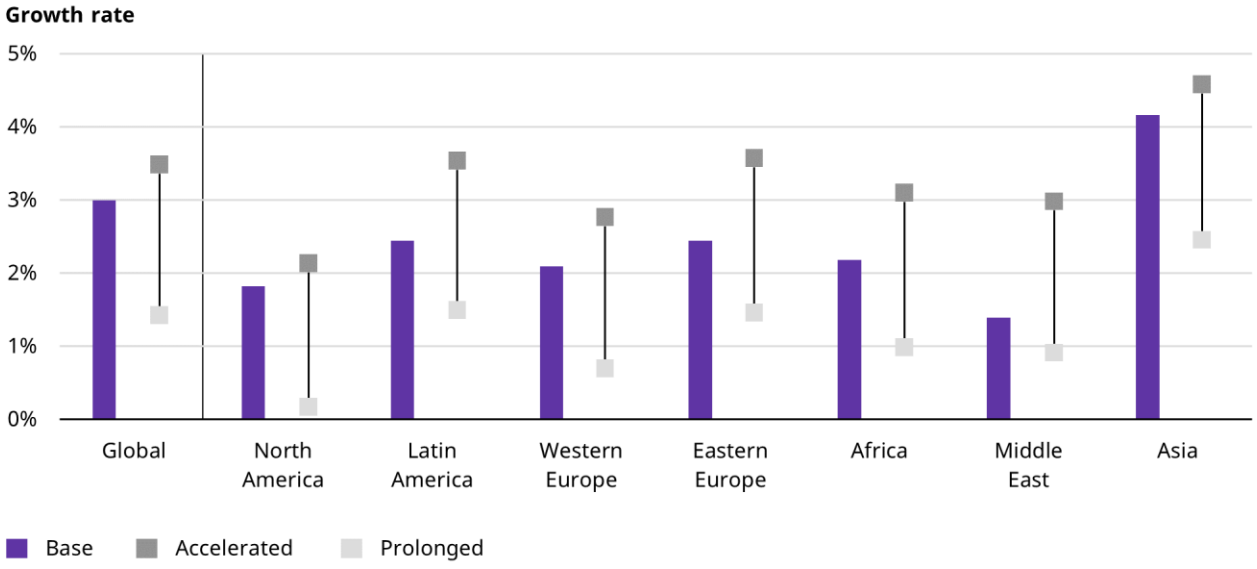
As the pandemic has played out differently in various countries, so too has the aviation recovery. Some domestic markets are already close to a return to 2019 demand levels, while others are not even halfway there. International demand is down dramatically across all regions. Across the world, four key factors have driven demand recovery and will continue to do so.

The first is tied to the epidemiological timeline and public health response — specifically, the number of COVID-19 cases within a region. Moving forward, that will be further affected by the availability, distribution, and effectiveness of vaccines. The second factor is traveler sentiment and how comfortable passengers feel traveling. Variations within traveler sentiment can be seen, based primarily on whether the proposed travel is international or domestic. The third relates to government restrictions, including travel bans to certain countries, as well as mandatory quarantine periods that dramatically decrease or eliminate demand. Finally, the macroeconomic recovery will affect both the leisure and business travel markets. Higher unemployment or lower economic growth would hurt both.

Business travel demand will also be tempered by a permanent increase in the use of telecommuting and videoconferencing technologies, which have been more widely disseminated during the pandemic. The level of recessionary impact and economic damage caused by COVID-19 will affect how quickly travel returns in both the short and long terms.

While these factors ultimately drive the timeline for recovery, there will be long-term impacts from COVID-19 that will linger even after a full recovery of passenger demand. COVID-19 has deferred industry growth forecasts by at least two to three years, with pre-COVID passenger demand levels forecast for 2030 now not expected to be reached until 2032 or 2033. In short, there will be lost growth that is unlikely to ever be fully recouped.

Exhibit 5: Passenger demand forecast scenarios, 2019-2031



Source: Oliver Wyman analysis

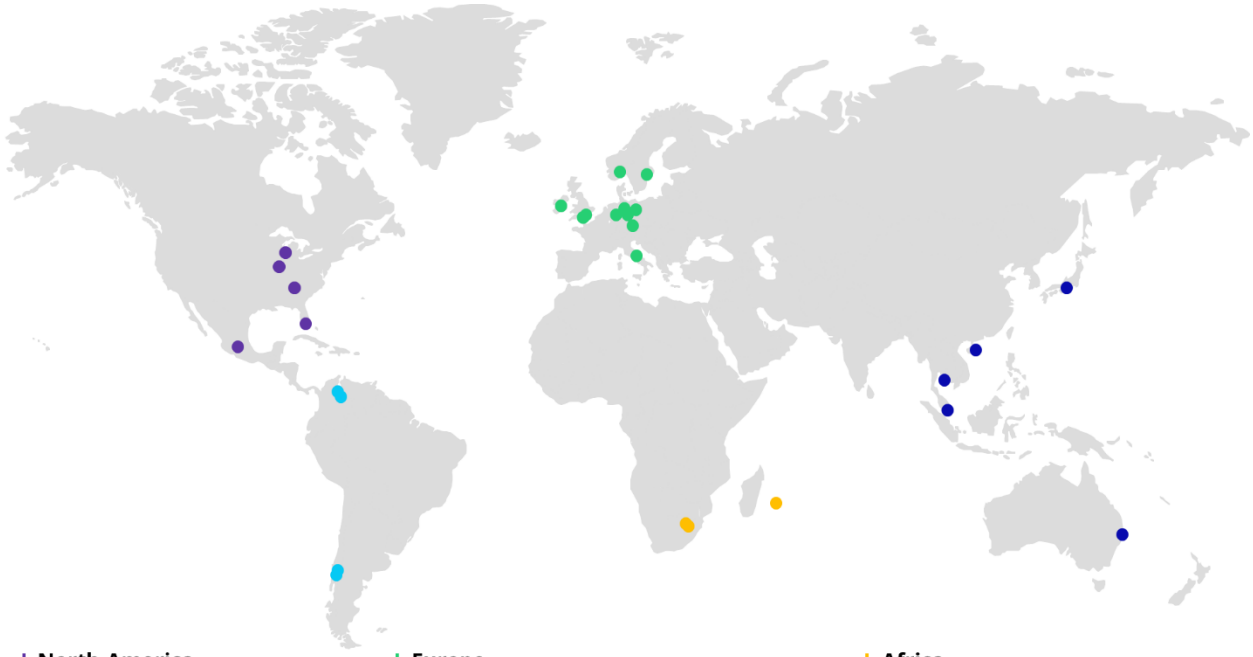
Globally, Oliver Wyman expects passenger demand to reach 2019 levels by the end of 2022, with a long-term compound annual growth rate (CAGR) of three percent through 2031. As with economic projections, there is uncertainty associated with passenger demand recovery estimates. In a more prolonged scenario, recovery could stall until 2026, while a more accelerated scenario would see a strong rebound in 2021.

With different epidemiological timelines, government restrictions and macroeconomic impacts, the recovery in passenger demand will vary at a regional level. Asia is expected to recover quickest, with total passengers — including international — reaching 2019 levels in early 2022. In fact, domestic travel in China saw year-over-year growth toward the end of 2020.

The Middle East has the slowest recovery timeline, attributable to an outsized exposure to international travel compared to other regions. With international recovery expected to lag until 2025, the Middle East recovery will follow a similar trend. Domestic traffic is expected to recover at a more accelerated pace, which will drive a shift in the distribution of passengers within the region and affect the makeup of the fleet.

That said, many airlines that carried passengers in 2019 may not be around for the recovery. At least 20 airlines around the world filed for bankruptcy protection in 2020; a dozen others have already ceased operations. Europe has been the region most impacted, with key carriers nationalizing or significantly restructuring.

Exhibit 6: Major airline bankruptcy filings, 2020



North America
ExpressJet Airlines
AeroMéxico
Compass Airlines
Trans States Airlines
Miami Air International

Latin America
Avianca Holdings
LATAM Airlines
Easyfly
One Airlines

Europe
Alitalia
Flybe
Virgin Atlantic Airways
Norwegian Air Shuttle
Smartwings Group
SunExpress Germany
Level Europe
BRA-Braathens Regional Airlines
CityJet
Go2Sky
German Airways

Africa
South African Airways
Comair
Air Mauritius

Asia
Virgin Australia
Cathay Dragon
AirAsia X
NokScoot
AirAsia Japan

Note: May not include all bankruptcies
Source: Leeham News

While airlines of all operational definitions have been hurt by COVID-19, long-haul, low-cost carriers have been hit particularly hard. Norwegian Air Shuttle and AirAsia X — two of the largest long-haul, low-cost carriers in the world — are undergoing restructuring. Even before COVID-19, this business model had struggled, exemplified by the closures of WOW and Primera Air in 2019. With input costs that are less flexible than those of short-haul carriers, long-haul, low-cost carriers had little room to absorb sharp declines in load factors.

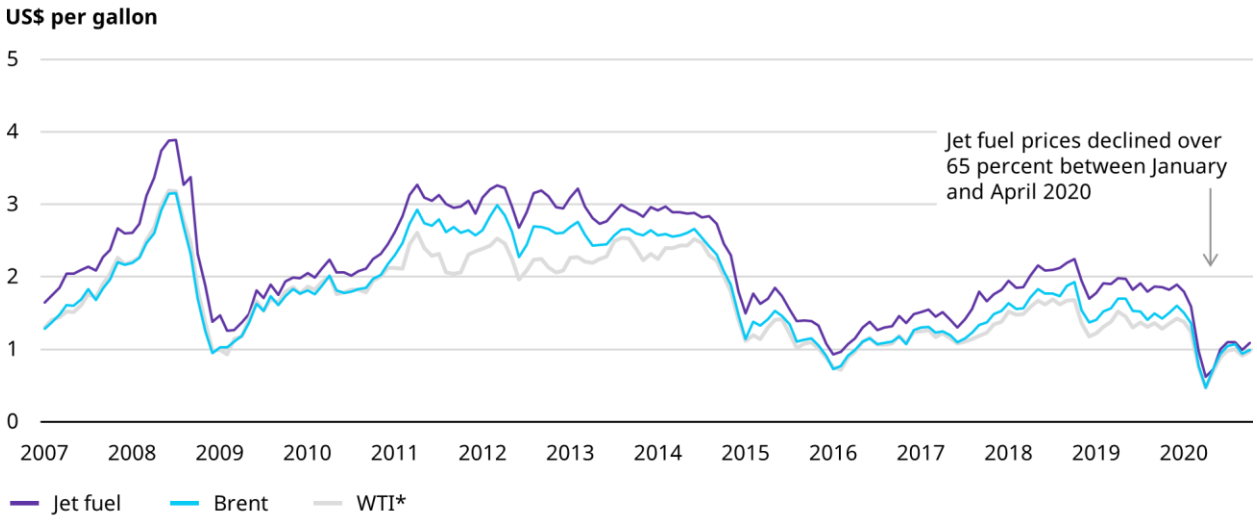
This contrasts sharply with more traditional low-cost carriers, such as Viva Aerobus, Ryanair, Wizz Air, and Volaris — which share more optimistic outlooks because of the relative strength in leisure travel versus business. The rebound in leisure and short-haul routes is expected to enable low-cost carriers like these to lead industry recovery in the months ahead.

FUEL AND LABOR

Historically, the cost of jet fuel has represented almost a quarter of operating expenses. Controlling such a large chunk of expenditures has guaranteed it a pivotal role in determining the profitability of airlines and, by extension, the MRO industry. Except in 2020. The dramatic decline in traffic because of COVID-19, combined with a significant decrease in fuel prices as demand dried up, drove a year-over-year 71 percent reduction in spending on fuel. In total, the estimated $55 billion in 2020 fuel expenditures represented only 13 percent of operating costs. While it didn't create profits, it was a welcome relief to cash-strapped airlines around the world.

In 2021, fuel expenditures are expected to increase to $78 billion, a 42 percent jump over 2020, but still 58 percent lower than in 2019. With fuel prices expected to remain below 2019 levels, operators can afford to defer the addition of some new, more fuel-efficient aircraft as a means to control cash burn.

Exhibit 7: Spot prices of crude oil and jet fuel, 2007-2020



*WTI = West Texas Intermediate
Note: Crude prices are calculated by dividing the price by the number of gallons in a barrel
Source: US Energy Information Administration

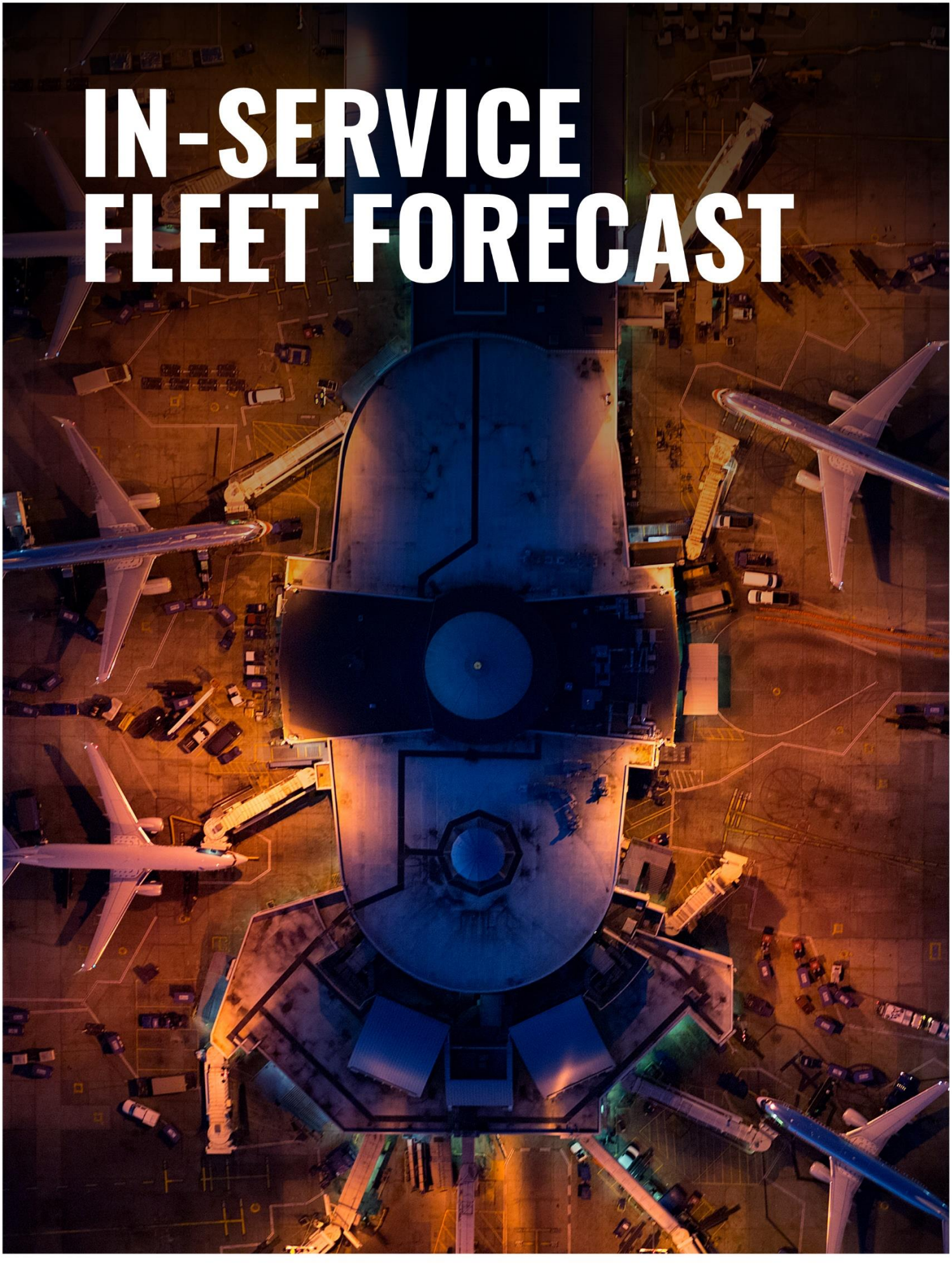
Retiring older, less fuel-efficient aircraft helps lower maintenance and fuel expenses over the long run and curbs the growth of carbon dioxide emissions. COVID-19's impact on demand allowed carriers to winnow fleets, with as many as 1,450 aircraft that may not return to service, versus a more customary annual number of about 700. Decisions to retire more planes ends up modernizing the fleet and improving its overall fuel efficiency. IATA estimates fuel efficiency based on capacity use improved by two percent in 2020.

