Aviation Leaders Report 2023:

New Horizons

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THE AVIATION LEADERS REPORT 2023
For the sixth year running *Airline Economics* and KPMG have gained insights into the commercial aviation industry through a series of in-depth interviews with major aviation leaders that delve into the real challenges facing the sector. This report details the main issues and perspectives shared by industry leaders in one insightful annual publication during one of the most difficult periods for the aviation industry.

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Aviation Global Leaders Report - Contributors

THANK YOU TO ALL OF THOSE EXECUTIVES WHO GAVE THEIR TIME TO ASSIST WITH THIS REPORT

THIS LIST DOES NOT INCLUDE THE MANY INDUSTRY EXPERTS, BANKERS, AIRLINE AND LEASING EXECUTIVES WHO PROVIDED THEIR COMMENTS TO *AIRLINE ECONOMICS* BUT HAVE OPTED TO REMAIN ANONYMOUS.

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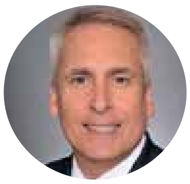
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NEW HORIZONS

We are delighted to present you with our Aviation Leaders Report 2023: New Horizons. The report captures the views of industry leaders across the leasing, airline and banking markets and includes input from rating agencies and analysts covering the sector.

Our report last year focused on the resilience of the overall sector, as it started to emerge from the shadow of the pandemic and the recovery took hold, at varying paces, across the globe.

COVID-19 has not gone away, and new significant challenges have emerged, but the recovery continues apace and it's clear that, while we remain in a very fractured environment, opportunities still abound.

Airlines: Riding the Recovery

From a financial perspective, global airline losses are on track to be $6.9bn for 2022. This represents a significant positive movement from the nadir of 2020 ($140bn loss) and the $42bn that was lost in 2021. What is even more heartening is that the industry is expected to return to profit this year, which would be a remarkable turnaround given the challenges that the sector has faced.

However, while the recovery is significant and meaningful, it continues to be fragmented. The geographically disparate nature of the recovery is intrinsically linked to the pace at which travel restrictions were eased.

The recovery in 2021 was driven primarily by large domestic markets. Over the course of 2022, post the Omicron wave at the start of the year, we saw strong recoveries in international traffic across the intra-Europe, Americas and Transatlantic markets. These routes are predominately back, or very close to, 2019 levels and the expectation is that growth should continue.

While Asia-Pacific has been a laggard in 2022, it has developed more positively as the year progressed and as restrictions gradually eased, we have seen international traffic move close to 80% of pre-pandemic levels.

In a similar fashion, the positive developments on China reopening its borders since the start of this year give cause for optimism for the recovery to grow in that region too. As China does reopen, the wider world would do well to remember the comments of the World Health Organisation (WHO) with respect to the fact that travel bans are not effective in controlling the spread of the virus.

Airlines, like many other sectors, face significant macro challenges including inflationary pressures, the heightened interest rate environment, the rising price of oil and the strength of the US dollar. Significant infrastructural challenges have also emerged over the course of the year as capacity sought to ramp back up. To date, the sector has broadly managed to buffer itself against these challenges as the bounce back in demand has been so strong.

2022 was again another year of relatively low airline failures and it also had only a small number of formal financial restructurings. Some expect that we will see more failures over the coming 12 months, but it was ever thus. In a similar fashion, we have also seen the emergence of a number of new airlines in the past year, seeking to take advantage of clean balance sheets and ride the crest of the demand cycle.

Overall, the general view of participants is that while we may see some slowdown across parts of the world, pent-up demand and heightened determination and desire to travel, should mean that 2023 continues to see a strong global recovery, with Asia in particular driving significant growth and opportunity.

Aviation Finance

Having enjoyed a low interest rate environment for an unusually long period of time, it was no great surprise to see rates rise over the course of 2022. However, driven by the inflationary environment, the swift pace of the increases, and the expectation that more is to come, have caused issues for the sector. While rates are higher now than at any time since the global financial crash of 2008, they are not out of kilter with longer term historical norms.

The aviation finance market is adapting, but it will take time. The natural upward movement of lease rate factors is taking place, but as has been the case in the past, there is a lag in the corelation with the rising rate environment.

Determining relative value with respect to debt terms, for both lender and borrower has been challenging. This uncertainty has been an impediment to some transactions progressing.

Investment grade lessors wisely filled their boots at very attractive rates in the unsecured bond markets over the course of 2021 and this, coupled with the current market, has meant very little issuances took place last year. This will likely change over the course of 2023 as the leasing community goes back to that very important and deep well. The expectation is that, despite the challenges the sector has faced in recent times, its evident resilience and the continuing maturing of the sector should result in large well-run lessors achieving similar spreads to those obtained in the recent past.

On the other side of the capital markets, the aviation ABS market had a very muted year, having bounced back stronger and quicker than most had expected in 2021. A notoriously sentiment driven space, the challenges arising from the Russian invasion, coupled with the broader challenges of the wider ABS market, meant only a handful of deals executed last year. There were some green shoots towards the end of the year, but it remains to be seen if this important financing channel will return in a meaningful way in 2023.

Stepping into the breach to fill some of this gap has been the alternative lenders. Predominately private equity backed players have played an increasing role in financing aviation transactions and the expectation is that the importance of this funding source will continue to grow.

For the wider leasing community, the rate volatility has brought home the importance of hedging and liability management strategies. Those that have a capital structure based on a stacked maturity over a longer-term period will be better placed to manage the challenges of this environment. The volatile market has also highlighted the importance of being able to access multiple funding sources and the importance of growing and maintaining relationships across the financing field.

The Age of Leasing

Since its inception almost fifty years ago, the trend line for operating lease market share has only gone in one direction. Over the course of the pandemic, the support that lessors provided and the pivotal role they played in the survival of many airlines has deepened and strengthened relationships between lessors and airlines.

With a greater appreciation for the flexibility that leasing offers and with most airline balance sheets still suffering, lessors have taken on a greater importance in funding new deliveries.

The percentage of leased aircraft has broken past that 50% threshold, and it is likely that lessors are funding closer to 60% of new deliveries currently, either via their own order books or the sale and leaseback channel. The dominant view from industry leaders is that over the medium term, the overall percentage is more likely to move towards the 60% mark than to recede.

The resilience of the leasing model has been remarkable and was evidenced further by the ability of the sector to absorb the $7bn of publicised impairments that resulted from the Russian invasion and the subsequent loss of over 500 aircraft. The court battle with the insurers will likely run for years. While the episode has caused significant challenges, both in terms of the general insurance market and the overall perception of geopolitical risk, it was impressive in how the larger players with the greatest exposure were able to shoulder the significant financial impact.

The importance of scale has been a recurring theme in our discussions with industry leaders and there is a consensus that the importance of scale from a leasing context is likely increasing. As the leasing product becomes more commoditised, as lessors seek to chase the most attractive metal, scale will continue to be a differentiator. Those that can access the widest pool of debt and equity investors, that can control maintenance costs, that can maximise their purchasing power, are the ones that will be able underwrite larger transactions and grow faster.

This scale point has driven some material M&A over the course of 2022 and there is a belief that more consolidation is likely to take place in the near term. There will be room for other players in the market, but they will need to play smarter and potentially in more niche areas.

We have also continued to see new entrants into the leasing sector, though what has been interesting is that the more notable new entrants are those that come with a vastly experienced management team but also with a sizeable war chest behind them, either in the form of significant private equity backing or with the support of sovereign wealth.

Fleet & Freight Focus

Supply chain issues and related production delays continue to hinder the duopoly of aircraft manufacturers, Airbus and Boeing. Delays on the engine side have been particularly challenging as bedding in new technology has given rise to some entry-into-service issues.

That said, both their order books reflect the high level of demand for product (particularly with respect to narrow body, fuel efficient best sellers like the 737 MAX and the A320 neo families) and those seeking to access new orders will be waiting many years.

Even with increased production on both sides, we are seeing shortages in meeting demand, and this should, coupled with the overall inflationary environment, result in an uptick is asset values. Though worth noting that the counter to this is that some lease encumbered assets may suffer from lease rate factors that reflected the previously benign interest rate environment. For those with order books, the negotiation of escalation clauses and related caps will also be of significant importance.

The wider trading environment has suffered from the OEM challenges, as larger lessors delayed divesting plans as they are forced to wait on deliveries, and the hope is that this market can return to a greater level of efficiency over the course of 2023.

On the freighter side, the surge in demand during the pandemic has cooled somewhat, on foot of global economic challenges and the return of more widebody belly capacity into the market. However, it remains an attractive space, as reflected in both the orderbooks of the OEMs and in the challenges in obtaining P2F slots for conversion. There are mixed views as to whether there is a potential for oversupply to occur in the near term, but the broad consensus is that the step change in demand on the cargo side post-COVID will be materially sustained.

Eye on ESG

The carbon reduction challenge continues to loom large over the sector and all stakeholders acknowledge and appreciate the need for immediate action. 'Flight shame', the imposition of environmental related taxes and regulations, and the increased Environment, Social and Governance (ESG) focus of investors, are real concerns for the industry.

While aviation contributes around 2.5% of global CO_2 emissions, it's path to reducing its carbon footprint is less clear than that of some other sectors. Offsetting is one option for managing current carbon output, but it is an area that requires more oversight and regulation, and it is viewed more as a temporary rather than long-term solution.

The primary near-term bet is in relation to Sustainable Aviation Fuel (SAF), however there are significant challenges in terms of supply and cost. We have seen interesting partnerships being explored by some lessors in relation to SAF and a concerted and more joined up effort, across the entire sector, as well as from governments around the globe, is needed if SAF is to deliver anything close to what IATA hopes it will manage in the journey of carbon reduction.

The wider leasing community has also sought to play a great role in the ESG challenge, with Aircraft Leasing Ireland, the industry group that represents the aircraft leasing sector in Ireland, developing their Sustainability Charter over the course of 2022. There is an acknowledgment from the sector that it has an important role in reducing carbon output. There are no quick and easy fixes, but we are seeing lessors set ambitious sustainability objectives and they are looking to increase collaboration across the industry to help drive meaningful solutions.

In Closing

Overall, the industry outlook remains positive. The sector has weathered a shock like no other and has lived to tell the tale. The recovery and the resilience have been remarkable.

There are still macro headwinds on the horizon, but with the knowledge that the demand to travel and explore remains embedded within us, we sit on the verge of the next aviation cycle with a confidence that the sector can continue to thrive and grow.

I would like to thank all those who gave their time and insights, and I hope you enjoy the read.