The other critical operating expense for airlines is labor, which, like fuel, historically makes up about a quarter of operating costs. COVID-19 put a significant amount of pressure on industry employment. IATA estimates that total airline employment fell 36 percent in 2020 and employee productivity dropped 16 percent.

In the US, a combination of government relief and private financing helped support carriers and their employees. In total, seven airlines received loans under the March CARES Act. These loans, designed to provide payroll support, stipulated that airlines could not fire or furlough employees before September 30, 2020. However, with this deadline passing before Congress reached a new agreement, thousands of employees were temporarily furloughed in October. The second relief package, signed December 27, provides an additional $15 billion for passenger air carriers, requiring that those carriers receiving initial assistance recall those employees involuntarily furloughed.

Other governments across the world have also provided direct support. In Europe, airlines have received over $25 billion since March 2020, and Singapore funded a significant portion of aviation worker pay. While necessary for the near-term survival of the industry, the significant accumulation of debt to enlarge cash positions will create an additional headwind throughout the recovery as reimbursements come due. In all regions, gains in total employment and employee productivity will play a key role in the industry's recovery timeline.

IN-SERVICE FLEET FORECAST



A PIVOTAL YEAR

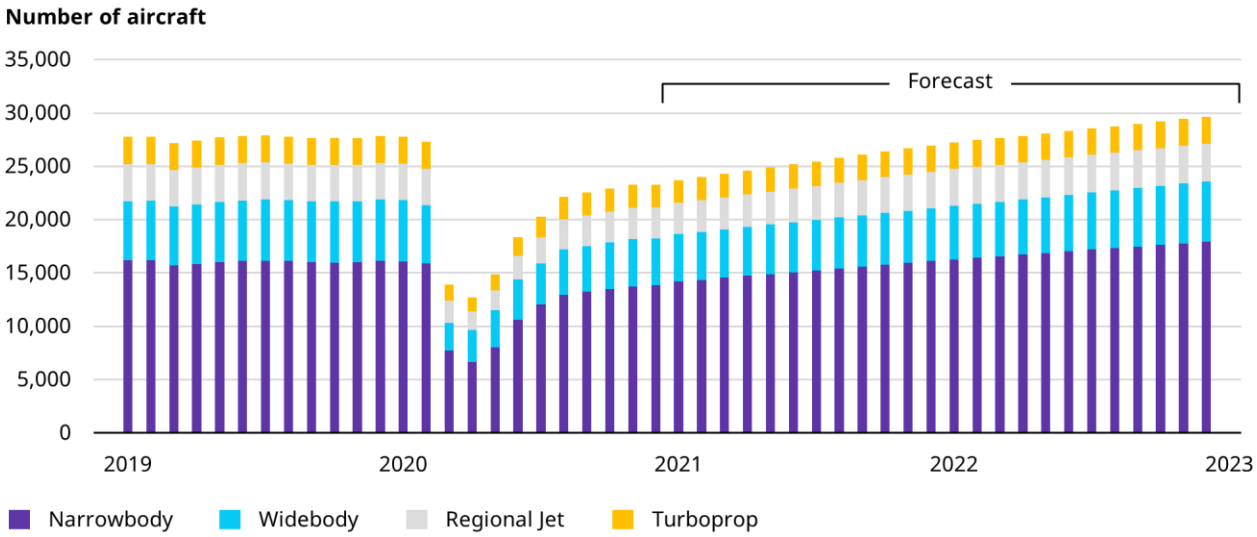
2021, expected to be the recovery year to arguably the most challenging financial and operational chapter in aviation history, began with an active fleet of slightly less than 24,000 aircraft. That's equivalent to the fleet size at the beginning of 2015 and is more than 15 percent below the pre-COVID total on Jan. 1, 2020.

More than 4,000 aircraft, including a disproportionately high number of widebodies, wait in storage to either be recalled or retired early. While most of the narrowbodies, regional jets, and turboprops in storage are expected to return to service by mid-2022 at the latest, much of the widebody fleet will never leave storage. The number of widebodies is not expected to recover to pre-COVID levels until 2024.

At its nadir in May 2020, the global in-service fleet was reduced to a mere 13,000 aircraft — less than half of where it stood at the beginning of the year. Over the summer, as domestic and leisure travel slowly recovered, airlines began to put aircraft back into service at a pace faster than traffic was returning. But a resurgence of COVID-19 toward the end of summer stalled the recovery. As the winter months approached, it became clear that the crisis was worsening and would last through the end of 2020 and well into this year. In response, the industry pulled back on the pace at which aircraft were returning to service.

For aerospace manufacturers and their suppliers, 2020 has ended up as their roughest year ever, with production down 55 percent from 2019 and deliveries at a standstill for several months. 2019 wasn't a picnic either after the 737 MAX was suddenly grounded that March after two fatal crashes.

Exhibit 8: Monthly in-service fleet, 2019-2022

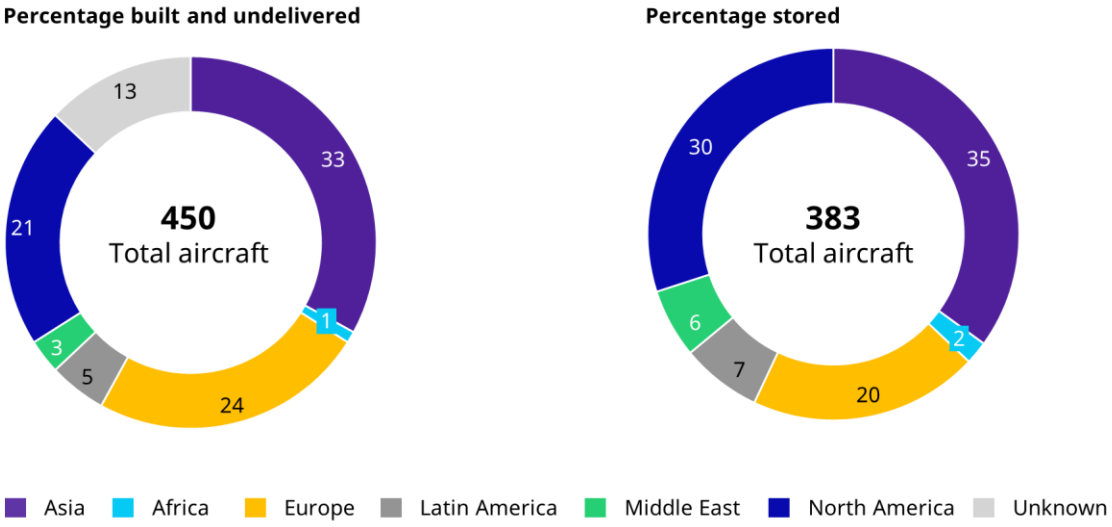


Source: Cirium Fleets Analyzer, Aviation Week Intelligence Network's Fleet Discovery, Oliver Wyman analysis

In November 2020, the Federal Aviation Administration approved the return of the 737 MAX to commercial service. Nearly 400 aircraft that had been grounded for 20 months could now be brought back into the fleet at least in the US. At the end of January, the European Union Aviation Safety Agency also recertified the 737, but the Civil Aviation Administration of China, which regulates another key market for the aircraft, has not revealed any plans. The expectation is for most, if not all, of the hundreds in airline storage to return to service by the end of 2021.

As of December 2020, Boeing had 400 to 450 more MAX aircraft that had been built but not delivered. The aerospace manufacturer has prioritized delivery of these aircraft, which it expects to complete by the end of 2022. A little more than 10 percent are "white tails" — aircraft that do not currently have a buyer or a carrier to receive delivery. Already, 20 have been delivered.

Exhibit 9: Regional breakdown of 737 MAX aircraft waiting to join the fleet

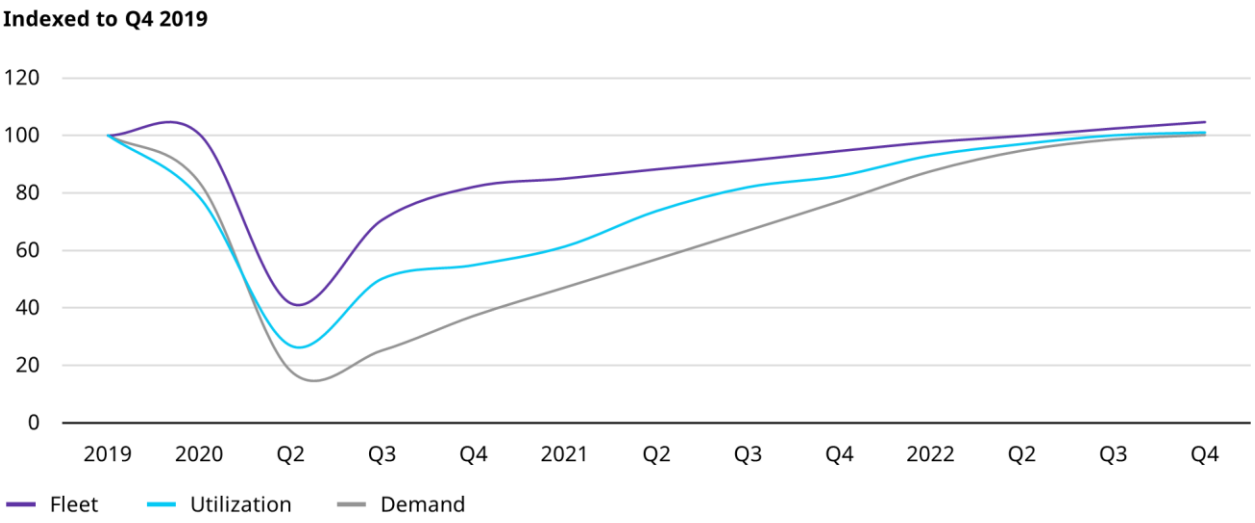


Note: Both charts are as of December 2020. Unknown category includes cancelled orders and unknown operators
Source: Aviation Week Intelligence Network's Fleet Discovery

For airlines to fly mostly full networks, an active fleet larger than demand is required — one that represents more than a one-to-one, aircraft to available seat mile ratio. That's because of geographical and logistical realities for medium and large carriers. This means that the global fleet will recover at a faster pace than demand — a phenomenon we are already seeing — if airlines are to achieve their full growth potential. Over the last nine months, the global fleet did not decline at the same rate as demand or reach the same depths, and the parked fleet has also returned at a faster rate than demand has recovered over the course of 2020.

Aircraft utilization will also outpace demand recovery, although at a rate slower than for fleet recovery. Daily hours and cycles per in-service aircraft, with smaller load factors over the short term, will be less than traditional conditions on average.

Exhibit 10: Fleet, utilization, and demand recovery curves, 2019-2022



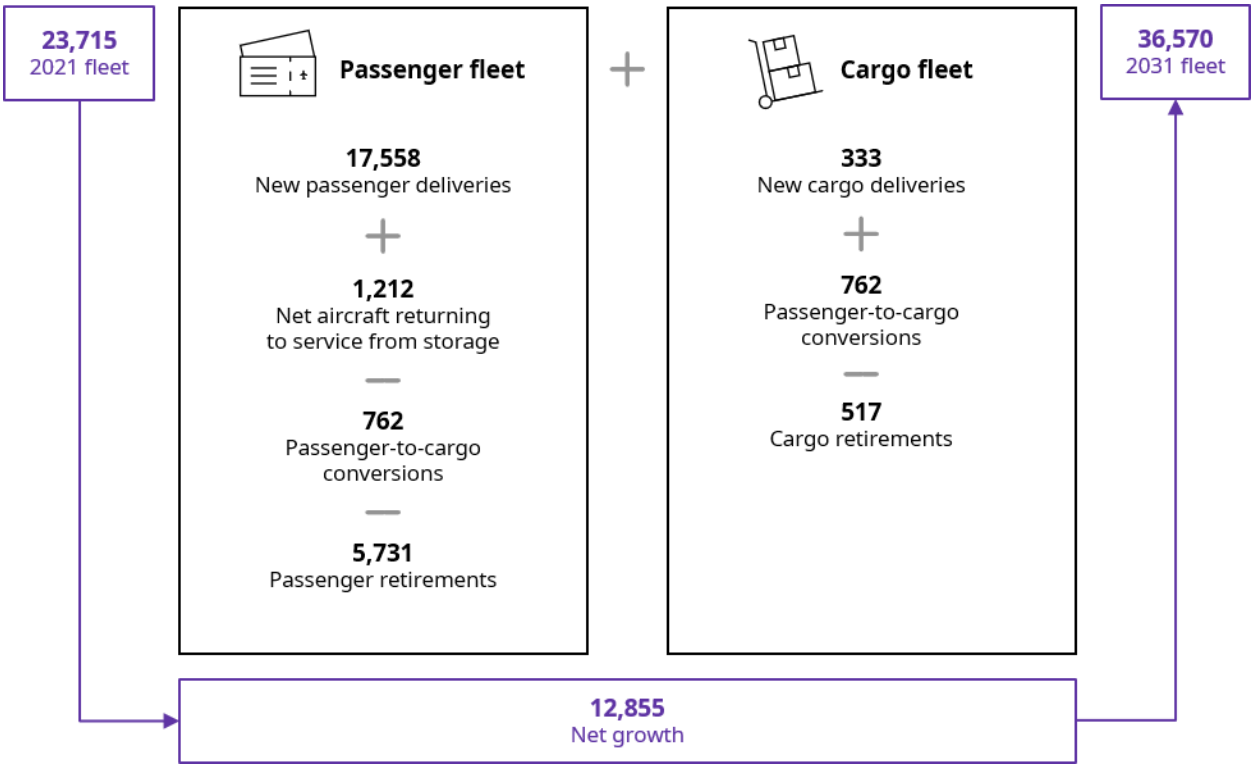
Source: Cirium Fleets Analyzer, Aviation Week Intelligence Network Fleet & Data Services, Oliver Wyman analysis

Before COVID-19, the global fleet and the industry at large had been on an unfettered positive trajectory for 10 years. That was particularly true in the second half of the last decade when low jet fuel prices also enhanced profitability. As this decade begins, however, the industry faces more uncertainty than it has for more than 20 years, starting off with the disruption wrought by the pandemic.

There exists a wide range of possible outcomes based on a host of unknowns that will take a year or more to resolve. For instance, as the year began, two vaccines — one from Pfizer and one from Moderna — had been approved around the globe. At least two more vaccines are expecting the go-ahead in the first half of 2021. While the level of effectiveness is unknown, Russia and China have independently created vaccines that are being distributed mostly within their borders.

In a scenario in which multiple vaccines prove effective and are distributed worldwide in the first half of 2021, an accelerated recovery could lead to stored domestic fleets returning to service by mid-2021 and the international fleet in early 2022. But in the unlikely development the vaccines prove less effective than expected or if problems persist into 2022 with the adequacy of supply and vaccine distribution, domestic and international fleet recovery may be pushed into 2024. As it stands, the most likely scenario is that domestic fleets recover in early 2022, with the international fleet recovery lagging behind two years.

Exhibit 11: Projected global fleet changes, 2021-2031



Note: Fleet sizes as of beginning of 2021 and 2031
Source: Oliver Wyman analysis

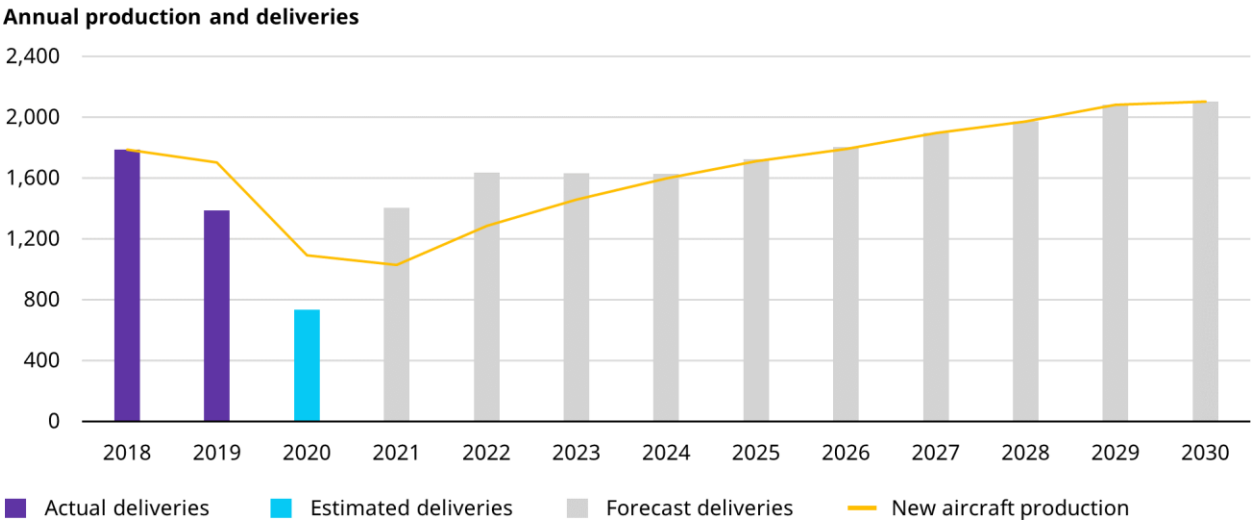
This will make for tough going in 2021 for aerospace manufacturers and their supply chain. Only 1,100 aircraft are estimated to have been produced in 2020 versus the 1,400 that were scheduled to come off assembly lines and delivered, and just two-thirds of those were expected to be delivered that year. In addition to the undelivered 400 to 450 737s, there are another 300 aircraft of various types still in the hands of manufacturers waiting to be delivered. Most of these aircraft have owners but have simply been pushed to a 2021 or 2022 delivery.

While there continue to be more aircraft being produced than delivered, the overall gap narrowed in the third quarter of 2020. For instance, at Airbus, deliveries and production matched at 145 for the quarter. This trend will have to continue and accelerate if production and delivery volumes are to reach equilibrium by the end of 2023.

Without clearing this backlog, manufacturers and their supply chain providers will not approach pre-COVID levels of production for the foreseeable future. Airbus has announced 25 percent production cuts for most platforms and has offered little guidance on how long those reductions will be in effect. Boeing has promised a conservative ramp-up of MAX production, while also sharply cutting production on 787 aircraft through 2020.

Oliver Wyman expects overall delivery rates to return to 2018 levels in 2026, and they will be weighted more toward narrowbodies. These rates would represent where aerospace stood prior to the 737 grounding in 2019 and the pandemic in 2020. The 10-year delivery outlook — total current delivery projections versus the pre-COVID forecast — is 23 percent lower.

Exhibit 12: Aircraft production and deliveries, 2018-2030



Source: Oliver Wyman analysis

In an accelerated recovery scenario, the built but undelivered backlog would be fully cleared in 2021. This would allow manufacturers to shift focus sooner to the production of new aircraft, particularly widebodies, and deliveries of all classes could recover to pre-COVID levels by early 2025. The 10-year delivery outlook would be a mere 10 percent lower when compared with the pre-COVID forecast.

In a prolonged crisis scenario, production would likely remain at 2021 rates through 2025, and the survival of several aircraft models would be threatened. Particularly vulnerable are the 777X and A330neo for widebodies and the SpaceJet and E-Jet E2 among regional jets. Assuming this scenario, a recovery to 2018 production rates would not occur until the end of the decade. Projected deliveries over the decade would be more than 14 percent lower with this more pessimistic scenario.

Given that international passenger demand has been hit hardest because of cross-border travel restrictions and is expected to be the slowest to rebound, widebody production is expected to see the greatest reduction in production over the course of the forecast. Even under the more optimistic scenario, deliveries are seen as ultimately declining 35 percent from pre-COVID forecast estimates. Total widebody production is not forecast to surpass 2018 levels until after the end of the decade, with most key platforms experiencing production cuts exceeding 30 percent.

Narrowbody production, while less impacted by COVID-19, fell substantially in 2020 from its 2018 levels because of the dual crises of the MAX grounding and the pandemic. It is expected to recover by 2024. Regional jet and turboprop production cratered in 2020, with some original equipment manufacturers temporarily shutting down production but is expected to rebound somewhat in 2021.

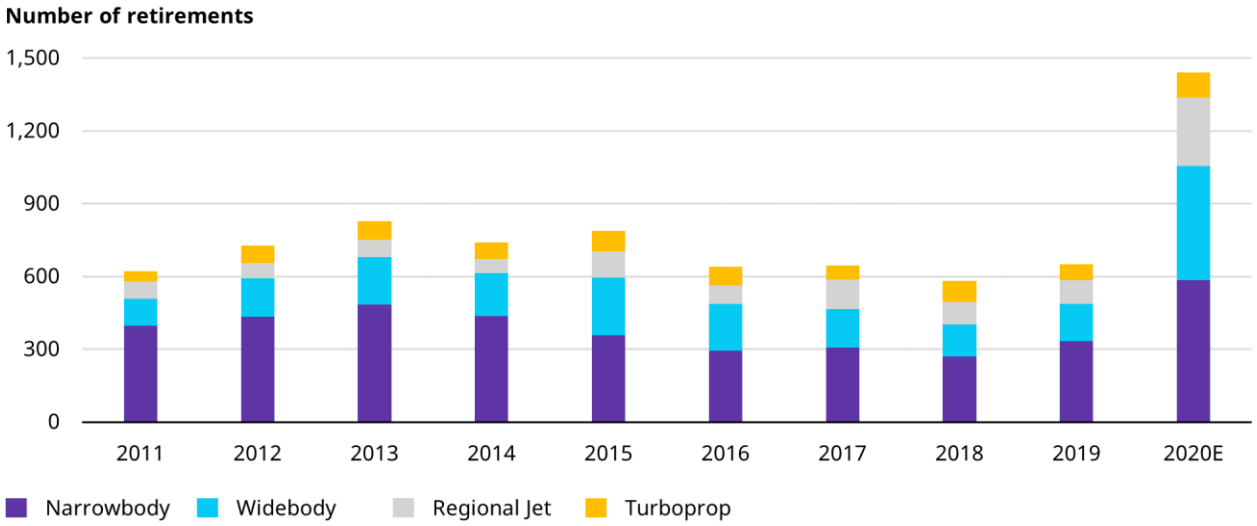
FLEET TRENDS AND INSIGHTS

The rate at which aircraft are delivered and retired determines the size and growth of the fleet. It also determines the cost and type of maintenance repair and overhaul services needed by that fleet. The following trends represent some of the forces driving the MRO spending outlined in the fourth section of this report.

Globally, decisions about retirements are driven primarily by an aircraft's age and the number of flight hours and flight cycles it has accumulated. As aircraft reach thresholds at which the maintenance and operation costs are not economically viable, airlines and other operators often park, store, and eventually retire them. Historically, individual aircraft have different retirement thresholds depending on their usage, class, and type, and these thresholds have held steady over the last decade.

In 2020, because of the pandemic, this checklist became secondary to the need for specific aircraft in regions, based on dwindling demand. This change in retirement criteria was most notable in decisions about widebodies. For instance, the A380 almost entirely exited markets in Europe and Asia Pacific. There were also retirements of many once popular transoceanic 767s that still had remaining life, as well as the conversion of some passenger 777s less than a decade old to freighters. Others were simply parked and then prematurely retired.

Exhibit 13: Annual retirements, 2011-2020



Note: Retirements in 2020 are based on an estimate of aircraft that will not return to service and may not reflect current financial retirement status
Source: Oliver Wyman analysis

Between 2011 and 2019, there were 700 aircraft retirements on average annually. Despite capacity challenges precipitated by the 737 MAX grounding and corresponding production slowdown, 2019 still saw a slight increase in retirements, up 12 percent over 2018. This trend was most prominent in North America, Western Europe, and China where the majority of 737 MAX deliveries were planned.

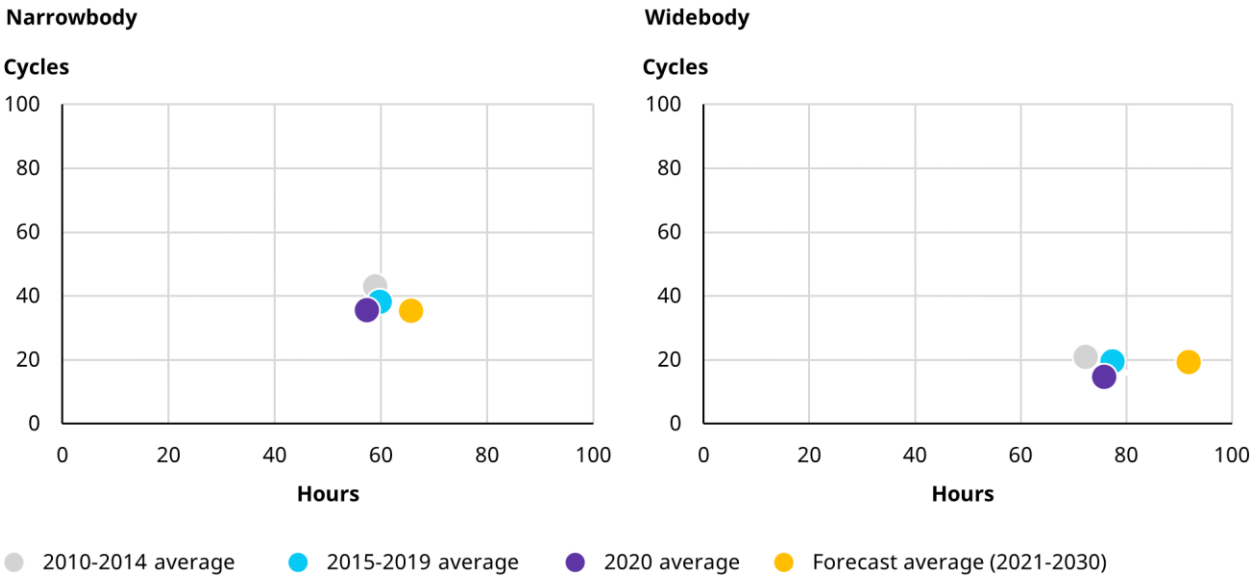
In 2020, retirements spiked to more than 1,400 — the most of any year on record — because of the COVID-19 pandemic and the subsequent evaporation of demand. Despite being just 20 percent of the fleet at the start of the year, widebodies made up one-third of retirements in 2020 reflecting the extent to which international travel was affected by COVID-19. Nearly half of these widebody retirements were 747s, A380s, and A340s.

Just over half of retirements in 2019 were from Western Europe and North America; in 2020, retirements in these more mature markets made up 71 percent of the total. The fleets in these regions contained many older aircraft already slated for retirement and replacement by new models. Although these planes were retired, they are unlikely to be replaced until demand recovers.

Because of the acceleration of retirement schedules for aircraft no longer considered optimal in COVID-19 and post-COVID environments, the industry is likely to see fewer retirements moving forward. The average number of retirements through 2023 is pegged at around 300 annually, less than half of the recent historical average. Between 2024 and 2031, we expect to see a more normal pace of retirements — about 750 aircraft annually.

Toward the end of decade, regional jets and turboprops will account for a disproportionately larger share of retirements. These are planes that would have been retired earlier under normal circumstances if replacements were available, but COVID-19 changed that.

Exhibit 14: Aircraft utilization distribution at formal retirement

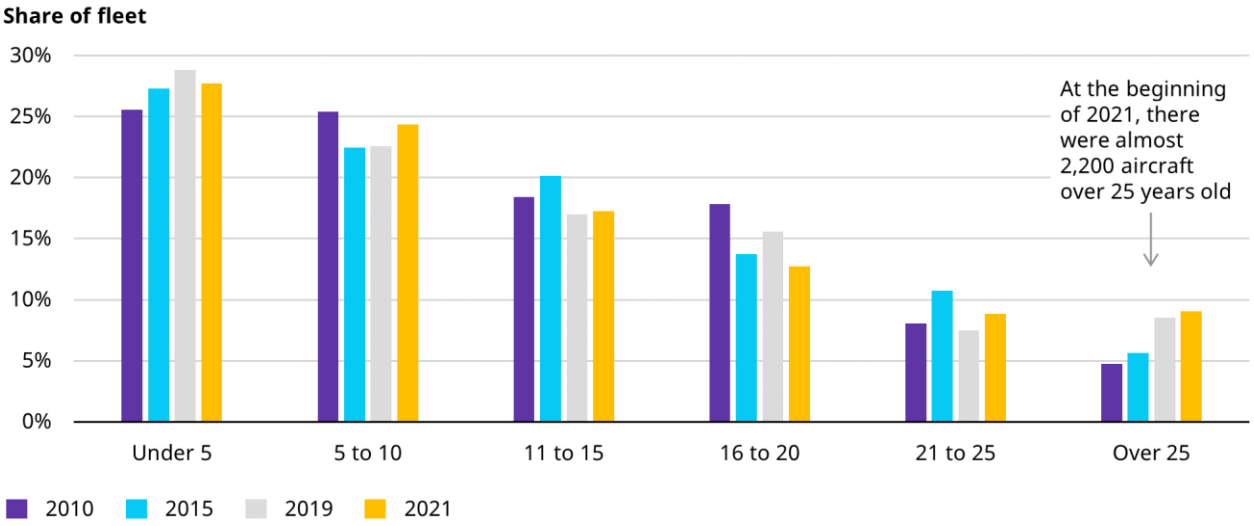


Note: Cycles and hours in thousands
Source: Cirium Fleets Analyzer, Oliver Wyman analysis

The characteristics of retiring aircraft over the next decade will also differ from those of the previous 10 years. While the average age of a retired aircraft will decrease slightly, it will have significantly more cumulative flight hours yet similar cumulative flight cycles. This is evidence that airlines are operating aircraft more frequently with longer stage-lengths. This will be particularly true of regional jets where life cycles of the current generation of aircraft will reach 150 to 200 percent of historical hours and cycles at retirement. Widebodies differ in that they will have considerably more hours while maintaining a similar number of cycles.

Currently, in absolute numbers, there are twice as many aircraft over the age of 25 in the global commercial fleet than in 2010. This is true even in the wake of the substantial number of retirements in 2020, when the average retirement age was 21.3. Many of the remaining aircraft that are over age 25 still have a great revenue case even in a post-COVID environment, which is why they will not be phased out until they have direct replacements later in the forecast period. Those older aircraft represent over nine percent of the current fleet versus only five percent in 2010. Almost half of these older aircraft are operated by airlines in North America. As they are phased out of the fleet, retirements in North America, starting in 2023, will increase six percent annually, averaging 300 per year through the end of the decade.

Exhibit 15: Global in-service fleet segmented by age



Source: Cirium Fleets Analyzer, Aviation Week Intelligence Network's Fleet Discovery, Oliver Wyman analysis

Outside of North America, the largest number of retirements will come from Western Europe and Asia Pacific. However, Africa will retire the largest share, 30 percent of its current fleet, by the end of the forecast period. China will retire the smallest share — just 10 percent of its current fleet.

IN-SERVICE FLEET CHARACTERISTICS

Before COVID-19, the global commercial fleet had grown at an annual rate of 3.2 percent from 2010 to 2020. The global fleet's average age remained relatively constant over the last 10 years: a pre-COVID age of 11.1 years as 2020 started versus 11.2 as 2010 started. At the beginning of 2021, the average age edged up to 11.6 because there were significantly fewer deliveries in 2020. That average fleet age will increase as operators defer or cancel deliveries over the short run to save cash and keep preferred types of aircraft in service longer.

From a usage standpoint, passenger aircraft represent 91 percent of the global commercial fleet, in line with the historic share. When the fleet was at its smallest in spring 2020, passenger aircraft comprised only 83 percent of the total.

The passenger fleet is expected to grow 2.5 percent annually from 2020 to 2031. The percentages of narrowbody aircraft will increase at the expense of widebodies, while turboprops and regional jets will retain more share than previously expected. Narrowbody aircraft currently make up 63 percent of the passenger fleet and 60 percent of the global fleet; over the forecast period, this share will rise to 68 percent and 65 percent, respectively.