Joe O'Mara
KPMG - Head of Aviation Finance

Chapter One

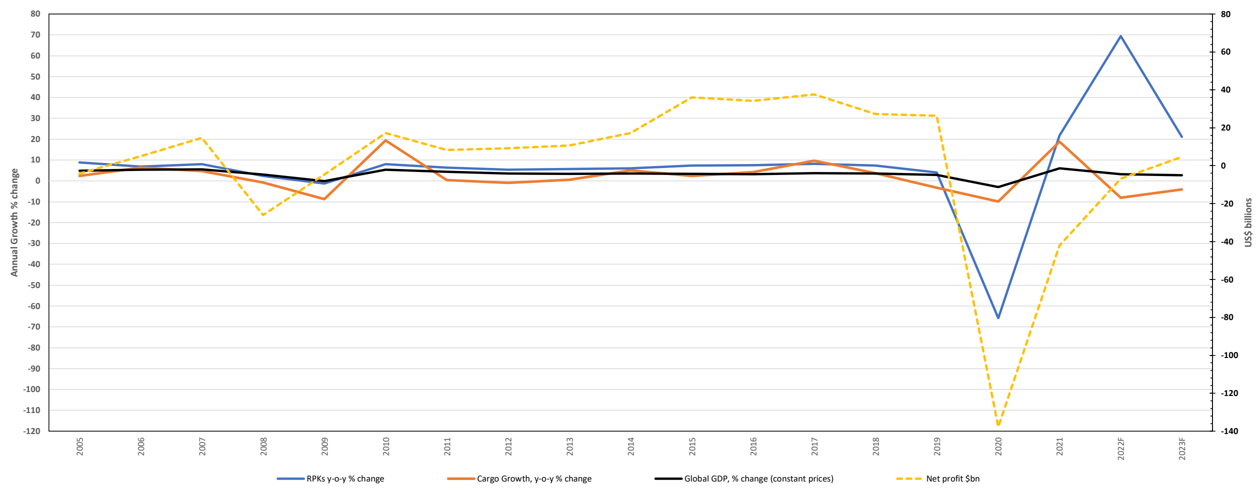
Airlines: Riding the Recovery

The recovery in the air travel market has been unsynchronous and unstable at times in the year since the end of pandemic-related travel restrictions but the trajectory is positive with the industry on track to return to full profitability in 2023.

The latest forecast from the International Air Transport Association (IATA) predicts a global profit of $4.6bn on revenues of $779bn in 2023. This muted forecast expects a slim operating margin for airlines of just 0.4% and a per passenger profit of just $1.1 but if the industry achieves these figures it will represent the largest and fastest recovery in the history of aviation. The global industry collectively lost $140bn in 2020, $42bn in 2021, and is on track for a $6.9bn loss for 2022. The losses seem severe but a return to profitability next year would represent a significant achievement considering the devastating impact of the pandemic and the fact that at the end of 2021, the industry was not expected to return to profitability until the end of 2023 or even into 2024.

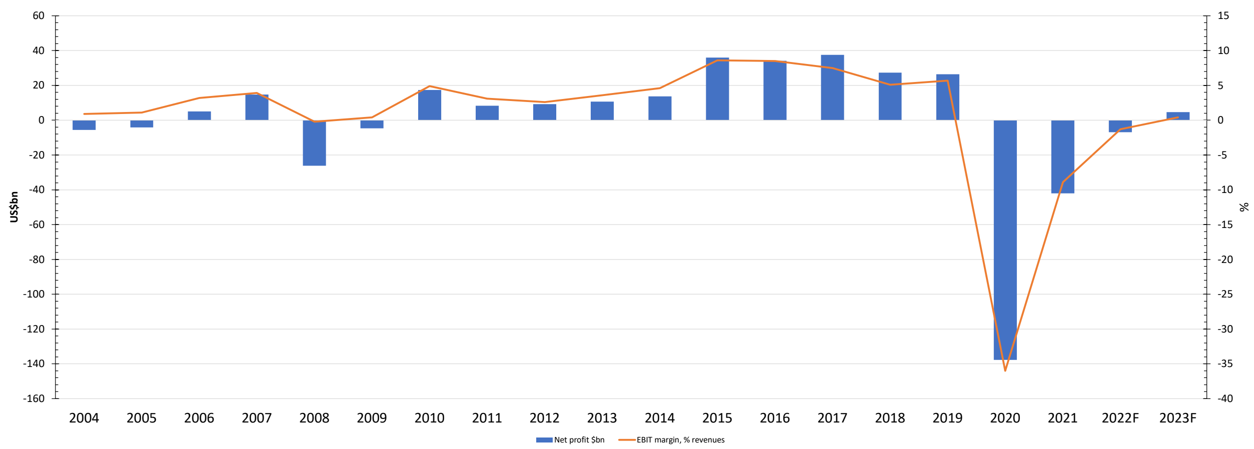
The charts on airline revenue and profitability show a positive trajectory for the aviation industry but 2022 has seen a significant amount of headwinds that will continue into the new year. Although there has been strong growth in air travel in many regions, there have been notable lags in the Asia-Pacific region and China. China's zero-COVID policy and stringent travel restrictions and quarantine requirements were in place for the majority of 2022 that deterred visitors and restricted travel outside of the country and around the Asia-Pacific region, denting traffic growth. Trans-Pacific, intra-Asia and Middle East routes to Asia were considerable reduced, with scheduled flights (measured in available seat miles (ASKs) barely reaching 30% of 2019 levels.

Some three years after the first COVID-19 case was reported in Wuhan, China finally began to ease its zero-COVID policy as discontent spread across the country. Policies changed rapidly within weeks, the government has now abandoned targeted lockdowns, testing, quarantine requirements and travel restrictions. Quarantine restrictions for inbound travellers to China will be



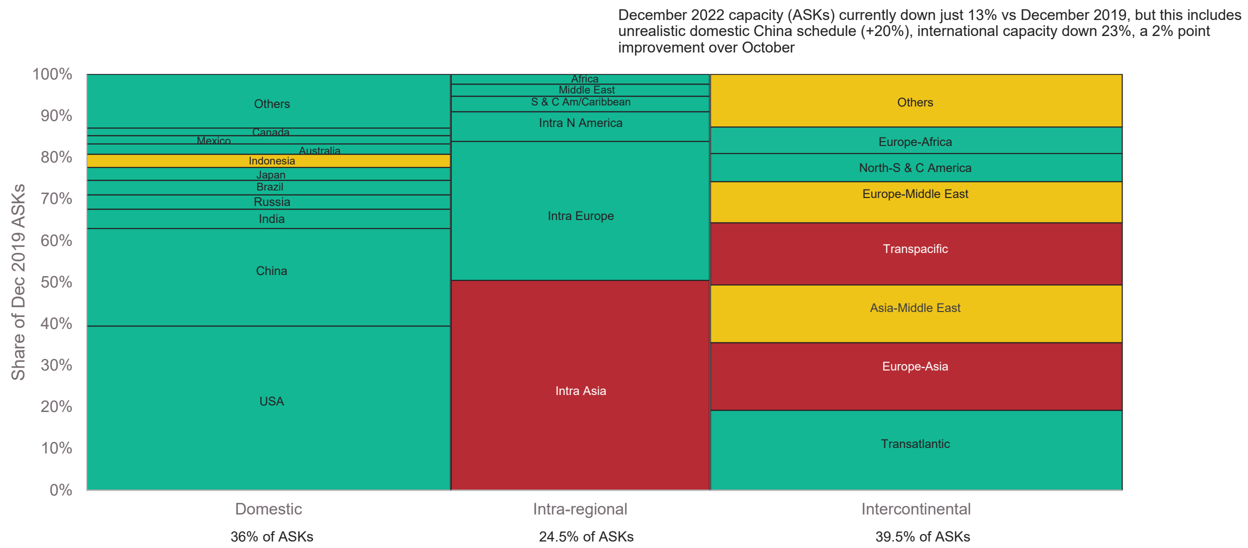
Source: IATA; International Monetary Fund, World Economic Outlook Database, October 2022

FIG. 1: WORLD ECONOMIC GROWTH, AIR TRAFFIC & AIRLINE PROFIT GROWTH



Source: IATA

FIG. 2: AIRLINE INDUSTRY NET PROFIT AND EBIT MARGIN



Source: Cirium Schedules data. Shading represents ASK change Dec 2022 vs Dec 2019 @ 28 Nov 2022. GREEN = less than 10% fall, AMBER = 10-30%, RED > 30%

FIG. 3: AIRLINE SCHEDULES – ASK CHANGE DEC 2022 V DEC 2019

lifted by January 8, 2023 and the country has resumed issuing visas for residents to travel overseas. Hong Kong too has lifted its remaining COVID restrictions. An early spike in bookings show Chinese tourists are eager to travel. However, with reports of rising COVID inflections and hospitalisations in China, certain jurisdictions have moved to impose entry conditions for travellers from the country – negative PCR test requirements for example – until they are able to better determine the potential impact of the rapid opening of China, mindful of a further untracked spread and possible new variant of the deadly virus around the world.

At the end of 2022, Japan, India, Italy, Malaysia, South Korea, Spain, Taiwan, the United Kingdom and the USA all announced new rules on travellers from China in response to rising cases. The EU is discussing certain controls but to date Italy and Spain have insisted on negative COVID tests for all travellers from China. Australia remains open to Chinese travellers without restrictions to date.

Such an abrupt reaction from countries around the world to the purported risk of a new wave of COVID cases is in keeping with the general reaction over the past few years to news of rising infection rates. In the first few months of 2023, these restrictions will likely dampen passenger numbers from China and curtail the rapid growth that the aviation industry has been waiting for that will revitalise the region.