From a geographic perspective, the distribution of the global fleet is shifting. Historically, the largest fleets have been in the mature regions of North America and Western Europe. Pre-COVID, the combined fleets of these two markets represented almost half of all in-service commercial aircraft.

Today and for the past several years, emerging markets in Asia have had the strongest fleet growth, which will eventually make that region the market leader if the pattern continues as expected. Since 2010, the global fleet share for Asia, including China, has grown from 22 percent to 31 percent. This was driven by average annual RPK growth of 9.1 percent through 2019. By 2031, Asia's robust fleet growth is expected to increase its global share to 37 percent.

Eastern Europe and the Middle East have also emerged as growth drivers for the global fleet and are forecast to see similar growth rates as China over the next 10 years. Much of this growth is driven by the significant number of narrowbody orders from those regions.

AIRCRAFT CLASSES

When drilling down on aircraft class, the general trend of the global fleet over the next decade will be an accelerating increase in the share of narrowbodies at the expense of widebodies. Within the narrowbody class, however, the post-COVID environment could lead to a resurgence of lower-capacity aircraft. With an industrywide focus on improving load factors and more modest expansion of operations, smaller narrowbodies become more attractive options. The Airbus A220, with 100 to 140 seats depending on the model, is positioned well for this market. The trend offers a unique opportunity for Chinese manufacturer COMAC as its small narrowbody, the C919, also provides the same seat range. It may become a popular alternative in Asia, considering the reduced production rates of the 737 MAX and A320neo. From a cost per seat mile perspective, this strategy is probably less efficient than using narrowbodies with 200 seats — if the demand exists to fill the airplane — but it would allow airlines to maintain valuable airport route slots while demand recovers in the interim.

There were some unique changes to the fleet during the COVID-19 crisis. From 2020 to 2021, the large increase in widebody retirements and vast number of aircraft in storage have led to a two-percentage point swing toward narrowbody share of the global fleet in just a year — significantly larger than for a typical year.

As the second-largest class, widebodies have maintained a consistent fleet share of close to 20 percent over the past decade. Looking ahead, that share will drop almost two percentage points over the next decade, with average annual growth of just 1.6 percent anticipated for the widebody fleet over the forecast period.

Within widebodies, extra-large variants were most significantly impacted by COVID-19. Over 20 percent of all historical passenger 747-400 retirements occurred in 2020 — double that of any other year. The A380 also had only seen a few retirements before sending nearly 50 to the desert in 2020. By the end of the decade, the average age of the extra-large widebody fleet will increase, from 16 years old to 22, because of low demand and production rates, as well as the availability of more popular new, smaller and flexible aircraft models. The 777 and A330, considered large

widebodies, are the most popular widebody platforms, making up almost half of the in-service widebody fleet. This will change over the next 10 years, with the 787 and A350 comprising most new deliveries.

Exhibit 16: Fleet aircraft by seat capacity

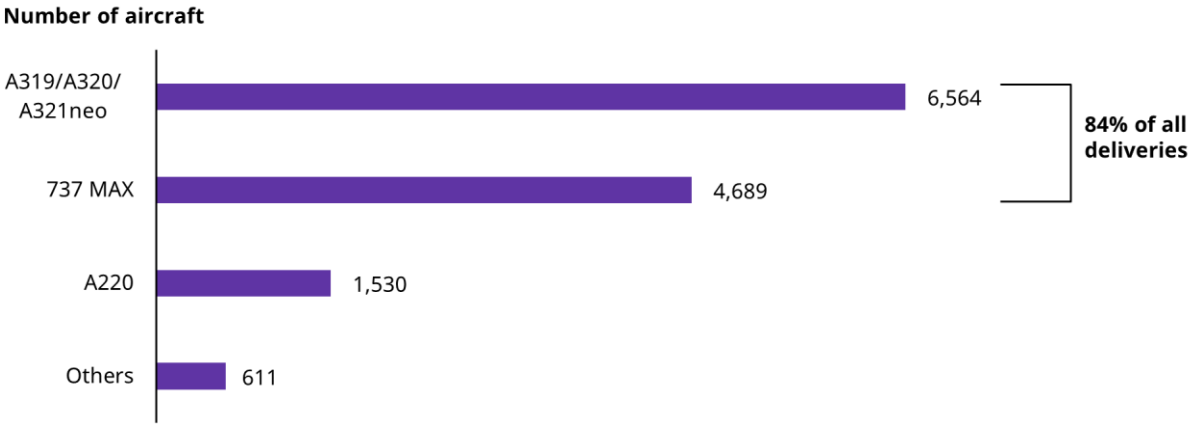
Narrowbody		Widebody			
Small <140 seats	**Medium ≥140 seats**	**Large <350 seats**	**Extra large ≥350 seats**	**Regional jet**	**Turboprop**
717	737-300/400/500	767	747	ARJ	ATR
727	737 NG	777/777X	A380	BAe 146/Avro RJ	BAe ATP
737-100/200	737 MAX	787		CRJ	Beech 1900
A220	757	A300/310		DO 328Jet	DO 328
A318	A319/A320/A321	A330		E-Jet/E2	EMB-120
C919	A319/A320/ A321neo	A330neo		ERJ	Jetstream 41
DC-9	DC-8	A340		Fokker	Q-Series
Irkut	MD-80/90	A350		SpaceJet	Saab
		DC-10/MD-11		Superjet 100	SkyCourier
					Modern Ark

Source: Oliver Wyman analysis

As the largest aircraft class, narrowbodies make up 60 percent of the global fleet, up from 58 percent at the start of 2020. With expected average growth of 3.5 percent annually over the next 10 years from its pre-COVID size, the narrowbody share of the fleet will expand to 65 percent by 2031.

Medium narrowbodies — defined as single-aisle aircraft with 140 seats or more — currently make up 98 percent of the narrowbody fleet. Of that group, 80 percent are either 737 NG or A320ceos. Growth in the narrowbody class is expected to be driven entirely by their successors — the 737 MAX and A320neo — with deliveries of nearly 11,500 of the two aircraft expected between 2021 and 2030. Asia, North America, and Western Europe — the regions where more than 80 percent of grounded 737 MAX aircraft will re-enter service — will see as many as 850 of these aircraft delivered or pulled out of storage. The share of expected narrowbody deliveries of the 737 and A320 combined over the forecast period is down five percentage points from the pre-COVID forecast, as A220 production appears to be minimally affected by COVID-19 and optimism about the C919 in China has increased.

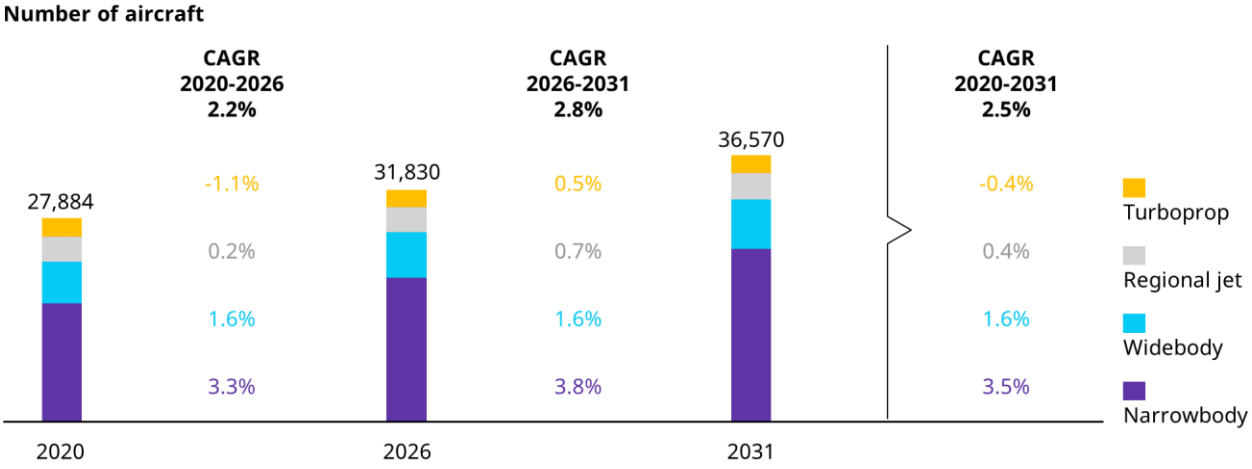
Exhibit 17: Narrowbody projected deliveries by aircraft platform, 2021-2030



Source: Oliver Wyman analysis

The A220, which falls into the small narrowbody category — defined as single-aisle aircraft with fewer than 140 seats but more than 100 — has also seen strong growth in recent years, despite a limited presence in certain regions. Since 2017, A220 deliveries have fueled almost all of this segment's growth, reflecting orders by Delta Air Lines, JetBlue Airways, Air Canada, and other major airlines. The A220 has not seen a production reduction at nearly the level of the rest of the Airbus suite of aircraft and is expected to move forward with production ramp-ups in both Mobile, Alabama, and Mirabel, Quebec, in 2021 after a delay in 2020.

Exhibit 18: Global fleet forecast by aircraft class, 2020-2031



Note: Fleet sizes as of the beginning of the year; CAGR stands for compound annual growth rate
Source: Oliver Wyman analysis

As the third-largest class, regional jets form only 12 percent of the current global fleet, a decline from a 16 percent share in 2010. Over the forecast period, the class is expected to grow at a 0.4 percent annual rate. By 2031, there will be roughly 3,600 regional jets in the fleet.

A potential obstacle for operators is the lack of a viable replacement for existing regional jet models, particularly on those with smaller seat counts. While operators are increasingly focused on adding seats to existing routes through the acquisition of larger aircraft, there is still a definitive need for an aircraft with less than 70 seats. Nearly 750 ERJ and CRJ-100/200 aircraft are currently in-service with an average age of 18.4 years. Historically, the retirement age for those aircraft is 16.9. While most of these aircraft are expected to fly well past historical age and utilization patterns, many will nonetheless have to retire by the end of the decade.

In late 2020, Mitsubishi announced an indefinite pause of the SpaceJet program. As a result, it is unlikely that the aircraft will see deliveries until the second half of the decade at the earliest. A potential joint venture effort between Boeing and Embraer that would have given the American airframer control of the E-jet program was officially quashed in 2020. Depending on the future of scope-clause agreements in pilot contracts, Embraer may continue production of the E-jet E1 through the end of the decade and beyond, particularly if no other regional jet alternative comes to market.

After unsuccessful ventures into Latin America and Western Europe, the Superjet is no longer expected to be domiciled outside of Eastern Europe. The COMAC ARJ has several aircraft flying within China, but orders do not exist outside the region and aviation authorities appear unlikely to approve the aircraft outside of the manufacturer's nation.

In an accelerated and optimistic recovery scenario, the ERJ and smaller CRJs would retire at a faster rate with the assumption that the SpaceJet program resumes and can fulfill orders to several large U.S. customers and the E2 program can begin scaling up. In total, regional jet growth from 2020 to 2031 would accelerate to 0.6 percent, slightly faster than the baseline of 0.4 percent, despite the increase in retirements. This scenario would be a huge boon to the mature markets of North America and Western Europe, which have a disproportionate share of the global regional jet fleet and where these operations are crucial as feeder airlines for the larger legacy airlines.

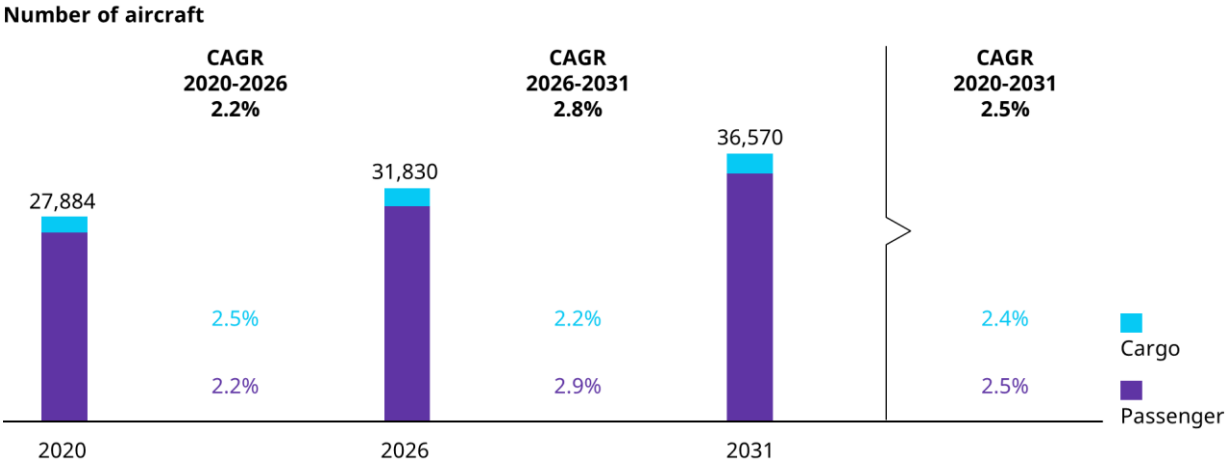
A prolonged crisis would see the smaller RJs utilized well past the 95th percentile of historical age and usage before they too would have to begin retiring by the end of the decade with no replacement. Mature markets would see their regional airlines strained for supply.

As the smallest class, turboprops represent less than 10 percent of the global fleet and are expected to decline further throughout the forecast period, shrinking at a rate of 0.4 percent annually. By 2031, they will make up seven percent of the fleet. Pre-COVID, there were about 2,500 turboprops in service, a number that stayed relatively stable over the previous 10 years. The average age of the turboprop fleet will remain around 18 over the course of the forecast.

AIRCRAFT USAGE

Passenger aircraft will dominate the fleet through 2031, as they have over the previous decade. By 2031, of the more than 36,000 aircraft in the fleet, nearly 34,000 will fly passengers. The number of cargo aircraft, now nine percent of the fleet, is expected to grow 2.4 percent annually over the forecast period, on par with the 2.3 percent annual growth rate of the previous decade. Historically, cargo growth has been concentrated in widebodies, but these aircraft will account for just one-third of the growth in cargo aircraft over the forecast period — specifically in 767-300F conversions and 777F deliveries and conversions. Driven by an increased demand — and availability — for narrowbody conversions, along with several direct freighter turboprops from ATR and Cessna, the widebody share of cargo aircraft will decline to 50 percent by 2031. More than 750 freighter conversions are forecast over the next 10 years, an increase of 28 percent from the previous decade; only 36 percent are projected to be widebodies.

Exhibit 19: Passenger and cargo fleet forecasts, 2020-2031



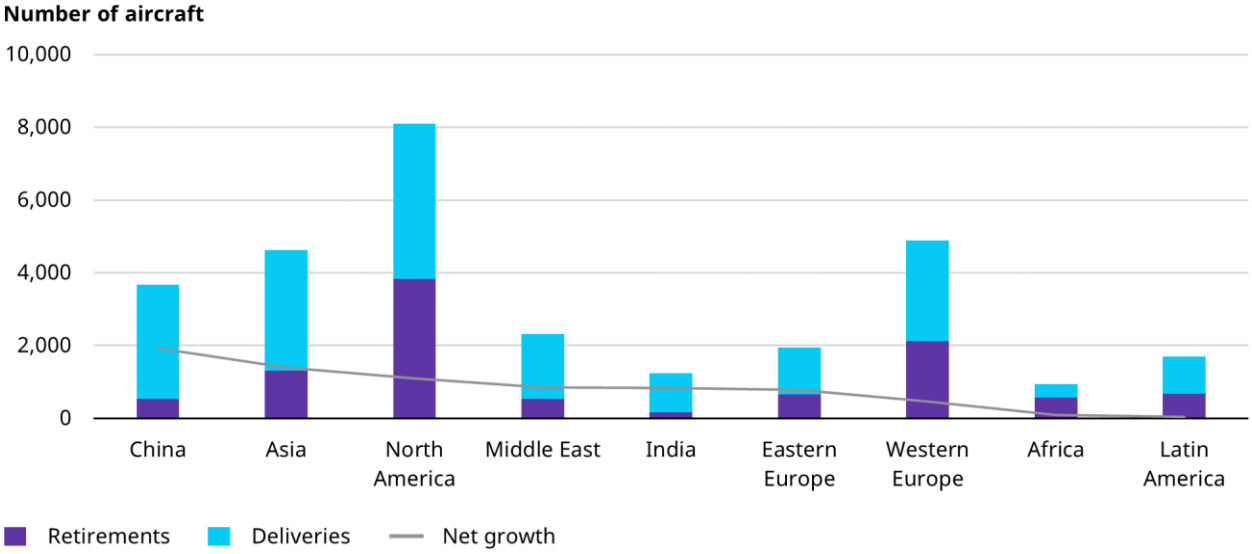
Note: Fleet sizes as of beginning of year; CAGR stands for compound annual growth rate
Source: Oliver Wyman analysis

REGIONAL TRENDS

While long-term global projections are uninspiring, the short-term regional outlook in certain parts of Asia is somewhat upbeat. China is one of two regions that experienced fleet growth in 2020. While it is expected to see some slowing, it will keep consistently expanding over the next decade. Only a small share of the Chinese fleet was stored at any point even at the beginning of the

COVID-19 crisis, and the active fleet had fully rebounded by late spring. The region is expected to grow more than 60 percent over the decade, though it is not expected to overtake the broader Asia Pacific fleet size until after 2031.