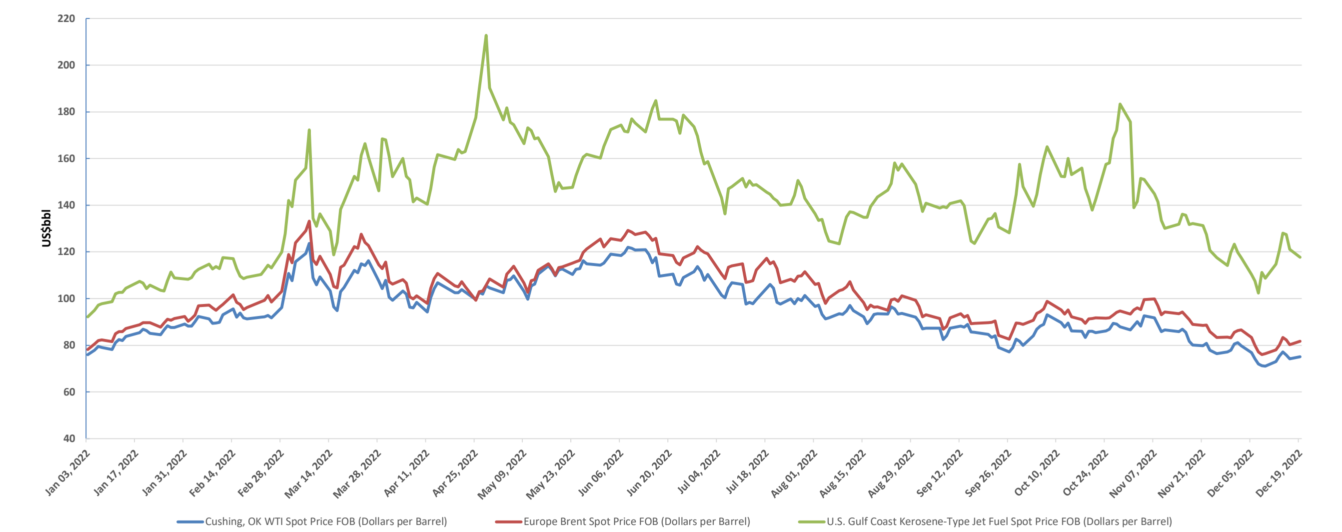
Willie Walsh, Director General of IATA, expressed his dismay at the new measures: "Several countries are introducing COVID-19 testing and other measures for travellers from China, even though the virus is already circulating widely within their borders. It is extremely disappointing to see this knee-jerk reinstatement of measures that have proven ineffective over the last three years," he said. "Research undertaken around the arrival of the Omicron variant concluded that putting barriers in the way of travel made no difference to the peak spread of infections. At most, restrictions delayed that peak by a few days. If a new variant emerges in any part of the world, the same situation would be expected.

That's why governments should listen to the advice of experts, including the WHO, that advise against travel restrictions. We have the tools to manage COVID-19 without resorting to ineffective measures that cut off international connectivity, damage economies and destroy jobs. Governments must base their decisions on 'science facts' rather than 'science politics'."

The restrictions will dampen demand out of China but once traffic starts to flow more freely again, airlines and lessors expect an immediate jump in demand for plane tickets and aircraft to serve the rise in customers.

From late February 2022, air travel was further disrupted by the outbreak of war in Ukraine, with flights to and from Russia banned by many countries that also introduced sanctions on Russia restricting all business with the country. The effective ban on overflying Russian airspace has impacted all airlines flying eastwards, none more so than Finnair. The airline, which had based its entire business plan on flying east from Helsinki into Asia, has been required to restructure its entire business model and flight schedules. Many US airlines also delayed resuming certain flights into Asia – United's Indian routes for example – due to the flight restrictions over Russia again impacting international travel growth. However, airlines in the Middle East have been benefitting from the gap in schedules by expanding their routes/frequencies into Asia and into India in particular, opening up a hub for Indian expats flying from the US to India via Dubai using Emirates.

Russian sanctions had the most grievous impact on aircraft lessors that had aircraft on lease to Russian carriers. At the time of Russia's invasion of Ukraine, around 500 aircraft owned by foreign lessors were operating in the country with an estimated market value of US$10 billion. Sanctions imposed by the EU and the US prohibited leasing assets into Russia, and all insurance policies were cancelled. Russian authorities then moved to prohibit the return of leased aircraft and allowed foreign-owned aircraft to be registered in Russia after Bermuda and Ireland suspended certificates of



Source: EIA

FIG. 4: OIL / JET FUEL PRICES 2022

airworthiness for aircraft currently in the country. The affected leasing companies have all since launched lawsuits to claim against insurance policies after failing to extract their aircraft from Russia using conventional means of repossession. Since the insurance companies are fighting the claims, a resolution to the issue may take years and in the meantime, most aircraft leasing companies have already written down the loss of the aircraft. (More on this in Chapter Three-Age of Leasing).

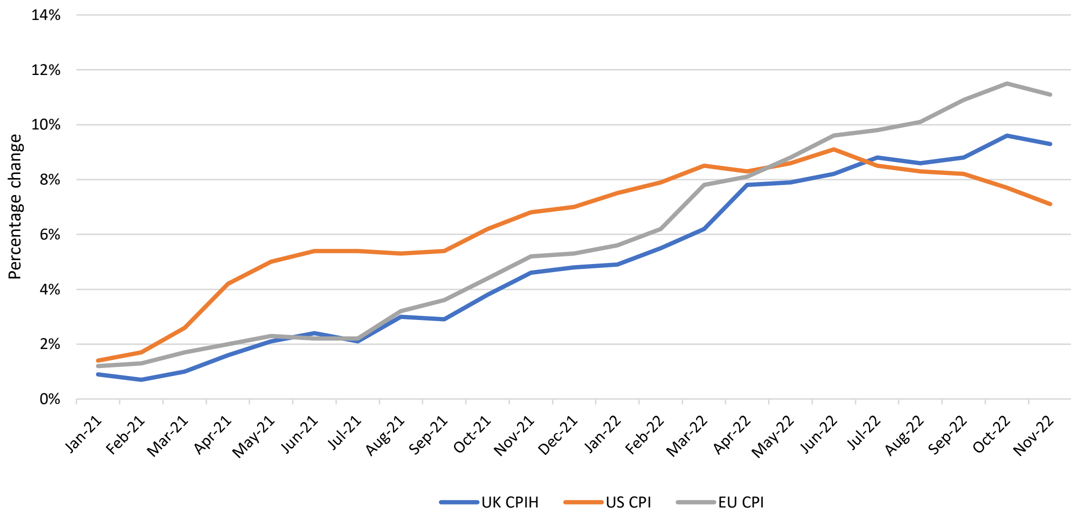
War in Europe created an energy crisis in many parts of the world as oil and gas prices rose significantly, sometimes threefold, increasing costs for businesses and individuals. Although prices cooled toward the end of 2022, the situation remains unstable. The oil price chart shows both the volatility of the crude oil price during 2022 but also the rising and historic high cost of jet fuel as refining capacity remained under pressure. The crack spread – the difference between a barrel of crude oil and the refined petroleum product – has been at a historically high level throughout the year, which has put pressure on airline fuel bills. Latest forecasts from the US Energy Information Administration (EIA) predict that the Brent crude oil price will average $92 per barrel in 2023. And although net global refinancing capacity is expected to continue to increase in 2023, according to the International Energy Agency's (IEA) June 2022 Oil Market Report, the price of a gallon of jet fuel remains significantly high and the drop in the crude oil price has done little to bring down fuel costs for airlines.

And although many are eager for the reopening of the Chinese market, a downside to that spike in air traffic growth will be an increase in demand for oil, placing further pressure on fuel prices for airlines. IATA figures show the airline industry fuel bill increased to $222bn in 2022 now accounting for 30% of total expenses, which is expected to remain the case for 2023.

The energy crisis is also impacting household incomes and pushing up inflation, which is increasing costs for all businesses and individuals, reducing purchasing power, pushing up interest rates and potentially dampening travel demand. The rise in inflation following the pandemic period was initially expected to be a short-term reset due to pent-up demand in spending, however geopolitical events and higher energy prices are continuing to filter into other product such as food prices and many analysts expect inflation to remain in double digits for a longer period. Central banks have reacted to the rise in inflation with a series of interest rate rises in quick succession during the last quarter of 2022. The decline in the global domestic product to around 3% from 6% in 2021 presents real challenges and many economies are expected to enter recession in 2023. With such economic pressures, rate rises are expected to continue.

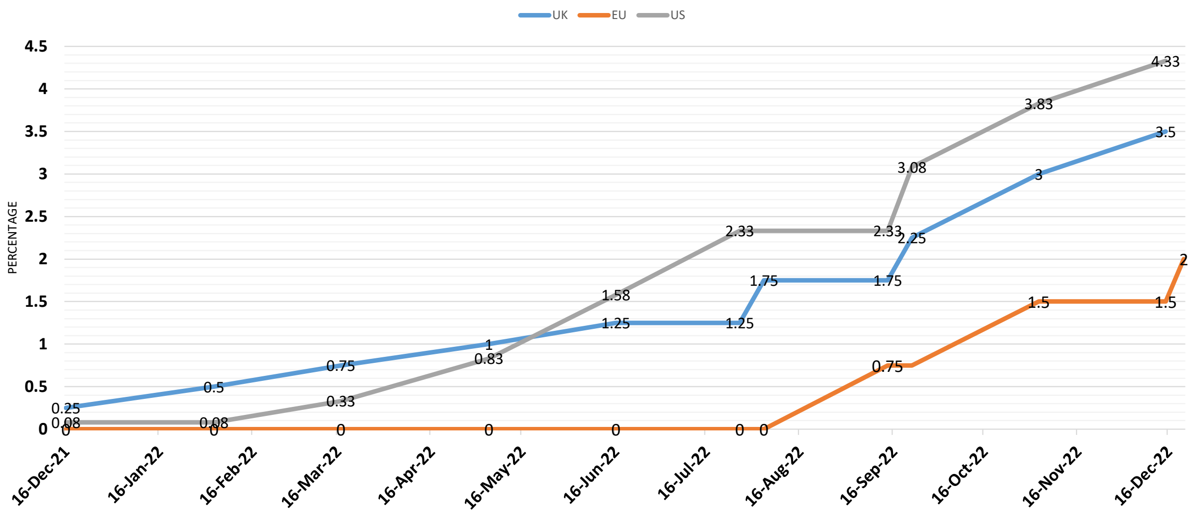
"Several countries are introducing COVID-19 testing and other measures for travellers from China, even though the virus is already circulating widely within their borders. It is extremely disappointing to see this knee-jerk reinstatement of measures that have proven ineffective over the last three years."