Exhibit 20: Fleet growth by region, 2021-2031

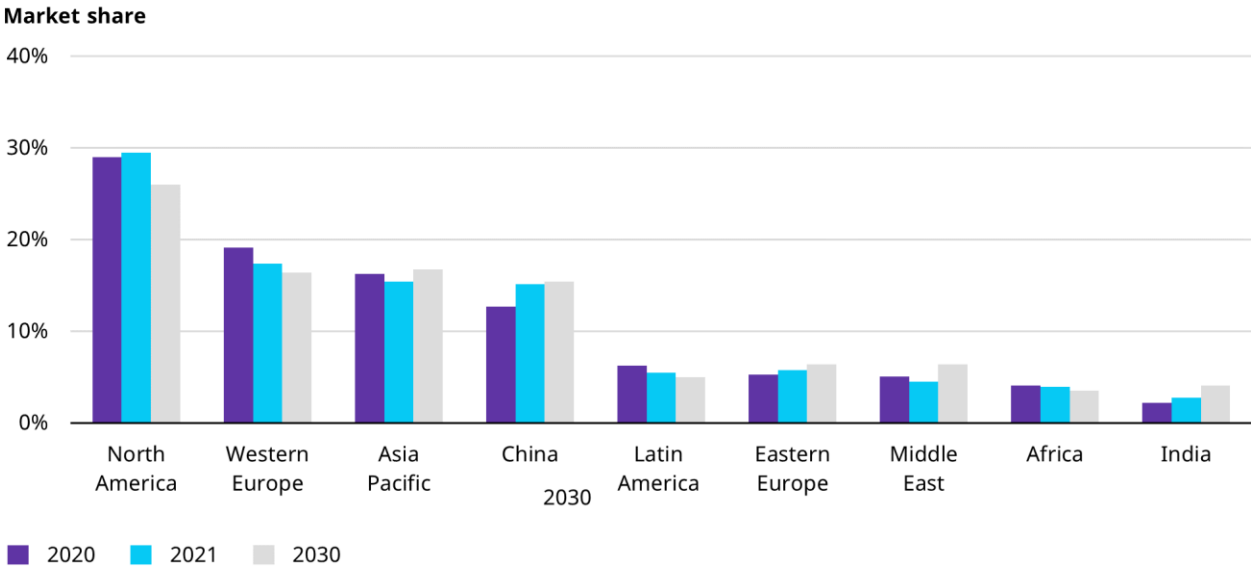


Source: Oliver Wyman analysis

A similar short-term picture emerges in India where the current fleet sits a full six percentage points above pre-COVID levels. This fleet growth is noteworthy, considering COVID-19 grounded almost all aircraft in the country in March and April. The Indian aviation industry had just finished a rough 2019, with financial instability across the aviation sector leading to the bankruptcy of large operator SpiceJet and subsequent grounding of its fleet of nearly 100 aircraft. Consequently, the suppressed in-service fleet at the beginning of 2020 provided room for growth despite the onset of the COVID-19 crisis. With India still considered the smallest region with the most potentially underserved passengers, its fleet is expected to more than double over the next decade. Widebodies will make up an increasing share of growth as local operators, such as Vistara and Jet Airways, expand international operations and surpass Africa's fleet around mid-decade.

While the spread of the COVID-19 was not nearly as pervasive in Asia Pacific, the region's fleet — particularly the international fleet — was still affected by the lack of flying to countries hit harder by the virus. The regional fleet bottomed out at 42 percent of pre-COVID levels in April and currently sits at 81 percent. Retirements are expected to increase over the forecast period as the region settles into a more mature status and the current fleet ages. Retirements in 2020 almost doubled from 2019, although the overall share of retirements decreased as other regions retired far more aircraft. The domestic fleet will likely recover in early 2022, while mid-2023 is more realistic for the international fleet. Long-term growth in the region is dampened only slightly — just half a percentage point on an annual basis — and will be powered by significant narrowbody growth, with more than 2,500 on order.

Exhibit 21: Regional composition of the fleet, 2020-2030



Source: Oliver Wyman analysis

The mature regions of North America and Western Europe will experience the most significant negative short-term impact, while long-term expectations remain mostly in line with the pre-COVID forecast. North America had a staggering number of retirements in 2020, nearly 3.5 times as many in 2019. The region was responsible for half of all global retirements, up from one-third in 2019. Importantly, many of these 700 aircraft were going to be phased out over the next several years, and the COVID-19 crisis simply moved up their permanent removal. At the beginning of 2021, 86 percent of the pre-COVID fleet was operating, with domestic fleet recovery expected by the beginning of 2022. Long-term expectations for the North American fleet have been downgraded by about half a percentage point on an annual basis from the pre-COVID forecast; many of the replacement fleet dynamics have been known for years and the region maintains a strong order book with both major aircraft manufacturers.

Western Europe is flying 77 percent of its pre-COVID fleet, with its operators the most aggressive in parking aircraft and tightening operational capacity. The region hit a low of 22 percent of its pre-COVID fleet in April 2020 and still has more than 1,200 aircraft in storage. The region retired more than 300 aircraft in 2020, nearly triple the number from 2019. Domestically, the fleet is expected to recover by mid-2022, while the international fleet takes until late 2023. Long-term growth for the regional fleet was expected to be one percent annually pre-crisis — the lowest of any large region and similar to the current expectations.

Eastern Europe is primed for a significant increase in fleet sizes of all aircraft over the next decade. Several large, low-cost operators outside of Russia, such as Wizz Air, have over 250 narrowbody aircraft on order, and those operators appear financially positioned to accept those deliveries. The fleet is currently at 93 percent of pre-COVID levels and is expected to recover by the end of 2021.

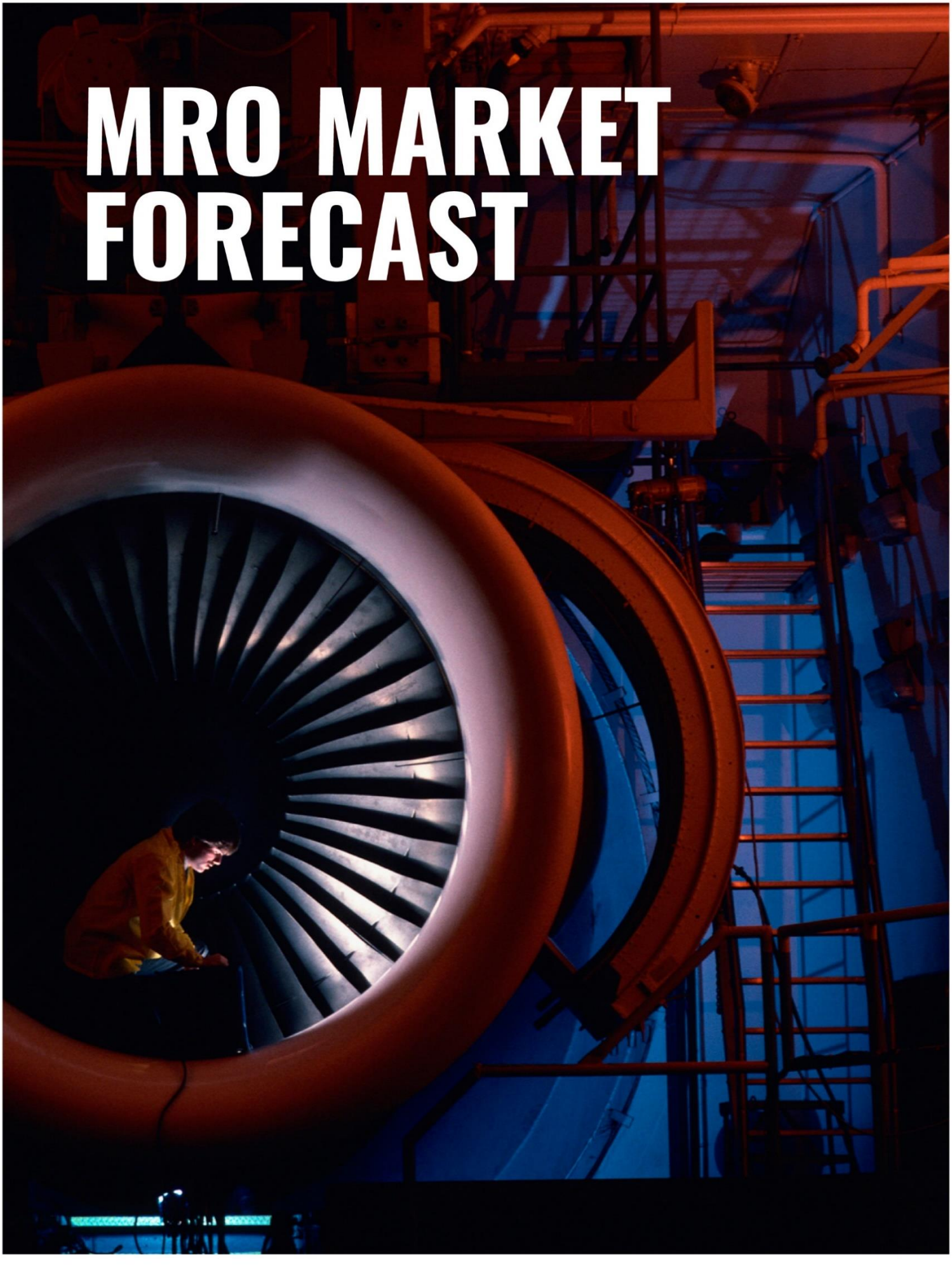
The geopolitical and economic issues of the mid 2010s created conditions in which many older aircraft were retired, and a number of high-profile bankruptcies forced other used assets out of the region. The region retired 25 percent fewer aircraft in 2020 than in 2019 as the age composition remains younger. In total, the current fleet in Eastern Europe is expected to grow more than 60 percent by the end of the forecast period.

The African fleet fell to a low of 36 percent of its pre-COVID count in March 2020 and hovered there through May before any significant recovery began. The fleet has recovered to 82 percent, with a significant portion remaining in storage. While fleet recovery is expected to occur by the end of 2022, the long-term growth of the region is expected to be significantly impacted by COVID-19, particularly the widebody fleet. The financial status of operators paired with low international demand is expected to reduce the number of aircraft delivered to the region. As has been the case for the last decade, the region will rely heavily on migrations for fleet growth — particularly from Europe and the Middle East.

The Middle East sits in a unique position in dealing with the consequences of the pandemic and the airline losses from it. Mostly state-owned operators are somewhat protected from the short-term financial hit, given that the government will likely provide financial support. While the regional fleet will not recover until early 2023, it is not expected to impact the medium- or long-term growth of the region, particularly when it comes to the domestic fleet. Operators like flydubai and Air Arabia have hundreds of narrowbodies on order, noteworthy given the region's narrowbody fleet size of just 500 aircraft at the start of 2020. Regional jets and turboprops are also expected to see strong growth — albeit from very small bases. The long-term widebody growth forecast is reduced by about one percentage point on an annual basis in direct correlation to long-term international demand and the Middle East's status as an important connecting hub. Narrowbodies are estimated to overtake the widebody fleet beginning in 2027.

After significant political and economic instability in the last few years — and with stagnant fleet growth since 2017 — Latin America was poised to grow at a slow but steady pace heading into 2020. Because of the pandemic, the region suffered a setback with 70 percent of its fleet parked by early summer. Currently, it sits at 75 percent of where it was at the beginning of the year. The region retired 80 percent more aircraft in 2020 than in 2019, and nearly 450 aircraft remain in storage. The number of aircraft flown domestically is not expected to recover until late 2023, and it may be years before the small widebody fleet recovers. The medium-term outlook for the region is stagnation, with reductions in the aging regional jet and turboprop fleets in exchange for more narrowbodies.

MRO MARKET FORECAST



A SLOW CLIMB BACK FOR MRO

Over the last 10 years, the commercial maintenance, repair, and overhaul (MRO) market has experienced strong, steady expansion on the back of global economic growth, increasing demand for air travel, and an expanding global fleet. COVID-19 and the devastating market impacts created by the pandemic marked the dramatic end of a decade of predominantly good news.

With more than half of the global fleet parked in the spring of 2020 and lower utilization of the remaining aircraft, airlines sought to preserve cash by deferring as much maintenance as possible. Non-essential modifications were canceled or deferred, and the multitude of available engines on grounded aircraft with remaining green time were used to put off engine shop visits to 2021 or later. In total, COVID-19 is estimated to have lowered spending on MRO by about $40 billion in 2020. The $91.6 billion in spend that was anticipated pre-COVID in 2020 was whittled down to $50.3 billion in projected spend.

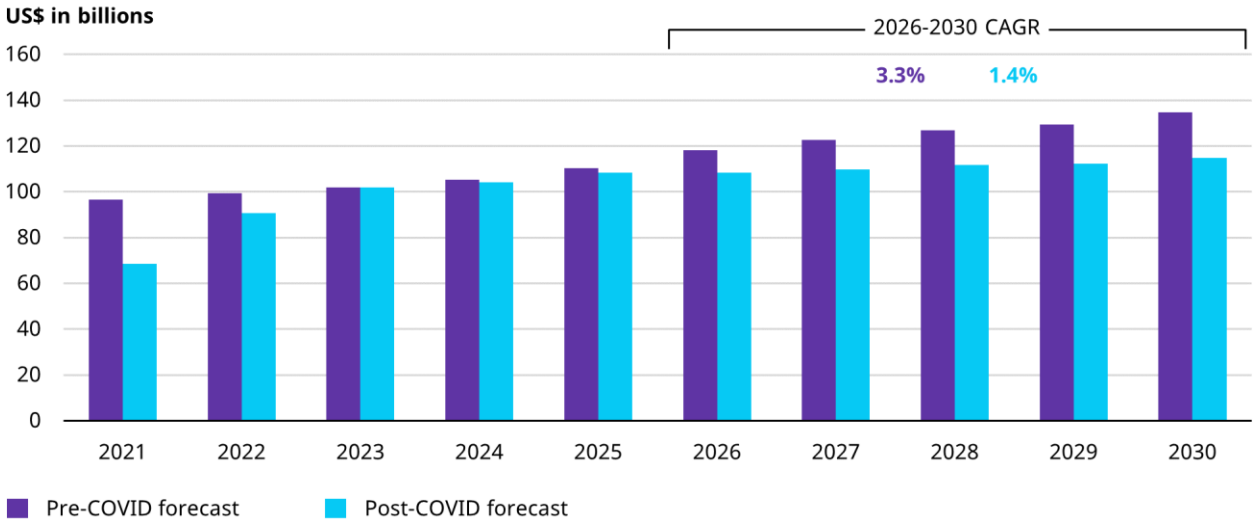
Some of that $40 billion in lost 2020 demand will be pushed into later years as aircraft return to normal utilization patterns, but much will be permanently lost as planes are retired early and expensive late-life checks are no longer needed. In total, Oliver Wyman expects the global commercial air transport MRO market to suffer a reduction in demand of more than $60 billion over 2020 and 2021 combined; MRO demand is unlikely to return to pre-COVID levels until the end of 2022.

The timing of MRO's return to pre-COVID levels of spend is determined primarily by a recovery in passenger demand, which in turn is driven by economic recovery, traveler sentiment, and the pace at which herd immunity is reached through vaccinations, which began at the end of 2020. In an accelerated recovery scenario, in which international and domestic passenger demand rebound at a similar pace, MRO spend would recover at the beginning of 2022. In a prolonged recovery scenario, with domestic demand taking years to recover, MRO spend would not return to pre-COVID levels until 2023.

WHY AIRCRAFT DELIVERIES MATTER

By 2030, MRO demand is expected to reach $115 billion, 15 percent less than the pre-COVID forecast of $135 billion for that year. This long-term decrease in MRO spend reflects the significant reduction in expected deliveries over the next few years. Many aircraft delivered in the next couple of years will reach their first expensive maintenance events near the end of the forecast. With an accelerated recovery, in which OEMs can increase production rates slightly faster than in the baseline scenario, MRO spend could reach $116 billion by 2030. In a prolonged recovery, where OEMs keep production rates low for multiple years, MRO spend would be only $103 billion.

Exhibit 22: MRO market forecast, 2021-2030



Note: MRO stands for maintenance, repair, and overhaul; CAGR stands for compound annual growth rate
Source: Oliver Wyman analysis

Over the short term, MRO demand is forecast to grow 50 percent between 2021 and 2023, an increase of over $30 billion, as fleet size and utilization gradually get back to pre-COVID levels. Maintenance events deferred in 2020 will also provide a short-term boost, as certain maintenance tasks will need to be completed prior to aircraft re-entering service. After this initial wave, MRO growth is expected to moderate. While both fleet size and MRO demand are expected to fully recover by 2023, long-term MRO growth will be dampened as a result of COVID-19.

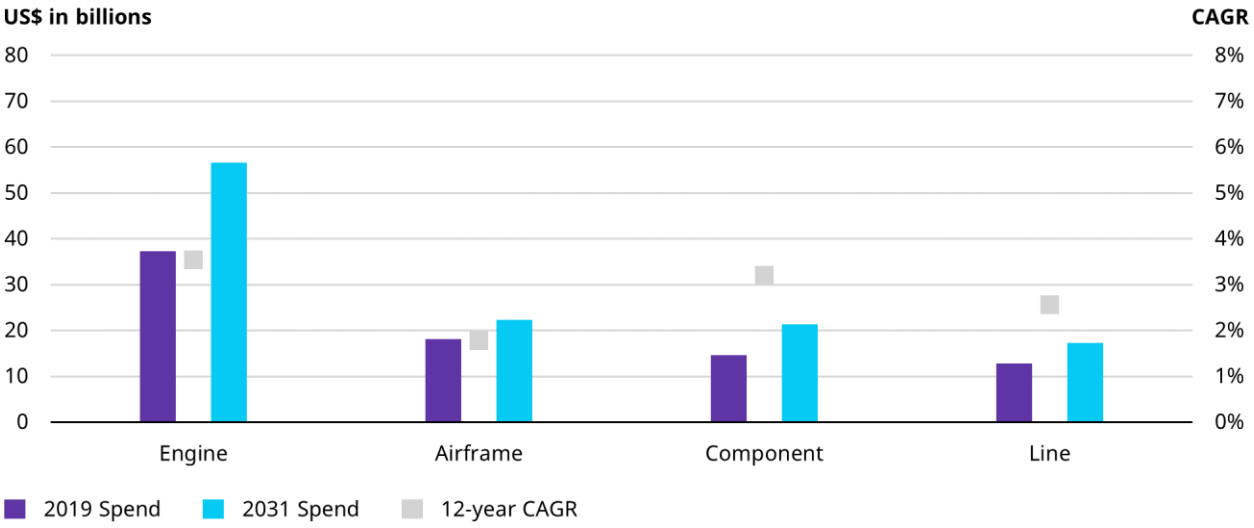
In total, 2020 deliveries fell 60 percent from 2018, the last year of normal delivery patterns. In 2019, deliveries were diminished by the sudden grounding of the 737 MAX that March. A reduction in deliveries is expected to continue past 2020, as production cuts will be permanent on certain platforms. In fact, by 2023 deliveries are expected to still be 10 percent below 2018 levels.

COVID-19 is expected to reduce deliveries over 40 percent between 2020 and 2023. While not seen immediately, this reduction will lower the base over which MRO spend will grow and likely lead to slower MRO demand growth upon market recovery. From 2023 to 2031, MRO demand is expected to grow only 1.8 percent annually as fewer deliveries in the first part of the decade mean fewer aircraft will reach shop visit and heavy airframe check thresholds. In a prolonged recovery scenario in which deliveries in 2023 are still 25 percent below 2018 levels, cumulative MRO demand from 2023 to 2031 could be 11 percent lower than baseline projections; in an accelerated recovery scenario, spend could be up one percent.

HOW SEGMENTS WILL RESPOND

Post-COVID, airframe MRO is expected to be the most resilient segment as calendar time thresholds drive most major inspections. While regulators and OEMs have provided increased short-term flexibility in scheduling airframe maintenance, aircraft in storage that pass airframe check thresholds must undergo the corresponding maintenance before they can return to service. With over 2,500 aircraft expected to be removed from storage in 2021 and 1,500 more in 2022, there may be a short-term capacity crunch involving airframe as many of these aircraft will need checks completed before they can return to service. This mass return to service in the next two years could create a demand bubble as there will be a large group of aircraft due for checks on the same timeline.

Exhibit 23: Total MRO demand forecast by segment, 2019 and 2031



Note: CAGR stands for compound annual growth rate
Source: Oliver Wyman analysis

Primarily driven by this surge of aircraft returning to service, 2021 airframe spend is forecast to be just 12 percent lower than 2019 spend — a far smaller decline than will be experienced by other MRO segments, which are projected to be 15 to 25 percent lower than 2019 spend. In total, airframe MRO spend is expected to recover to 2019 levels by 2022. With a prolonged recovery scenario, airframe would not recover until 2023; in an accelerated scenario, 2021 airframe spend would be 99 percent of 2019 spend.

While the COVID-19 impact to airframe will be marginal in the next few years, long-term growth will be limited. From 2026 to 2031, airframe MRO is expected to grow less than one percent annually despite fleet growth of 2.8 percent. This depressed growth is because new generation aircraft, which are relatively cheaper to maintain thanks to extended check intervals and fewer

manhours required per check, will make up a larger percentage of the fleet in the second half of the decade. In 2021 and 2022, airframe MRO should make up 24 percent of MRO spend, but its relatively slow growth will cut its share to 19 percent by 2031.

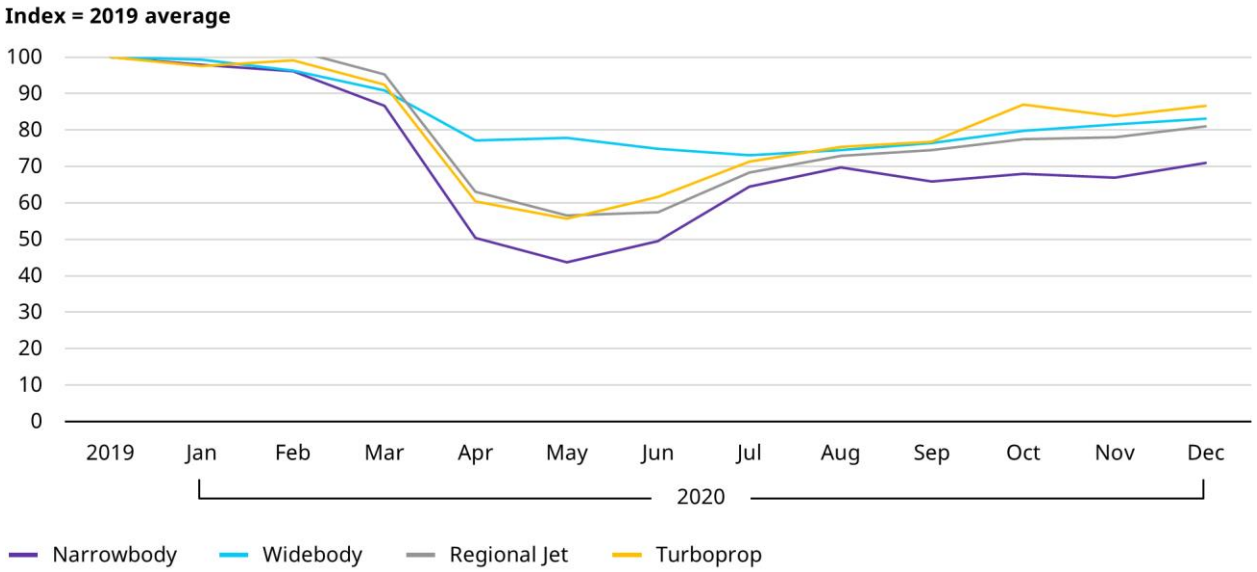
One potential consequence of the shift of the global fleet toward narrowbodies and away from widebodies is an imbalance in the supply and demand for airframe MRO among regions. Asia Pacific, typically the region to which widebody heavy maintenance is most outsourced, could see an abundance of supply while hangar space would be much tighter in other regions of the world.

The short-term COVID-19 impact on the other MRO segments is expected to be more significant than that for airframe MRO, as maintenance for engines and most components is driven by utilization, primarily accumulated flight hours and flight cycles. In reaction to the precipitous COVID-related drop in demand, most operators have been forced to send aircraft into storage and cut utilization on aircraft still in service. The combination of these two actions has led to a drastic reduction in the total number of hours and cycles accumulated in 2020, which will directly affect engine, component, and line MRO compared with pre-COVID expectations.

In 2019, according to utilization data provided by Aviation Week Intelligence Network Fleet & Data Services, the average in-service narrowbody jet flew 8.5 hours a day while the average in-service widebody flew almost 12 hours a day. Regional jets and turboprops, which are typically utilized to a lesser degree, flew six hours and four hours per day, respectively. In May, utilization for narrowbodies, regional jets, and turboprops reached its lowest when hours per day and cycles per day fell almost 50 percent versus 2019. These reduced levels coincided with a drop in the size of the active fleet of over 50 percent for these aircraft classes. The combination of these two trends led to a substantial drop in overall flight hours.

Utilization of widebodies behaved slightly differently than other classes. Because so much of the widebody fleet was in storage by March — almost a month earlier than other aircraft classes — daily utilization for those still flying didn’t drop as much as the other classes of aircraft. While only 40 percent of the January in-service widebody fleet was active by the end of March, daily utilization was down just 10 percent. As widebody aircraft began to return to active service over the summer, daily utilization trended down. It reached its lowest point in July when hours per day were down 25 percent and cycles were down 15 percent compared with 2019. The lack of recovery in long-haul international demand has prompted airlines to use widebodies on shorter routes, a strategy which in turn has lifted average daily hours more so than cycles.

Exhibit 24: Flight hours per active aircraft by aircraft class



Source: Aviation Week Intelligence Network Fleet & Data Services, Oliver Wyman analysis

These utilization trends began to show signs of recovery toward the end of the year. By December, active widebody hours per day were down 17 percent from their 2019 average while cycles were down 7 percent. For all other classes, hours and cycles per day were 20 percent to 30 percent below 2019 levels.

As a result of the large numbers of stored aircraft and lower utilization, 2020 engine MRO demand is expected to fall 30 percent from 2019. With aircraft returning to service and utilization getting closer to normal levels, engine MRO is expected to recover to 80 percent of 2019 levels in 2021 and fully recover by the end of 2022.

In a prolonged scenario, engine MRO recovery could stretch until 2023 as international travel remains suppressed and daily utilization recovery across all classes stagnates. The most significant impact of a prolonged recovery would be felt over the long term, as engine spend in 2031 would be 14 percent less than in the baseline scenario — a decline of nearly $8 billion. The cumulative drop over the full forecast period between the baseline and prolonged scenario exceeds $55 billion.

In an accelerated scenario, engine MRO would see more shop visits for the most expensive engines as widebodies would return to service and normal utilization patterns at a faster rate. While it will still take until 2022 for total engine spend to recover, the long-term impact is significant. In the accelerated scenario, over the 10-year forecast period, cumulative engine MRO spend would be three percent higher than the baseline scenario and just five percent below pre-COVID expectations.

Another factor reducing demand for engine MRO, particularly over the next few years, will be an expected influx of available green-time engines from COVID-related early retirements. The changing prioritization of routes and types of aircraft to fly those routes meant that many aircraft

were retired for operational expediency, not just age, and therefore have engines with sufficient hours and cycles remaining to power an aircraft for a year or two. These engines can be used to replace engines due for maintenance, allowing operators to delay incurring the cost of a shop visit. With retirements in 2020 nearly 2.5 times more than average, there are an estimated 2,000 available engines with usable green time. This supply is forecast to defer nearly 1,700 scheduled shop visits over the next five years, saving operators almost $1.5 billion in the short term.

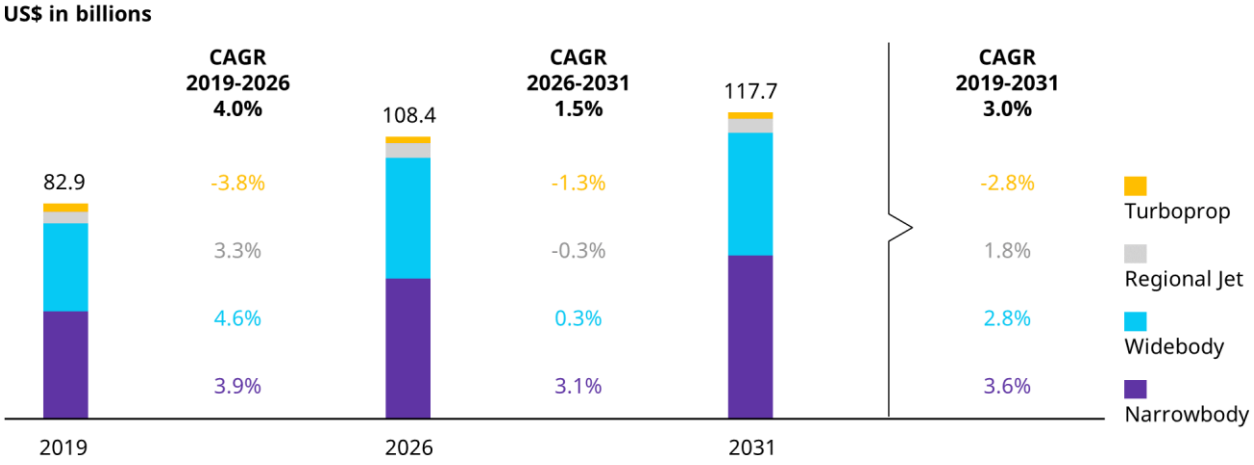
From 2022 to 2031, engine demand is forecast to grow at a compound annual growth rate, or CAGR, of 3.8 percent, driven primarily by a fleet expansion of 3.3 percent annually. Engine MRO growth is expected to outpace fleet growth primarily because engines that power new-generation aircraft have more expensive material requirements. As they make up an increasingly larger portion of the global fleet, they will drive higher engine MRO spend. Additionally, with utilization returning to normal levels and the availability of green-time engines exhausted, the segment will get a push in the decade's second half from deferred shop visits.

Like engine MRO, component MRO will recover to 2019 levels in 2022. In 2021, component MRO demand is expected to be 80 percent of 2019 levels. Component MRO is made up of dozens of different Air Transportation Association (ATA) chapters, but most demand is concentrated within a few chapters. The top three chapters, consisting of wheels and brakes, auxiliary power units, and avionics, will account for 45 percent of total component spend. In fact, the top 10 ATA chapters are expected to be almost 80 percent of all component spend over the forecast period. After recovery, the component market is projected to grow at a CAGR of 1.9 percent annually in the second half of the decade.