Willie Walsh, Director General of IATA



Source: Bank of England, Federal Reserve, European Central Bank

FIG. 5: INFLATION RATES 2021-2



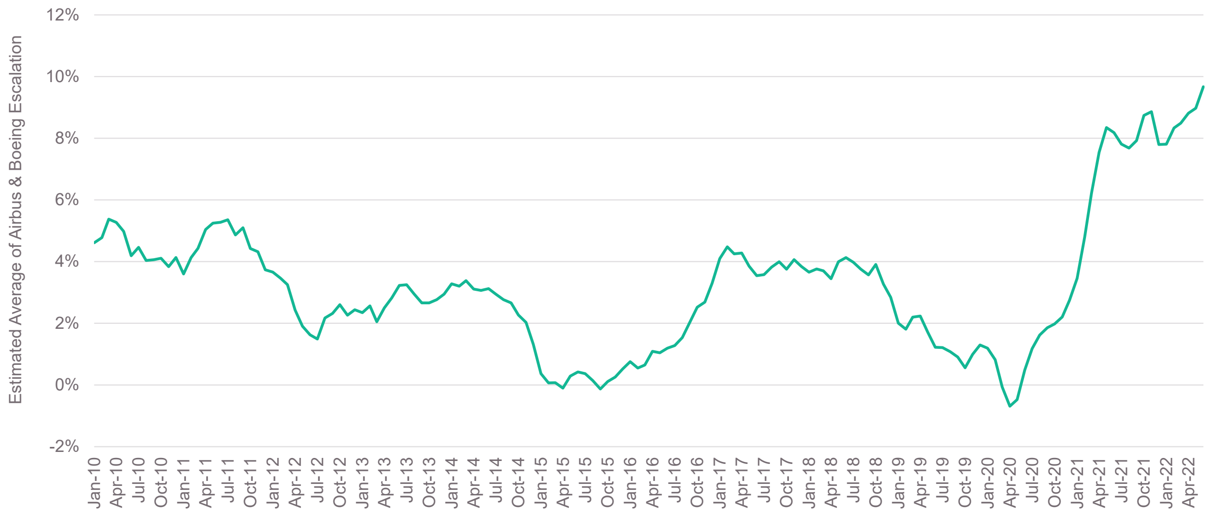
Source: Bank of England, Federal Reserve, European Central Bank

FIG.6: CENTRAL BANK INTEREST RATE RISES 2022

Greg Lee, Global Head of Transportation Banking at Goldman Sachs indicated that his colleagues in the macroeconomic forecasting area do not expect a recession in the US but are predicting a shallow recession in Europe and significantly slower growth in China, but he adds that even with a global economic slowdown, positive top line demand for air travel remains strong.

Rising interest rates impact all aviation companies pushing up borrowing costs as well as purchasing costs, which adds to the inflationary pressures. The rising rate environment has dampened borrowing in 2022 with issuance down on 2021 levels – although this is not surprising since the industry raised a record amount of funding over the past two years with many not in any rush to refinance in the volatile lending environment (more on this in *Chapter Two-Aviation Finance*).

Airlines have begun to resume deliveries of aircraft at a greater pace than the past few years but still fewer than expected as airframe and engine manufacturer production delays continue. As interest rates rise, escalation may become a real problem for airlines with aircraft on order without escalation protection policies in place. AerCap chief executive Aengus Kelly opined that some companies without AerCap's buying power may not have been able to demand competition escalation caps, particularly if they ordered aircraft in the last 12 months. He notes that timing of aircraft orders is critical. "You need to be thoughtful when interacting with manufacturers," he said during an interview with Joe O'Mara in December 2022 for this report. "There is a binary difference between ordering aircraft when the OEMs need you and when they don't need you. For those that have ordered aircraft in the past 12 months, their escalation protection will be nothing like what it would have been two or three years ago, for example we ordered 50 NEOs in March 2020 when no one was ordering aircraft."



Source: Ascend Analysis of Federal Reserve Economic Data

FIG.7: OEM CONTRACT PRICE ESCALATION ESTIMATE

Conversely, lessors and operators that are selling aircraft are benefitting from the rising inflationary environment and are reporting an uptick in asset values when they sell.

As the world's largest aircraft lessor, AerCap sells a lot of assets and Aengus Kelly confirmed that the company had printed "some very strong gains" from aircraft sales in the third quarter of 2022 in particular. However, Kelly added that the asset sales were constrained by a noticeable lack of capital from the effective closure of the asset-backed securitisation (ABS) as a means of funding aircraft (more in *Chapter Two*). "We have found that if you are selling block of assets of around $250 million you still find pretty competitive tension, so long as you know where the buyers are and which assets they are looking for – that comes with experience, market knowledge and execution prowess," says Kelly. He added that AerCap was selling more aircraft to airlines than it ever had before due to a lack of available aircraft from the OEMs. "For the first time in our history, we are selling more airplanes to airlines than to non-airline buyers because they believe Boeing and Airbus won't be able to deliver on schedule for a significant period of time. The airlines knew the manufacturers wouldn't hit their production targets, which is why they are buying the 17/18-year-old aircraft they never thought they would be buying because they need to be certain they have lift."

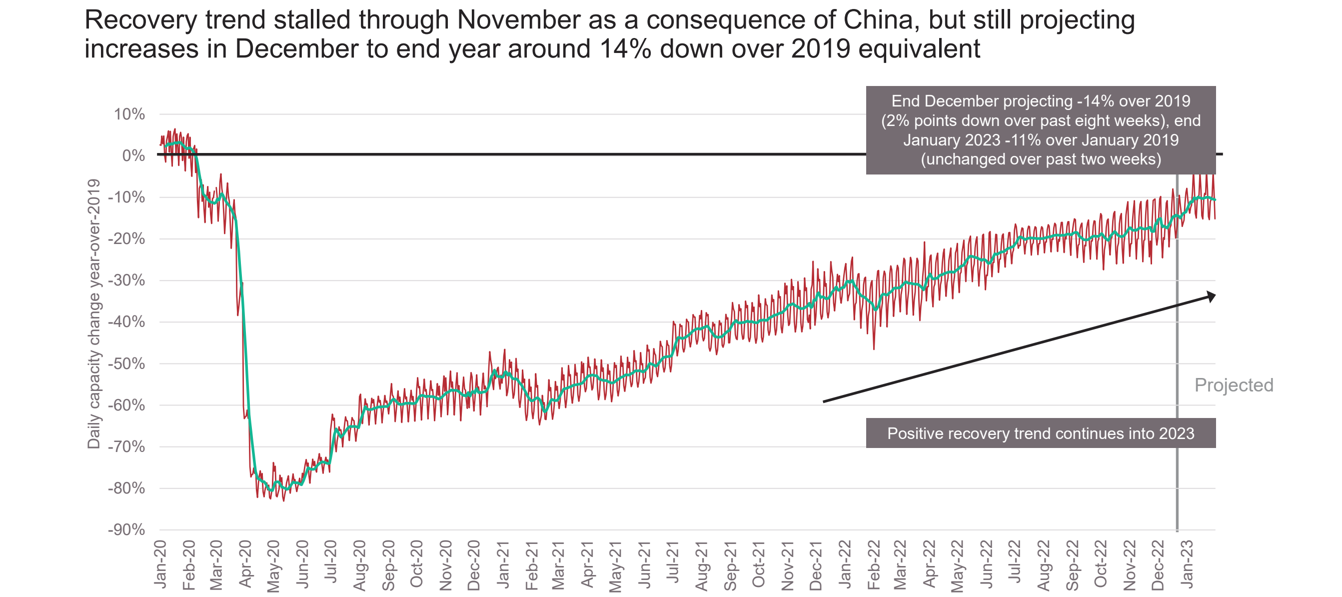
Higher inflation is also feeding into higher lease rates, which are rising but more slowly due to in part to the competitive environment. Higher lease rates are bumping up costs further for airlines that have pivoted more towards leasing assets during the pandemic as they monetise existing assets to raise much needed liquidity. As airlines work to reduce their significant debt burdens, leasing will likely remain a key avenue for accessing capacity and retaining flexibility especially in a more volatile operating environment.

The pent-up demand released after restrictions eased surprised many and airlines struggled to put in place the capacity to service so many passengers. As Kelly notes, new deliveries continued to be delayed causing airlines to shop around for older assets and even turned to wet leasing aircraft as labour too remains in short supply.

The air travel recovery period revealed significant infrastructure issues for airlines around the world. Labour shortages impacted all aviation companies but the most pressing shortages are with pilots, cabin crew, air traffic controllers in the US, and globally airports have struggled to cope with the ramp up in air travel with shortages of security staff and ground handlers. Last minute flight cancellations characterised the spring and early summer period as airlines and airports struggled to

"If you are selling block of assets of around $250 million you can still find pretty competitive tension, so long as you know where the buyers are and which assets they are looking for – that comes experience, market knowledge and execution prowess"

Aengus Kelly, CEO, AerCap



Source: Cirium Schedules, data filed 18 December 2022, 2021-2023 change is over 2019 equivalent

FIG.8: DAILY CAPACITY CHANGE, FORWARD SCHEDULES (Y-O-Y OVER 2019)

staff and board planes on time. In July, the shortage of staff and services prompted London Heathrow to impose a daily capacity limit of 100,000 passengers per day to reduce delays through the airport, which lingered throughout the busiest summer season to October 2022. Fed by the rising cost environment, strikes have also characterised the latter half of 2022 with airport workers, pilots and cabin crew around the world staging industrial action mainly in disputes over pay and working conditions.

Inflation is also feeding into higher maintenance costs for airlines, which are still bringing parked aircraft back into service. Capacity is in such short supply that certain airlines that were determined to phase out larger aircraft – such as the A380 – have brought those back into service to cater to the rise in demand over the summer period due to the lack of new aircraft deliveries. Lufthansa announced in June that it was bringing its A380s back into service for summer 2023. The German flag carrier had 14 A380s held in long-term storage – it has since sold six but has eight remaining, which it plans to utilise to fill a gap until its new A350s, 787s and 777-9s are delivered over the next three years. Singapore Airlines too has brought two of its eight A380s out of storage, with Etihad moving to resume service on four of its 10 A380s by summer 2023. The largest A380 operator Emirates is bringing back its aircraft with many have been retrofitted with new premium economy seating boosting the revenue-generating potential and to service a rise in demand for premium seats.

The lack of new aircraft has served to restrict capacity growth in 2022. The recovery in the US has been significant with North American carriers on target to realise profits of $9.9bn for 2022. Passenger demand is expected to continue to accelerate into 2023 with a predicted 6.4% growth forecast, which will outpace capacity growth at 5.5%. US carriers are all bullish on growth rates for 2023, with strong forward bookings after a record summer period.

Although European carriers are expected to post a loss of $3.1bn for 2022, a predicted 8.9% growth in passenger demand will likely be curtailed by the 6.1% forecast capacity growth. Ryanair has bucked the trend for the region, however, reporting a strong summer with capacity now at 115% of pre-pandemic levels. Speaking on an earnings call on November 7, Ryanair chief Michael O'Leary said that traffic was up 11% in the September quarter on the back of a 12% increase in capacity, with fares jumping by 15%. Although he added that he didn't expect that to continue over the quieter winter quarter, he did note he has been surprised at the strength of forward bookings into the holiday period: "Christmas looks strong, both at volume and at the average fare level and this weekend's bookings were stronger than the previous weekend's bookings which is remarkable, given all of the kind of coverage of recession, inflation, consumer price pressures." Despite the bullish outlook, Ryanair was still forecasting a loss of between €100-200 million for the winter period but with a positive outlook heading into summer 2023.