In 2021, line maintenance will be 16 percent below 2019 spending, with full recovery not expected until 2022, according to baseline projections. Cumulative line maintenance spending between 2021 and 2030 is forecast to come in 10 percent below pre-COVID expectations, driven primarily by a smaller fleet and fewer flights. By 2030, the fleet will still be 10 percent smaller than pre-COVID projections. With an accelerated recovery, line maintenance and fleet would recover in 2022, while in a prolonged recovery scenario it would recover in 2024.

The distribution and growth of line maintenance spend closely matches the distribution and growth of the fleet. In 2019, narrowbodies were 58 percent of the fleet and 62 percent of line maintenance; by 2031, narrowbodies are expected to be 65 percent of the fleet and 68 percent of line maintenance spend. Following fleet recovery, line maintenance is expected to grow at a CAGR of 2.7 percent from 2026 to 2031, while the fleet grows at a CAGR of 2.8 percent.

Exhibit 25: MRO market forecast by aircraft class, 2019-2031



Note: CAGR stands for compound annual growth rate
Source: Oliver Wyman analysis

BY TYPE OF PLATFORM

Total narrowbody, widebody, and regional jet MRO spend is expected to recover to 2019 levels in 2022. Turboprop MRO will never again reach 2019 levels as the commercial turboprop fleet will continue to shrink and many older maintenance-intensive turboprops are replaced by more efficient ATRs with longer honeymoon periods before their first major maintenance visit.

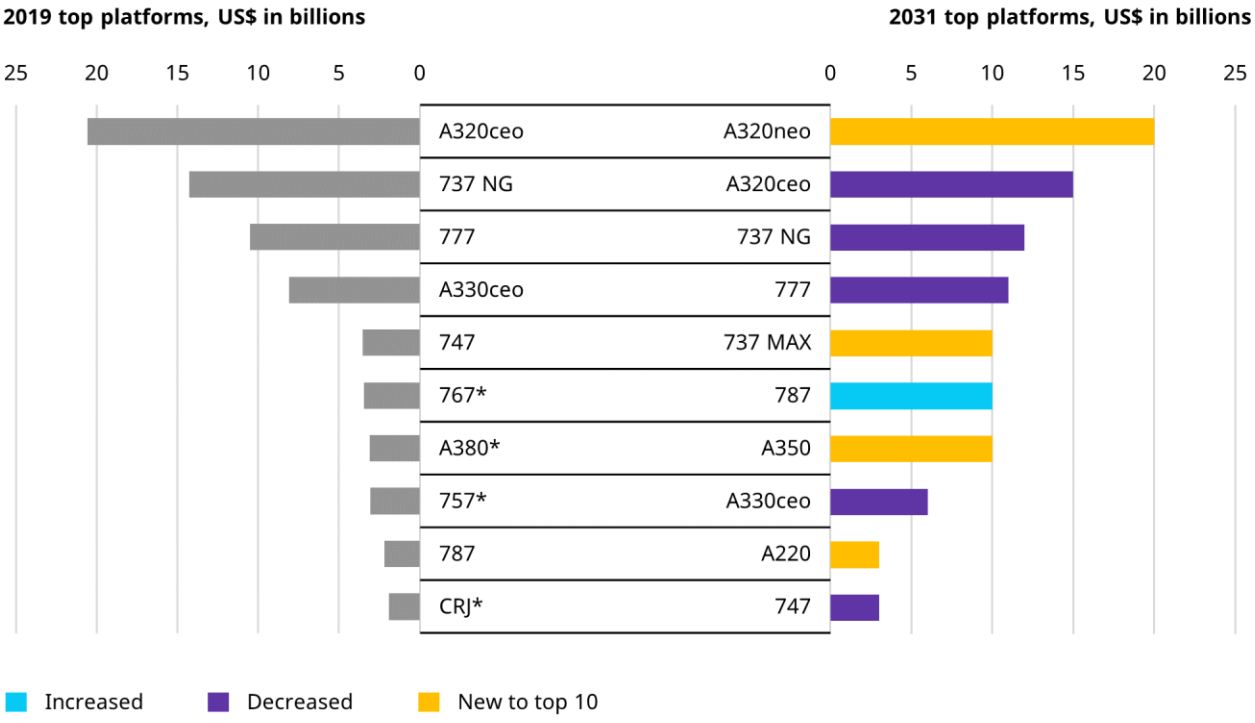
Regional jets will see an 18 percent drop in 2021 MRO demand from pre-coronavirus expectations, while narrowbodies will decline 22 percent and turboprops 26 percent. Widebodies, primarily used on international routes, should see the greatest reduction in 2021 demand, at 39 percent. Narrowbodies will be responsible for 35 percent of the COVID-19 impact in 2021 on MRO, while widebodies will be responsible for 58 percent.

Narrowbody and widebody aircraft comprise most of the fleet and will also be responsible for the majority of MRO spend over the next 10 years. However, across all MRO segments widebodies have a disproportionately large share of spend relative to their fleet size. This is most pronounced in engine MRO where widebodies have historically been half of all engine spend but only around 20 percent of the fleet. In 2021, as the widebody fleet share declines to 19 percent and utilization on in service widebodies remains below traditional averages, the class' share of MRO spend will drop to 37 percent. Once the widebody fleet recovers, widebodies share of MRO will return to its historic average of roughly 40 percent and remain there through 2031. By 2031, regional jets and turboprops, which are currently 21 percent of the fleet and 11 percent of MRO demand, will drop over the decade to 17 percent of the fleet and seven percent of MRO.

The vast majority of MRO spend has historically been concentrated in the top 10 platforms. In 2019, the top 10 platforms were responsible for 85 percent of MRO spend. In 2031, the top 10 platforms are again expected to account for 85 percent of MRO spend, but the platforms will change. Four new generation platforms, A320neo, 737 MAX, A220, and A350, will enter the top 10 in 2031 as older platforms, including the 767, 757 and CRJ drop out. In 2031, the top 10 platforms will be evenly split between narrowbodies and widebodies, but narrowbodies will make up four of the top five.

The 737 MAX is expected to remain a major platform, but the extended grounding in 2019 and 2020, combined with COVID-19, tempered its long-term growth potential. The 737 MAX was recertified in the United States in November 2020 and then in most of Europe in late January. In December 2020, there were close to 400 737 MAXs being held in storage by airlines and an additional 450 that Boeing had built, but not yet delivered. By 2030, the MAX is expected to account for 13 percent of the fleet and seven percent of MRO, down from the 16 percent of the fleet and 11 percent of MRO anticipated pre-pandemic. An interesting effect of the extended MAX grounding will be the likely spikes in major maintenance events on aircraft returned to service or delivered in 2021 and 2022. There will be about 1,000 MAX aircraft entering service over the next two years, while the MAX production over a two-year period is not expected to exceed 1,000 until the second half of the decade.

Exhibit 26: Top aircraft platforms by total MRO spend, 2019 actuals versus 2031 projections



Note: * indicates not in 2031 top 10
Source: Oliver Wyman analysis

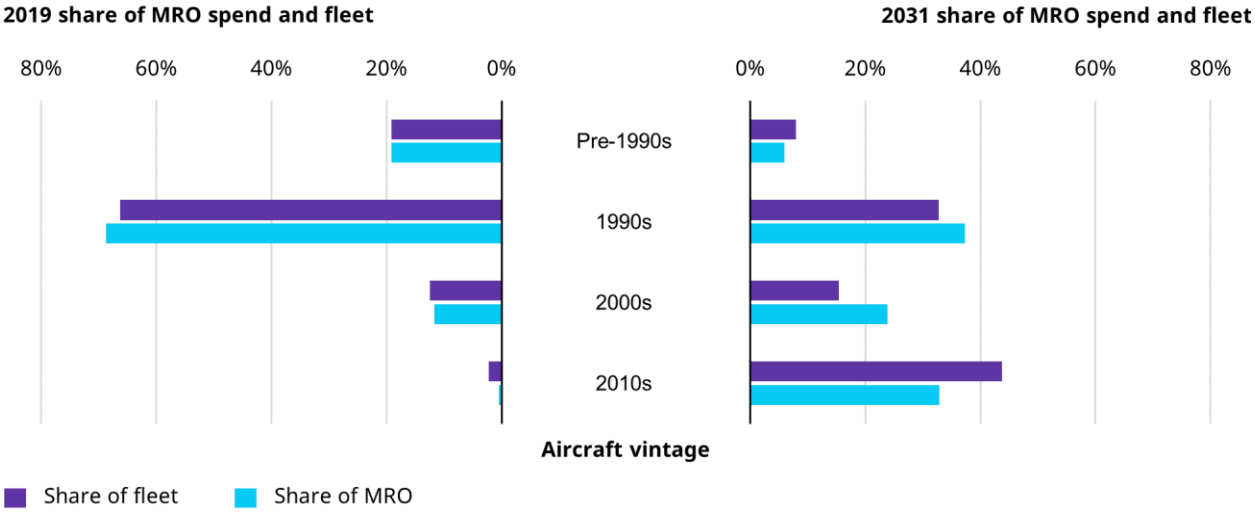
AN AGING FLEET

Along with fleet size, fleet vintage is another major driver of MRO demand. In 2019, aircraft developed in the 1990s accounted for 66 percent of the fleet and 69 percent of MRO spend, while aircraft developed after 2010 formed two percent of the fleet but less than one percent of MRO.

Over the next 10 years as more 1990s-vintage aircraft reach retirement age, their share of the fleet will decline but they will still have a disproportionately large share of MRO because of their advanced age. By 2031, 1990s-vintage aircraft are expected to account for 33 percent of the fleet and 37 percent of MRO. Aircraft built between 2010 and 2019 are projected to increase to 44 percent of the fleet but 33 percent of MRO, given that only a small portion of that fleet will have expensive heavy checks or shop visits.

Overall, the 2021 fleet is older by a full year on average than the pre-COVID projection, as the sharp reduction in deliveries more than offset the acceleration in retirements. This trend is expected to continue, with average age of fleet aircraft expected to increase from 12.1 years to 12.8 years over the next 10 years. That's 1.8 years older on average than pre-COVID expectations. This aging of the fleet is attributable more to a projected decline in new deliveries than delayed retirements over the forecast period.

Exhibit 27: Total MRO spend by aircraft vintage, 2019 versus 2031

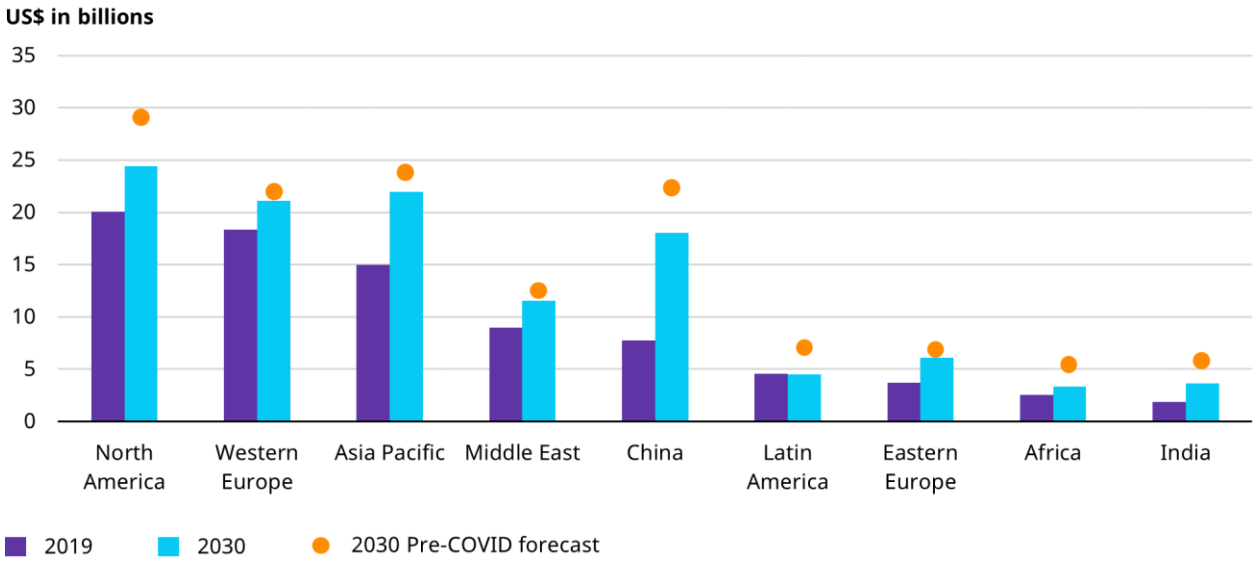


Source: Oliver Wyman analysis

REGIONAL DIFFERENCES

Regional recovery and growth in the MRO market will mirror the recovery and growth of the fleet in each region of the world. China, where the active fleet has already recovered to pre-COVID levels, is forecast to have an eight percent larger MRO market in 2021 than in 2019, making it one of only two regions to surpass pre-COVID levels of MRO in 2021; the other is Eastern Europe. In a prolonged recovery scenario, China would not recover to 2019 MRO spend until 2022. By 2031, the projected MRO market in China will more than double its pre-COVID size to nearly $20 billion as the nation's share of the fleet increases from 12 percent in 2019 to 16 percent in 2031. Along with fleet growth, the average age of the fleet in China is expected to increase from 6.4 to 10.6, driving additional MRO demand.

Exhibit 28: Total MRO demand forecast by region, 2019 versus 2030



Source: Oliver Wyman analysis

India, where the fleet has also surpassed pre-COVID size, is expected to more than double its fleet by 2030 and see significant growth in its MRO market. By 2030, the Indian MRO market is also projected to double to $3.7 billion, but it will still be 36 percent below its projected pre-COVID value for the end of the decade. Even with lowered expectations for 2030 spend, India is still expected to see an increase in market share as it grows from two percent of the 2019 MRO market to 3.4 percent in 2031. MRO demand in India could grow to as much as $4.1 billion in 2031 or as little as $3.4 billion, depending on passenger demand recovery.

Recovery in the Middle East will be the most dependent on international demand recovery, as the region relies heavily on international travel; its pre-COVID fleet consisted of over 50 percent widebodies, compared with a global fleet that was only 21 percent widebodies. With such dependence on international travel, the Middle East MRO market is not expected to recover until

2023, making it one of the last regions to rebound. In a prolonged recovery scenario, Middle East MRO demand would also recover in 2023, but to 10 percent above 2019 levels rather than the baseline scenario of 23 percent over 2019. In the accelerated scenario, MRO recovery in the Middle East could occur as soon as 2022.

One mitigating factor that could partially offset the drop in international demand is the relatively large number of narrowbody deliveries scheduled in the Middle East over the next decade. These deliveries would help recoup some of the MRO demand lost from the cut in widebody deliveries to the region. After recovery, the Middle East outlook stabilizes with MRO growth of more than two percent annually as its relatively young fleet grows at a CAGR of over six percent between 2023 and 2031.

While developing regions of the world bounce back quickly from COVID-19, more developed regions of the world will take longer to recover, experiencing slower growth after recovery. The fleets in North America and Western Europe are unlikely to reach their pre-COVID size again until 2023 and will grow at a CAGR of around one percent between 2023 and 2031. The MRO market is expected to recover in 2022 in North America and 2023 in Western Europe.

After recovery, North America's MRO market will inch ahead at less than half a percent of growth annually through 2031, while Western Europe's expected growth is one percent annually. Though both regions are expected to see similarly sluggish growth in their fleet sizes post-recovery, the average age of the fleet in Western Europe will increase from 12.5 in 2023 to 13.9 in 2031, driving additional MRO demand. The average age of the North American fleet over the forecast will stay flat at around 15. As a result of sluggish growth, the MRO share of North America is estimated to decline from 24 percent in 2019 to 20 percent in 2031, while the MRO share of Western Europe drops from 22 percent to 18 percent over the same time.