Asia-Pacific growth remains muted, held back by the closure of China, but with travel now expected to resume after restrictions have been lifted in the country, capacity demand will soar. Prior to the announcement that Chinese restrictions would be lifted, IATA forecasted passenger growth for Asia-Pacific of 23.4% with capacity growth of 21.1%. These figures are now expected to be much higher despite the resumption of entry requirements for Chinese travellers in response to reports of rising COVID cases in China.

Although Middle East carriers have benefitted from re-routing as a result of the war in Ukraine, collectively they are expected to post a loss of $1.1 billion in

2022, with a return to profit next year. In 2023, passenger demand growth of 23.4% is expected to outpace capacity growth of 21.2%.

Profitability is also forecast to evade Latin American carriers until 2024 with capacity growth of 6.3% in 2023 on the back of a predicted 9.3% rise in passenger demand. African carriers too will not repair profitability levels until into 2024 although capacity is also predicted to rise by 21.9% with passenger growth exceeding 27%.

"It has been a tough year for the whole aviation industry, no matter the jurisdiction," says Helane Becker, managing director, Cowen. "We think about airlines as winning the pandemic and losing the recovery. With strikes in Europe, delays in the US, and a lag in the recovery in Asia, it has been difficult to fly anywhere in 2022, although it is starting to get better."

Becker points to all of the headwinds mentioned above from interest rate rises to labour shortages and aircraft production delays, as "conspiring to keep a lid on how much capacity can grow in in 2022 and probably how much it will be able to grow in 2023". She notes that despite IATA predictions, some airlines estimate that the industry won't get back to "whatever normal is for four or five more years because of these issues".

That said, Becker expects airlines, specifically the US carriers that she covers, to have a better 2023 since demand remains strong and air fares remain high with capacity constrained. Airline stocks, however, show a more pessimistic picture, she says, and have "behaved as though we are already in recession" with share prices back to 2020 lows even though airline revenues are more than 60% back to 2019 levels. "We believe that 2023 airline revenues are going to be close to 2019," says Becker. "In 2019, some 2.5 million people travelled every day in the US – one million domestic and 1.5 million business and international travellers - and earlier this year number reached 2.2 million even though business travel remains half pre-pandemic levels and international travel is down 60%."

With these numbers and the fact that outbound US air travel is elevated in part due to the strong US dollar, Becker forecasts greater revenues from the return of more international and business travel in 2023 for US carriers even though the recent stock prices may assume otherwise.

United Airline chief executive officer, Scott Kirby, commented in an earnings call in October that the airline was "firing on all cylinders" and that he was optimistic for 2023 and the longer-term. American Airlines too remains

"We believe that 2023 airline revenues are going to be close to 2019. In 2019, some 2.5 million people travelled every day in the US – one million domestic and 1.5 million business and international travellers - and earlier in 2022 this number reached 2.2 million even though business travel remains half pre-pandemic levels and international travel is down 60%."

Helane Becker, Cowen

confident for the next year, with CEO Robert Isom stating in October that he expects demand to remain robust but notes that the airline is keeping a close eye on the macroeconomic environment and will adjust plans if necessary. Delta Air Lines CEO Ed Bastian points to the countercyclical recovery the travel industry is experiencing. "Global demand is continuing to ramp as consumers shift spend to experiences, businesses return to travel and international markets continue to reopen. Demand has not come close to being quenched by a hectic summer travel season. At the same time, industry supply is constrained by aircraft availability, regional pilot shortages, and hiring and training needs."

Acknowledging the main headwinds, United's Kirby also pointed out several tailwinds assisting the airline, including the fact that several jurisdictions were only just reopening from COVID – Japan and eventually China – and the constrains on capacity increases relating to labour shortages, airports and ATC infrastructure constraints that will take years to resolve fully. He also said that there had been a permanent structural change in demand due to the flexibility of hybrid working. "With hybrid work, every weekend could be a holiday weekend. That's why September, a normally off-peak month was a third strongest month in our history. People want to travel and have experiences, and the hybrid work environment untethered them from the office and gave them the new found flexibility to travel far more often than before."

Kirby noted the resurgence in business travel, which for United rose back to 80% of 2019 volumes. "Business traffic for long-haul segments across the Atlantic has recovered at a faster pace than domestic," he said. "It's our observation that a Zoom meeting is simply less practical in a global setting. We remain optimistic that business traffic will continue to get better from this point forward. Our traditional view on business traffic recovery rates relative to 2019 may now be obsolete measurement, given the changes in how customers now travel in a remote work environment or business and leisure trips often are combined."

American Airlines, which has posted a profit for the past two quarters, is also reporting the same recovery in business travel. "Leisure and business revenue remain incredibly strong, again, surpassing 2019 levels in the third quarter," said CEO Robert Isom. "Demand for small and medium-sized businesses and customers traveling for a combination of business and leisure continue to outpace the recovery of managed corporate travel."

Many airlines are seeing a resurgence in demand for business travel on long-haul trips and more airlines have been adding premium economy seats to capitalise on that demand even in leisure travel for more comfort on longer trips.

Outside of the US, the strong US dollar is a further headwind for airlines. Most currencies lost value against the dollar in 2022 – some more than others – which is adding further cost pressures to airlines already struggling to resume operations. Moreover, the risk of repatriating earnings from emerging markets increases in such an environment. IATA estimates that the airline industry had $1.9bn in blocked funds in 2022 – a quarter of which are in Nigeria – which is expected to rise in 2023. Total airline funds blocked from repatriation in Nigeria are $551 million, said IATA. Repatriation issues arose in March 2020 when demand for foreign currency in the country outpaced supply and the country's banks were not able to service currency repatriations. However, Nigerian authorities have been engaged with the airlines and have had some success in releasing some funds.

A further headwind to airline profitability may also be found in future costs and taxes relating to the industry's commitment to net zero CO2 emissions by 2050. (This issue is explored in more detail in *Chapter Five-Eye on ESG*).

The air cargo market has been the bright point in the aviation market since the onset of the global pandemic and the growth of eCommerce. However, growth cooled during 2022. From growth of 18.8% in 2021 with 65.6million cargo tonnes transported, air cargo commanded some 40% of total airline revenue in 2021 compared to the pre-pandemic range of between 10-15%. In 2022, air cargo growth dropped to 8% below 2021 levels with 60.3 million tonnes transported and a 28% share of total airline revenue. Cargo traffic has been impacted by the global economic slowdown in global GDP and there is a general consensus that the boom in export orders seen in 2021 has now stabilised. Sanctions against Russia, the war in Ukraine and China's zero-COVID policy all helped to suppress cargo traffic added to which the shipping capacity has repaired over the course of 2022 while belly capacity has been steadily growing cannibalising some of the dedicated cargo traffic.

IATA forecasts that air cargo revenue will fall back further still to about 20% of total revenue – some $150bn – on the back of softer demand and lower yields. Analysts also predict that there could be excess cargo capacity in 2023 that will put further pressure on yields. Despite the forecasts, air cargo remains an area of focus for lessors that are investing in conversions and dedicated freighter fleets while global logistic companies are creating new cargo airlines to capitalise on demand. MSC Mediterranean's MSC Air Cargo and Maersk Air Cargo (a takeover of Star Air) were both launched in 2022 by their shipping conglomerate parent companies. (More detail on the air cargo market can be found in *Chapter Four: Freight and Fleet Focus*).

"Business traffic for long-haul segments across the Atlantic have recovered at a faster pace than domestic. It's our observation that a Zoom meeting is simply less practical in a global setting. We remain optimistic that business traffic will continue to get better from this point forward."

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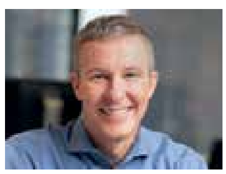


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Start-up airlines

Despite the significant headwinds, airlines continue to offer an enticing prospect for many investors. Throughout the pandemic period and now into the recovery, new passenger airlines have continued to be established. The addition of new start-up airlines to the market is a familiar trend following a downturn. Intrepid entrepreneurs seek to take advantage of the gaps in the market made by the demise of certain airlines and by the apparent weakness of surviving airlines weakened by the pandemic and constrained by heavy debt burdens. New airlines begin with a clean balance sheet with little debt and have been able to take advantage of the favourable lease rates and terms offered by lessors keen to place aircraft in a depressed market. With the return of air travel those more competitive packages such as low rate power-by-the-hour lease terms diminished as the industry recovered during the course of 2022 but the competitive environment ensures leasing remains attractive to start-up carriers even as rates are rising.

Emerald Airlines, which operates out of Dublin and Belfast using a fleet of 14 ATR72s, is one such new airline that owes its very existence to the global pandemic. "The concept for Emerald Airlines was formed in May 2020 when we decided to pitch for the Aer Lingus Regional network franchise," said CEO Connor McCarthy. "After we won, we started to put the airline together and received our AOC in September 2021 and took our first flight in February 2022. After a hectic 20 months, we are now settling into the business of making a few dollars in this crazy world of aviation in 2023."

The collapse of the previous operator in 2021 created the need for a new partner for Aer Lingus Regional Network franchise and, with the return of air travel in 2022, this requirement was brought forward a full 12 months as AerLingus and BA CityFlyer needed to re-deploy their A320s and E190s to their own network recovery.

For McCarthy, the creation of the airline was only possible because without the impact of the pandemic on the incumbent airlines since they would have remained strong enough to continue operating the franchise. "IAG and Aer Lingus chose Emerald and our leadership team based on their historic performance at other airlines," said McCarthy. "Other airlines may have had stronger balance sheets. Another factor that went in our favour was not only the wide availability of aircraft, but also availability of skilled extremely skilled airline professionals, from engineers to pilots, to cabin crew to operational specialists following the pandemic."

Emerald has performed well since its launch, capitalising on the strong, pent-up demand to fill planes but the new airline has not evaded the problems related to the sudden return to travel. "The demand is there; the money is there; people have an innate need to travel, which they have shown in 2022," he said. "The main challenge last year was the infrastructure - many third-party handlers, third-party catering companies, for example, let go of a lot of their resources that just didn't come back. We have seen an easing of that pain in the last few months, but we have also established our own ground handling at our Dublin hub and our own catering/delivery service."

In the video interview with Joe O'Mara, McCarthy notes the importance of the delicately balanced air travel ecosystem, which relies on 20-plus activities working in harmony from aircraft maintenance through to air traffic control, that is only now back to "about 85% of where it should be". He said: "The travelling public gave the industry a pass in 2022 because they realised how decimated airlines were due to the pandemic and due to certain government restrictions on air travel, but we won't have that for 2023 and we have to be back to 100% this year."

Another, larger scale, beneficiary from the post-pandemic aviation industry environment is Arajet, which started up operations in 2022 from its base in the Dominican Republic. Arajet announced its arrival as the Caribbean market's first ultra-low fare airline, headquartered in Santo Domingo, in March 2022, with a mission to make air travel accessible to travellers to and from the Dominican Republican, the Caribbean, and North and South America, while building the most convenient commercial transportation hub in Latin America, strengthening and facilitating air traffic between the Americas. An estimated 2.2 million people of Dominican descent live in the United States – a significant diaspora marketplace that Arajet intends to serve.

Arajet, led by founder Víctor M. Pacheco Méndez, operates an ultra-low-cost carrier business model and is financially backed by Bain Capital Special Situations (Bain Capital) and Griffin Global Asset Management (Griffin). The airline also has the support of the Dominican government and VINCI Airports. Commenting on the operating environment during and following the pandemic, Griffin chief executive officer Ryan McKenna noted that the current environment is structurally advantageous for low-cost carriers and new airlines. He remains cautious to the long-term health of airlines that survived the pandemic period but which are now heavily levered. "Our view is that it is only a matter of time until those airlines that took on additional capital to survive during the pandemic will need to restructure," he said in a video interview with *Airline Economics* and KPMG conducted in New York in October 2022. "It will be very difficult for airlines to compete with carriers that have already gone through those processes to fundamentally change their cost structure, as well as renegotiate their labour contracts, fleet, and outstanding debts."

McKenna believes that low-cost carriers structurally have an advantage in the current operating environment, including start-up carriers with clean balance sheets. "We are big believers in newly-capitalised businesses that have strong support from institutional investors and the manufacturers and manufacturers with the scale to succeed," he says. McKenna also favours state-backed carriers although admits that they warrant careful analysis since not all state-backed carriers can be considered safer investments since some have been allowed to fail.

McKenna is confident that demand has returned and pricing data for the summer has been truly "remarkable" but he doubts that this is sustainable with the economic the headwinds facing the industry. "Our industry has been so incredible resilient that there is the sense that these issues too will pass," he says, "but I think this next period is going to be particularly challenging. We conduct in-depth analysis on the ability for certain airlines to survive over the longer-term, with volatile oil prices, rising interest rates,

FIG.9: AIRLINES LAUNCHED IN 2022

Airline	Country
Emerald Airlines	Ireland
Akasa Air	India
FlyArna	Armenia
Bonza	Australia
Ultra Air (not yet certified)	Colombia
Surcar	Spain
Niceair	Iceland
FlyBe (relaunched)	UK
Aeroflyer	Canada
Equair	Ecuador
Céleste	France
Air Congo	Democratic Republic of Congo
Air Alderney	Channel Islands
Fly Jinnah	Pakistan
Q-Airways	Pakistan
Aeroitalia	Italy
Silk Avia	Uzbekistan
JetSmart Perú	Peru
Wizz Air Malta	Malta
Fly Dhaka	Bangladesh
L'Odissey	Switzerland
Air Astra	Bangladesh
Kuva Air	Zimbabwe
Southwind	Turkey
Jet Airways	India
Air Connect	Romania
Jetlines	Canada
RIA	Saudi Arabia
Arajet	Dominican Republic
FitsAir	Sri Lanka
ValueJet	Nigeria
Aeroexpress Regional	Hungary
Antigua Airways	Antigua and Barbuda
Marabu	Germany
Air Samarkand (Sam Air)	Uzbekistan
MSC Air Cargo	Switzerland
Maersk Air Cargo (Star Air)	Denmark

inflation and a strong dollar, along with the tense geopolitical environment. It's unclear how the consumer will respond in a slowing economic environment and how airline business models will perform over the coming years."

Directly related to the headwinds already noted is the rising cost and availability of capital – for equity and debt. McKenna points to the delayed impact of this factor on airlines and all businesses. He says: "The question is how long it takes for business models to adjust to the rising cost of capital because you cannot simply just pass that along to the without affecting passenger demand over a longer period of time." He also notes that fewer investors are bidding on RFPs, inflation is pushing up lease rates and asset prices, and escalation on OEM deliveries is a real issue. "Many escalation formulas were agreed to in some cases 10 years ago and in other cases just two years ago but all of them will result in higher prices for newly-delivered aircraft. Over time, we believe that this will shift the whole curve of aircraft values upwards, but that takes time to adjust." These factors and more all have to be included when considering airline risk and deploying capital.

Weaker airlines and those concerned over the possible erosion of market share have looked to merge with their peers, pending regulatory approval. Avianca and Viva announced their intention to merge in April but Colombia's Aeronautical Authority rejected the application in November since it concluded it would stifle competition. The airlines are appealing the motion but it demonstrates that mergers are never easy option and are certainly not the quickest. The main merger news that dominated the summer of 2022 was the battle for Spirit Airlines fought out between Frontier Airlines and JetBlue – the latter emerging as the victor after a very public tousle for shareholder support. In October, Spirit Shareholders approved the merger with JetBlue for $3.9bn. Spirit confirmed in an SEC filing in December that the two airlines had responded to request for additional information from regulators in September and that they still expect the merger to be approved and the deal closed "no later than the first half of 2024". Should the merger be approved, JetBlue would attain control of 9% of the US marketplace.

FIG.10: AIRLINES THAT CEASED OPERATIONS IN 2022

Airline	Country
Comair/Kulula.com	South Africa
aha!	United States
Blue Air	Romania
Airleap	Sweden
EGO Airways	Italy
Tel Aviv Air	Germany
GCA Airlines	Colombia
AB Aviation	Comoro
Kamchatka Airlines	Russia
Genghis Khan Airlines	China
Air Choice One	United States
Tchadia Airlines	Tchad

FIG.11: AIRLINES THAT ENTERED BANKRUPTCY PROTECTION OR VOLUNTARY RESTRUCTURING IN 2022

Airline	Country
Scandinavian Airlines (SAS)	Scandinavia
Hong Kong Airlines	Hong Kong
Finnair (voluntary reorganisation)	Finland

The Indian market has seen more success in terms of M&A activity in 2022. In December, Singapore Airlines (SIA) agreed with Tata Sons to merge Air India with Vistara. Going ahead, SIA will invest $250 million in Air India gaining a stake of 25.1% in the enlarged Group while Tata Sons will hold 74.9% stake. The new Air India is estimated to be valued at $1bn. The merger is expected to be completed by March 2024, subject to regulatory approvals.

The enlarged Air India group comprises Air India, Vistara, AIX Connect (formed by the merger of AirAsia India and Air India Express), thus making Air India the second-largest airline in India in terms of fleet capacity and market share. Through this transaction, SIA will reinforce its partnership with Tata and immediately acquire a strategic stake in an entity that is four to five times larger in scale compared to Vistara. The merger is expected to bolster SIA's presence in India, strengthen its multi-hub strategy, and allow it to continue participating directly in a large and fast-growing aviation market.

AirAsia has also had a dramatic reorganisation in 2022. The holding company was rebranded as Capital X, with all of its airline carriers moved under one AirAsia Aviation Group comprising: AirAsia Malaysia, AirAsia Thailand, AirAsia Philippines, and AirAsia Indonesia, as well as AirAsia X Malaysia, AirAsia X Thailand and eventually the newly-launched AirAsia Cambodia created as a joint venture with Sivilai Asia. AirAsia India having already been sold to the Tatas in November. The reorganisation followed the company's successful exit from a financial restructuring in March 2022 that was carried out using a Malaysian Scheme of Arrangement. Over the course of the year, the airline and its many advisers successfully renegotiated debts and leases with multiple Malaysian and international banks, plus 14 operating lessors (AerCap, Aircastle, APALG, Aviator, BOCA, Carlyle, Castlelake, DAE, Deucalion, ICBC, Kayan, Macquarie, Minsheng and Skyworks) as well as UK Export Finance, Airbus and Rolls-Royce, covering 30 A330 aircraft.

Foong & Partners acted as Malaysian law Scheme counsel while Bird & Bird (Singapore branch) acted as English law restructuring counsel and aviation counsel. Seabury was the financial advisor and V2 Aviation provide the technical advice.

This Scheme of Arrangement was a first of its type airline restructuring in Malaysia, involving multiple creditors, including those mentioned above as well as trade creditors, Malaysian Airports and thousands of passengers. Despite what was described as "very significant haircuts" on the debts, the vast majority of the voting creditors voted in favour of the scheme and were given a right of profit share in the airline's future profits.

Lion Air Group - which operates several airlines including Lion Air, Wings Air, Batik Air, Batik Air Malaysia and Thai Lion Air – also completed a restructuring last year using a French restructuring scheme. After several months of negotiations under the aegis of the court-appointed administrators, bilateral agreements were reached with the group of lessors, which together owns 30 aircraft and engines, enabling the Paris Commercial Court to validate an exit from the proceedings without the need to present a continuation plan and by extinguishment of liabilities – a so-called extinction du passif. This consensual and innovative contractual exit made it possible to carry out the €1bn-plus restructuring involving multiple international lessors, whilst preserving the confidentiality of all individual bilateral agreements. Watson Farley & Williams Paris advised the group of lessors.

Also in the region, Air Seychelles entered administration in October 2021 where it worked to restructure its debt relating to its ongoing participation and obligations under a securitisation of loans to various Etihad Alliance partner airlines (including Air Seychelles) with an aggregate value of $1.2bn. Air Seychelles successfully exited administration in November 2022.

It is clear that the risk dynamic of the aviation industry has changed and become more concerning over the course of 2022. However, industry leaders remain optimistic, albeit cautiously so, heading into 2023. The prime reason for such optimism is the continued and demonstrated resilience of the aviation industry and the determination of people to travel and experience the world.

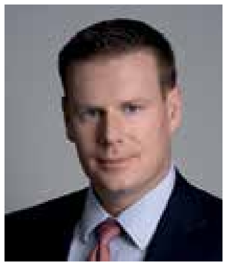
"We have experienced a number of periods in the past of high and rising interest rates, high inflation and a strong dollar but airlines have always powered through," said John Plueger, chief executive of Air Lease Corporation (ALC), speaking to *Airline Economics* and KPMG in a video interview in New York in October 2022. "There will be some pain and some airlines will go bankrupt – they always have – aviation is not a pure investment grade industry. But we have seen all of these challenges before and we have the tools as lessors to deal with the new environment."