APPENDIX

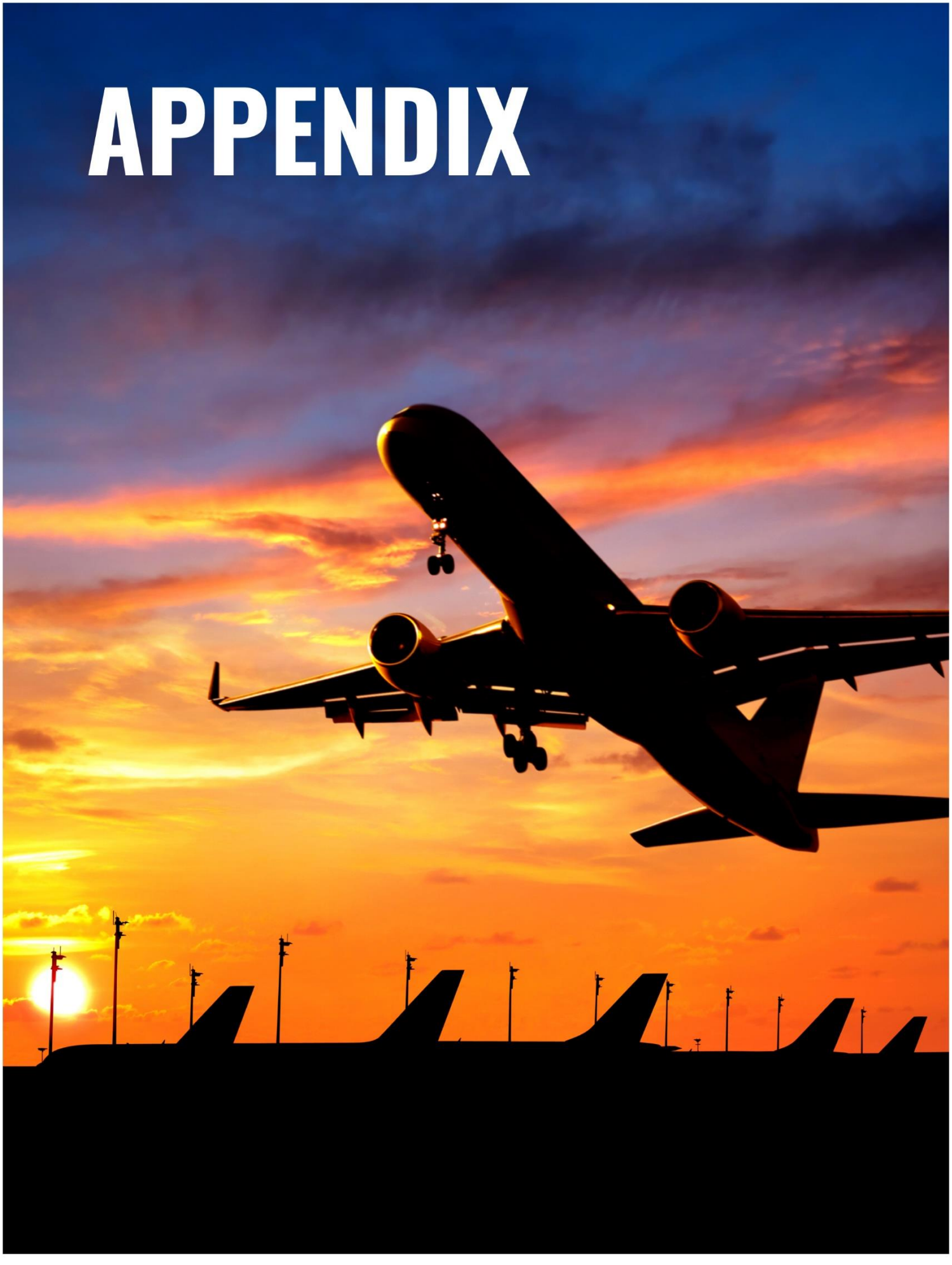
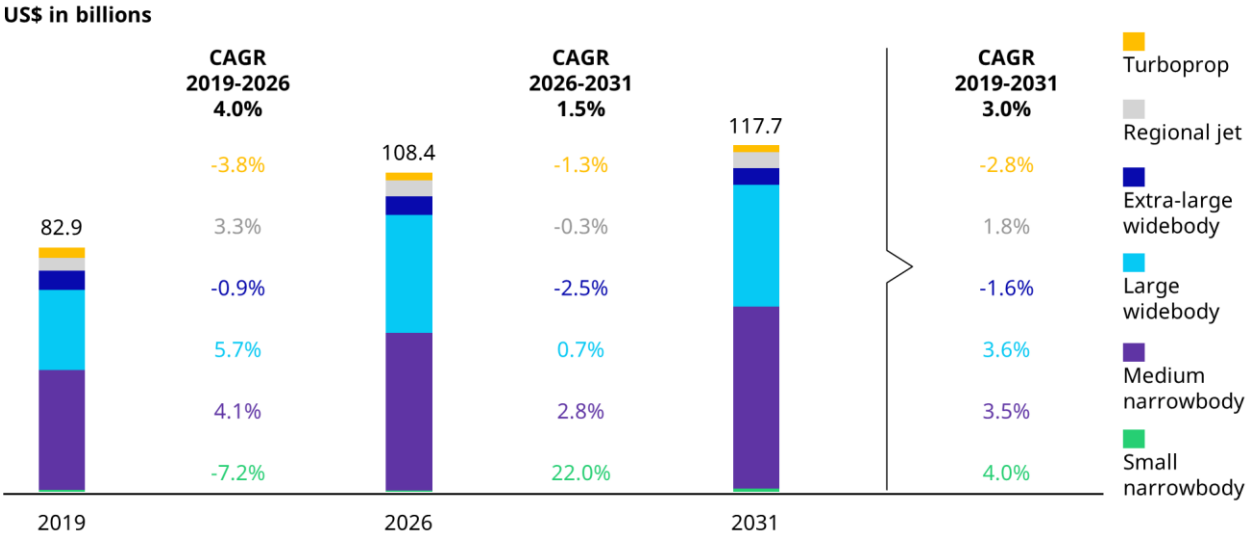
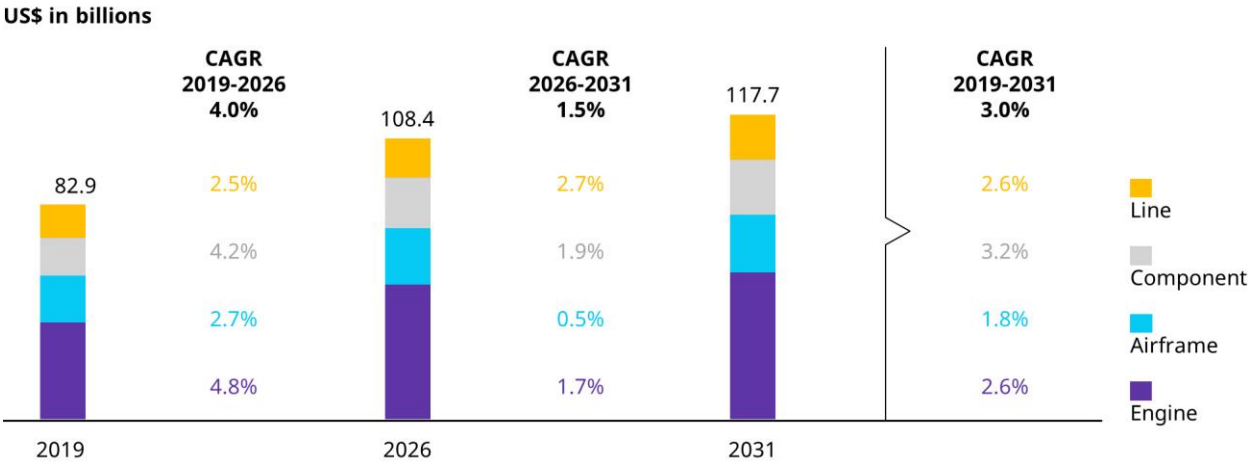


Exhibit 29: MRO Market forecast by aircraft size, 2019-2031



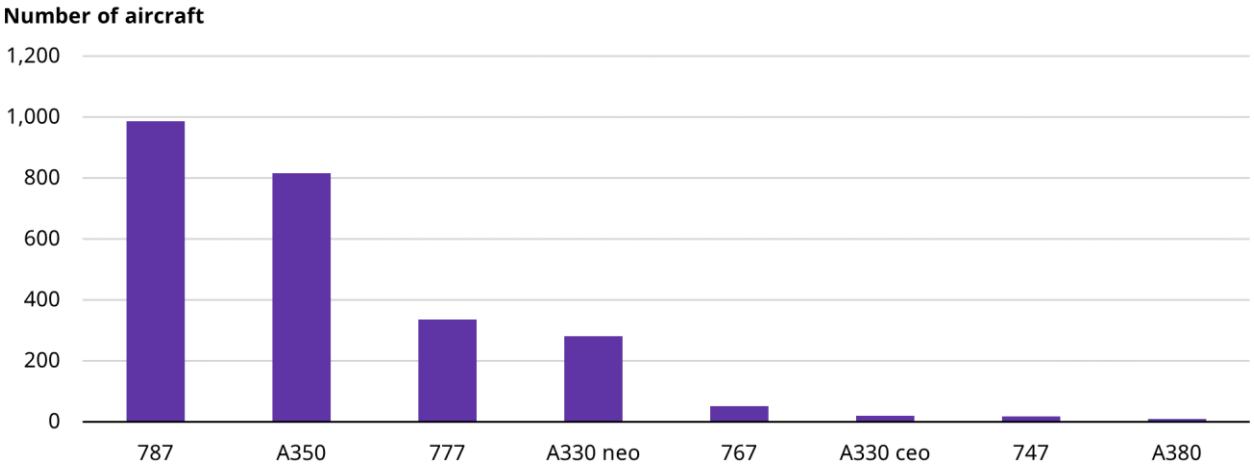
Note: CAGR stands for compound annual growth rate
Source: Oliver Wyman analysis

Exhibit 30: MRO Market forecast by MRO segment, 2019-2031



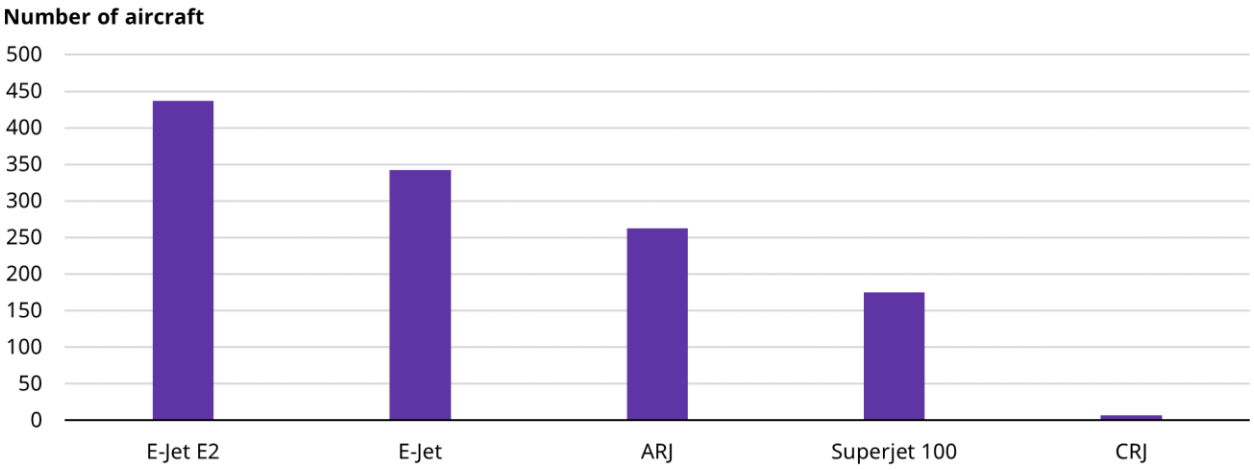
Note: CAGR stands for compound annual growth rate
Source: Oliver Wyman analysis

Exhibit 31: Projected Widebody Deliveries by Aircraft Platform, 2021-2030



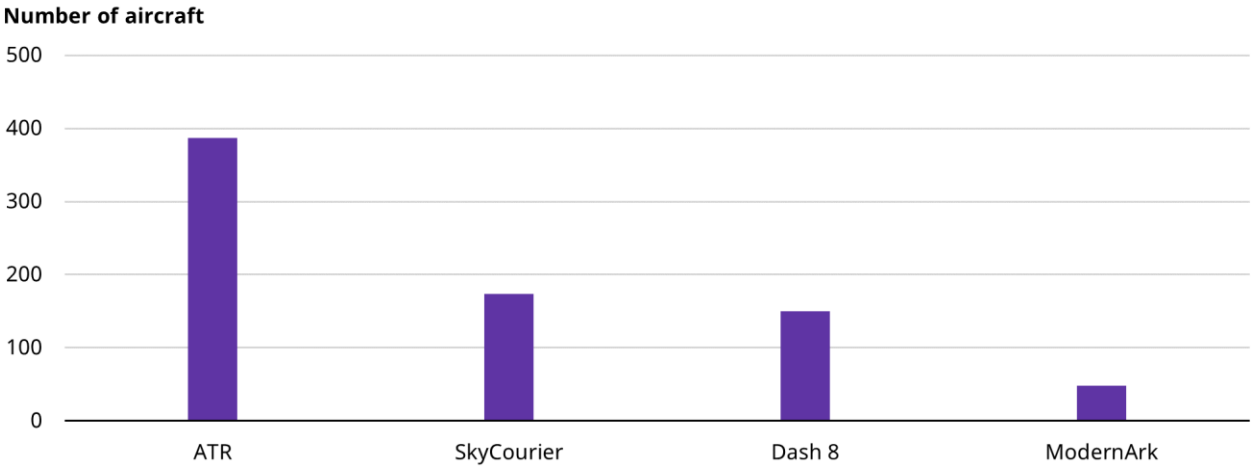
Source: Oliver Wyman analysis

Exhibit 32: Projected Regional Jet Deliveries by Aircraft Platform, 2021-2030



Source: Oliver Wyman analysis

Exhibit 33: Projected Turboprop Deliveries by Aircraft Platform, 2021-2030



Source: Oliver Wyman analysis

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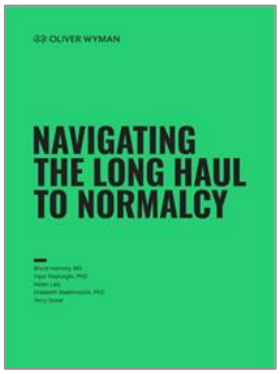

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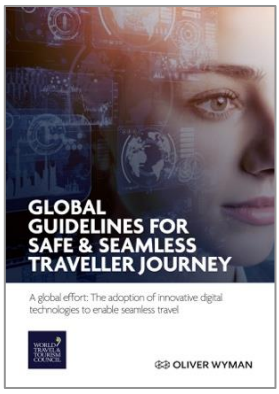

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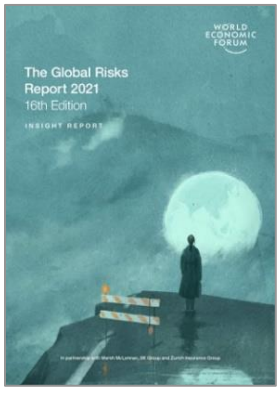

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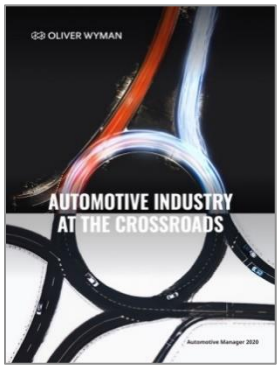

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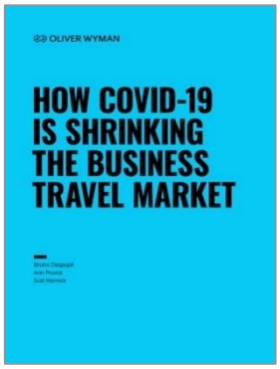

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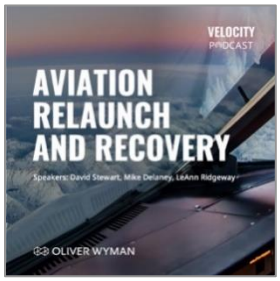

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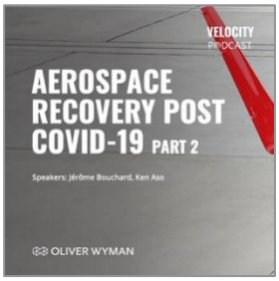

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