Airline bankruptcies and restructurings have continued in 2022 with many smaller airlines ceasing trading and there have been two large-scale notable new filings for bankruptcy protection with Scandinavian Airlines (SAS) filing for Chapter 11 in the US and Hong Kong Airlines entering a Scheme of Arrangement in the UK and Hong Kong. However, several airlines have now restructured and successfully resumed trading with sleeker and more sustainable debt profiles. LATAM Group successfully completed its financial restructuring in the United States in October 2022 raising $2.8bn in the process (more detail on LATAM DIP-to-Exit financing in *Chapter Two - Aviation Finance*).

Although airline bankruptcies are an expected feature of the aviation industry, Plueger notes that the geopolitical situation is more uncertain and admits that the seizure of the Russian leased fleet was unforeseen. Despite the challenges of high inflation and lower GDP, he is confident that travel demand will continue. "There has been a very clear trend over the last five years, especially with younger people, that whatever money they have to spend, they tend to favour spending it on travel and experiences opposed to widgets and goods," he said. "That will continue. While these global macroeconomic factors are certainly something to be carefully watched, this strength in the passenger travel recovery will continue – and demand is accelerating on all fronts."

"Many escalation formulas were agreed to in some cases 10 years ago and in other cases just two years ago but all of them will result in higher prices for newly-delivered aircraft. Over time, we believe that this will shift the whole curve of aircraft values upwards, but that takes time to adjust."

Ryan McKenna, CEO, Griffin



Chapter Two

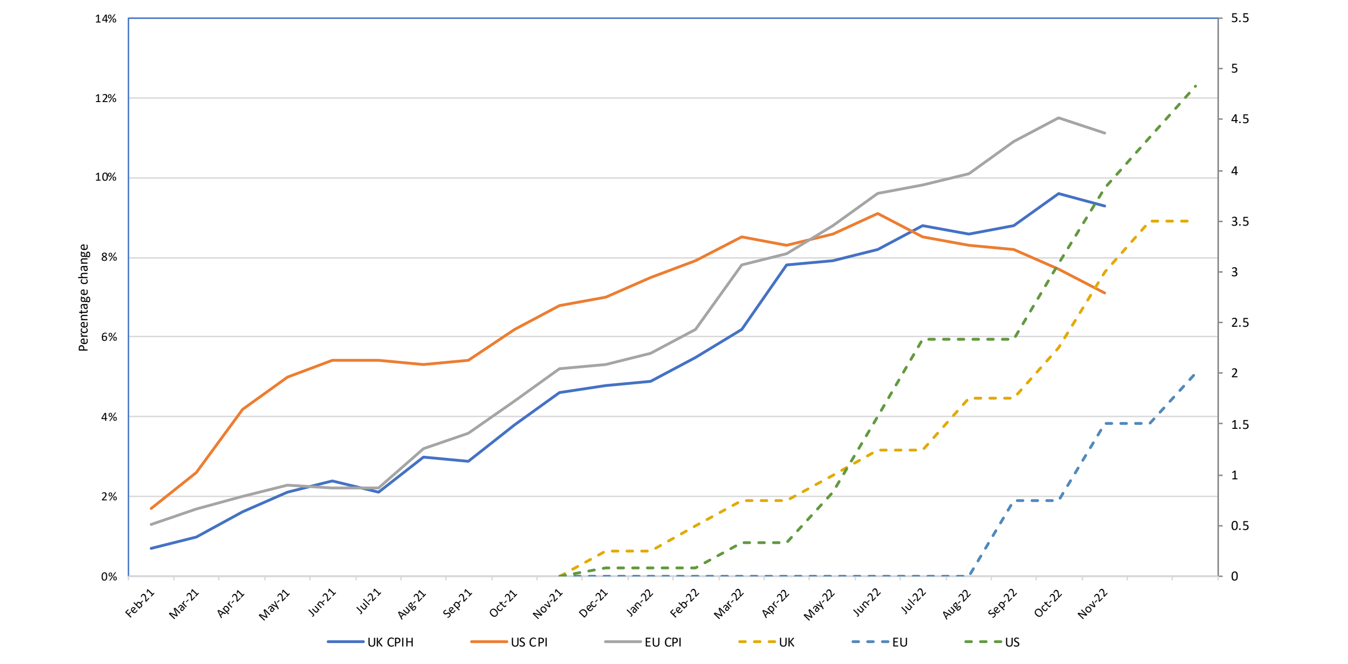
Aviation Finance

After a record year for aviation finance in 2021, the increased cost of capital came as a shock to many seeking to raise funds in 2022. As well as being more expensive, capital also became accessible toward the end of the year. Inflation has been steadily rising since countries began to exit pandemic lockdown measures but spiked following the Russian invasion of Ukraine and continued to rise until the fourth quarter of the year when oil prices started to cool slightly. Central banks reacted to curb inflation by increasing interest rates in steeper increments than markets had expected.

At the end of 2022, interest rates in the US were 4.5%, in the EU rates rose to 2%, while the UK Bank of England interest rate finished the year at 3.5%. The consensus is that further rate rises are expected for 2023 while inflation is being brought back under control. Goldman Sachs predicts that the short end of the interest rate curve will be as high as 5-5.25% but could increase further should rising inflation threaten to push the US into recession. The EU and UK are expected to fall into a shallow recession this year but interest rates in both regions are expected to continue upward. The market is predicting that the Bank of England base rate will rise above 4% in early 2023 and as high as 4.6% by July 2023. Rate rises in the Eurozone are expected but in smaller increments.

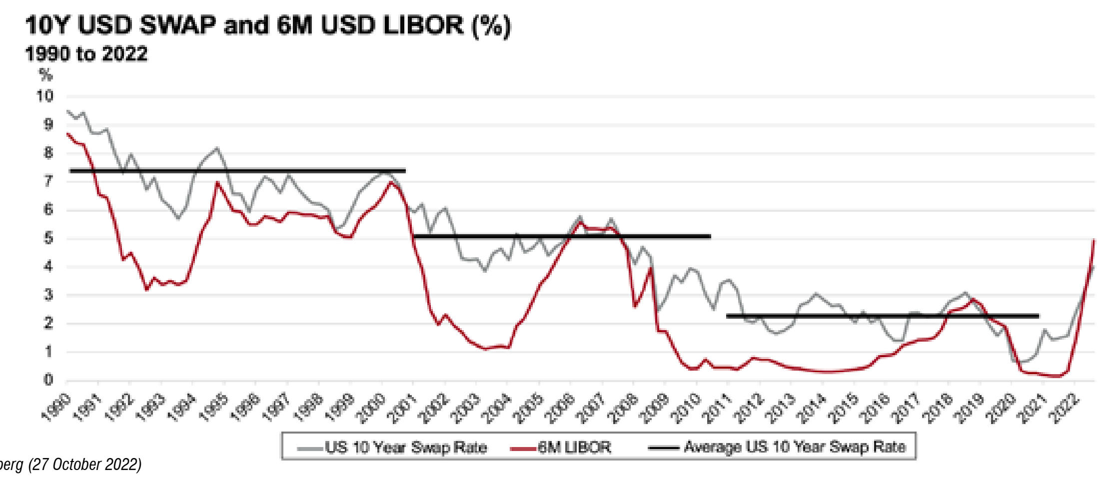
Even though interest rates are now rising and at their highest level since the global financial crisis in 2008, at between 4-5% they still remain very low when viewed over a longer time horizon (see chart).

Although rate rises were expected, the real issue concerning investors has been the flat and inverted yield curve – which tracks the gap between long-term and



Source: IATA; International Monetary Fund, World Economic Outlook Database, October 2022

FIG.12: INFLATION & CENTRAL BANK INTEREST RATE RISES 2021-2



Source: Bloomberg (27 October 2022)

FIG.13: HISTORICAL INTEREST RATE ENVIRONMENT

short-term government borrowing rates – that often is a harbinger of a recession. In the US, a so-called "yield-curve inversion" occurred in April 2022 for the first time since 2019. The chart below shows that the US Yield Curve remains inverted for short, mid, and long-term maturities.

"Concerned that interest rates are rising very quickly, colleagues in our macroeconomic forecasting area are focused on the shape of the yield curve," said Goldman Sachs' Greg Lee. "On the short end of the curve, rates are expected to be 5%-plus, the unknown is where whether the long end of the curve will continue to be inverted around the low 4%. We are watching developments very carefully since an inverted curve is a relatively negative signal in terms of the demand for capital."

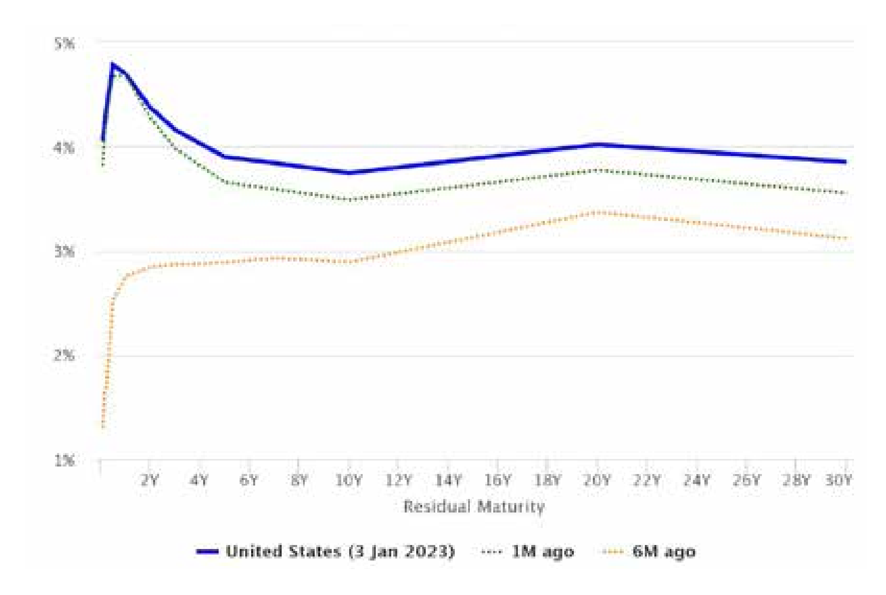


FIG.14: US YIELD CURVE (JANUARY 3, 2023)

Lease rates are expected to rise, with many lessors already indicating an uptick (see *Chapter Three-The Age of Leasing*), but it will take some time for them to catch up with rising interest rates to return that equilibrium with the debt markets.

For the aviation sector, rising interest rates and the increased cost of debt will – and indeed need to – feed into lease rates eventually but there is always a delay due to the long-term nature of the aircraft lease products. Lee says that although some lessors will be able to cope with rising interest rates, others may struggle. "Lessors with a capital structure based on a stacked maturity schedule over a five or seven-year period would only need to refinance one seventh of their debt stack in any given year, which is a good pattern to follow alongside strong capital allocation and a good liability management strategy," he says. "The problem for lessors that have too much debt coming due at once with long-term rates, is that if they are not hedged appropriately, they could get caught out where the return on equity implied by the lease rates is not generating a sufficient return for their shareholders."

Hedging is a sound financial tool used to flatten out interest rate rises and, until the volatility ends and the rate rises stop or become more predictable, this will become a more feasible solution for many more companies. Vinodh Srinivasan, Managing Director, Co-Head of the Structured Credit Group at Mizuho, notes that it is the volatility which is pushing out credit spreads for aviation issuers. "Because investors have uncertainty around what the Fed might do with regards to rates, they're building in a cushion into the credit spread, which is then unfairly penalising the issuers because it's not reflective of what their true credit spreads should be," he says. "It's totally understandable from an investor perspective, but that's just piling on a level of debt cost that's unsustainable."

AerCap's Aengus Kelly agrees that without adequate hedges in place, certain lessors will be exposed to interest rate rises. "Lease rates increase with interest rates – and we have seen that happening over the past 10 months on new aircraft and it is almost instantaneous – on older aircraft there is generally a few months lag to catch up," he says. "That's a pretty small impact but interest rate rises also feed into your funding structure, for hedged businesses like AerCap, your exposure occurs when your liabilities mature. For example, if we have $5 million of liabilities maturing in a year, we will also have approximately $5million of assets repricing in that year to offset the interest risk. Companies that aren't hedged will be in a very tight spot. Those that were playing the yield curve and funding the business with three-month floating money, will inevitably be hurt badly."

For CALC CEO Mike Poon, like many of his peers, maintaining a diverse

"The problem for lessors that have too much debt coming due at once with long-term rates, is that if they are not hedged appropriately, they could get caught out where the return on equity implied by the lease rates is not generating a sufficient return for their shareholders."

Greg Lee, Goldman Sachs

CHART 13: TOP TEN AIRCRAFT LESSORS (BY PORTFOLIO VALUE)

AIRLINES

Date	Issuer	Size (m)	Tenor	Maturity	Rank	Spread to T/ MS	Coupon
12-Jan-22	Wizz Air	€ 500	4	Jan-26	Senior Unsecured	MS+105	1.00%
14-Jan-22	Korean Air Lines	¥30,000	3	Jan-25	Senior Unsecured		0.45%
12-Jan-22	Singapore Airlines	US$600	7	Jan-29	Senior Unsecured	180	3.38%
20-Jan-22	VistaJet (Malta)	US$1000	8	Feb-30	Senior Unsecured	461	6.38%
20-Apr-22	VistaJet (Malta)	US$500	5	May-27	Senior Unsecured	526	7.88%
18-May-22	Air New Zealand	AUD 300	4	May-26	Senior Unsecured	240	5.70%
18-May-22	Air New Zealand	AUD 250	7	May-29	Senior Unsecured	300	6.50%
10-Aug-22	Allegiant	US$550	5	Aug-27	Senior Unsecured	446	7.45%
15-Sep-22	Korean Air Lines	$300	3	Sep-25	Senior	90	4.75%
20-Oct-22	Air New Zealand	NZ$100	5.5	Apr-28	Senior Unsecured	190	6.61%
11-Oct-22	LATAM	US$450	5	Oct-27	Senior Unsecured	1085	13.38%
11-Oct-22	LATAM	US$700	7	Oct-29	Senior Unsecured	1094	13.38%
09-Nov-22	Spirit Airlines	US$600	3	Sep-25	Senior Unsecured	MS+405	8.00%

LESSORS

Date	Issuer	Size (m)	Tenor	Maturity	Rank	Spread	Coupon
05-Jan-22	Air Lease Corp	US$750	5	Jan-27	Senior Unsecured	MS+220	5.85%
05-Jan-22	Air Lease Corp	US$750	10	Jan-32	Senior Unsecured	MS+102	2.20%
12-May-22	BOC Aviation	US$300	5	May-27			4.33%
28-Nov-22	Air Lease Corp	US$700	5	Dec-27	Senior Unsecured	MS+142	2.88%

funding strategy is critical, particularly during a downcycle. "Lessors may have different strategies but for CALC, our strategy is to maintain a diversification of funding sources," says Poon. "We will try to maintain each of our funding sources; we maintain the channel and maintain a relationship with a different kind of funding or financing. CALC has long-established diversified onshore and offshore financing channels over the years. Poon adds that thanks to its diversified funding sources, CALC can also consider switching to RMB financing "when appropriate and favourable."

The tense macroeconomic environment has served to increase the cost of funds for leasing companies and airlines alike. In 2021, top-tier leasing companies were able to raise five-year senior unsecured debt at an all-in rate of around 2-2.5%; today that number reaches 6% although it peaked above 7% in mid-2022. Airlines have been able to tap the commercial bank market for significant amounts of unsecured debt at what Lee describes as "decent levels" at around 200 basis points, whereas issuing in the capital markets would have been "a hundred, 150, and sometimes 200 basis points wide of those levels".

The capital markets are a deep and renewable source of funding, which were being used increasingly by aviation companies with issuances peaking in 2019. The capital market also provided a lifeline for airlines and lessors during the pandemic, with record amounts of debt raised in 2020 and 2021. In 2022, the rising rate environment increased the cost of debt became unattractive and many companies pivoted back to the commercial banks for access to more efficient capital.

Greg Lee sees this as another step change for the sector: "In general the aviation sector had fed mostly on relationship bank lending but that really started to change in the early to mid-2010s, cresting into 2020," says Lee. "In the three to five years going into 2020, peaking in 2019, it was interesting to see investment grade leasing company paper starting to trade at levels that were much closer to a triple-B bond index. In fact, lessors were able to access the capital markets at much better rates than provided by the bank market. Now we're seeing a reversion back to that period where the bank markets were more efficient."

There was the sense that prior to the pandemic, the investment grade leasing sector had matured and companies had demonstrated their stability relative to airlines. However, the global pandemic and particularly the Russian seizure of leased aircraft have served to reverse those years of hard work. "Aviation is being penalised based on its recent history of severe pandemic crisis and the Russian invasion of Ukraine," says Lee. "The capital markets have assumed that the aviation sector is volatile and cyclical in nature and so have priced in a risk premium in addition to the fundamental sector risk. The equity markets are also ascribing a lower valuation multiple to the sector. You can see that in the way that airlines trade – not on their price equity but more on an enterprise value (EV)-to-cash flow or EV-to-Ebitda. In general, airline multiples have traded lower than other comparable businesses in a larger corporate bonds or corporate equity index."

Issuance of even the most liquid capital markets product – investment grade, senior unsecured, non-amortising bonds – has been limited during 2022. Wizz Air kicked of airline issuance in January 2022 with a €500 million 1.000% four-year Reg only bond offering at midswaps+105bps. This early issuance attracted an orderbook in excess of €3.3bn and achieved the lowest coupon for an airline issuance in the post-pandemic period. Singapore Airlines (SIA) also issued into the US dollar bond market at the start of the year with an offering for $600million 3.375% seven-year Reg-S senior fixed rate notes due 2029. There have been more airline issuances last year (see Debt Capital Markets Issuance 2022 table) but pricing has widened as the headwinds build up over the year, but lessor issuance has been considerably reduced.

Boeing was noticeably absent from the capital markets in 2022 but this was unsurprising considering the huge sums it has raised over the past two years in this channel at very low rates and with

long tenors. Brian West, CFO of Boeing, commented in November at an investor conference that the company has "no plans to raise any kind of capital from either the debt or the equity markets. We don't need to. As we close this year, we expect to have around $17bn of cash on hand, that's between $7bn and $9bn higher than historical baselines."

Investment grade lessors often issue in this market once a quarter in a normal year, or once a year in large quantities – $1bn issuances became common the pre-pandemic period. But for the few companies that entered the market, they found that pricing was much higher by the second quarter. Air Lease Corporation (ALC) came to market twice in 2022 – once in January, ahead of the rapid change in monetary policy, with $1.5bn of 2.200% five-year and 2.875% 10-year senior unsecured notes; and once again in late November with $700 million 5.85% five-year senior unsecured medium-term notes (coupled with a $400 million five-year unsecured term loan that closed in December).

Although ALC has been able to tap into the bond markets, the two issuances were well timed – one just ahead of the tightening of monetary policy in February and the other closer to the end of the year when the markets began to show signs of easing. Speaking to *Airline Economics* and KPMG in New York in October, chief executive of ALC, John Plueger, commented: "Classically we have tapped into the public bond markets for the vast majority all of our funding and quite successfully. And we will continue to do so but now is also a time when we can use other resources – such as the $7 billion unsecured bank facility with very attractive financing that runs out for several years, which remains largely unfunded. In recent months, several banks have approached us with offers for more term loans and other banking products, which we will evaluate."

Plueger goes on to stress the importance of demonstrating to investors, rating agencies and the market the company's "broad depth of funding sources" and its lack of dependency on a single or few sources of financing. He notes that it was the perfect time to deepen the company's banking relationships. "We have always funded in the public markets and we will continue to do so, but there's no gun to my head to do that right now. We can use this period as a chance to expand our debt portfolio, maybe additionally through bank means – the Middle East is a huge source of potential funding capability today, for example."

ALC also has the advantage of a skilled treasury team that, as Plueger says, is "spectacular at maximising ALC's position in debt funding".

AerCap has been a prolific issuer in the bond market but didn't go to market at all in 2022 but the lessor did raise $4.5bn outside of the capital markets with compelling pricing. "There are other forms of financing besides the bond market," says Kelly. "Many debt investors have a glass half full mentality but they witnessed the worst possible stress the industry could have. The world stopped flying. It doesn't get any worse for aviation or for any business when there is no revenue coming in but the demand for aircraft rapidly recovered as did the demand for AerCaps bonds, demonstrating the durability of AerCap and the aircraft leasing industry."

BOC Aviation chief executive officer, Robert Martin, speaking in Singapore in November, said that although the lessor was a major issuer in the corporate bond market, he has also seen a renewed strength in the commercial bank debt sector. "We have 50 banks in our banking group," he said. "We just closed a $500 million facility in that market rather than using the corporate bond market where secondary rates have been pushed up by the rise in interest rates."

There is a core group of aviation banks that have been steadfast supporters of the industry throughout the many cycles over the decades. But in recent years, bank regulation has served to increase their cost of capital and in some cases reduced their capacity for aviation debt. Over the past year, airlines and lessors have leaned heavily on their banking relationships to raise financing at a more efficient rate than the capital markets. However, this may only be sustainable for the very top tier credits and those with those all-important existing banking relationships, and then financing may only for certain assets since many banks are moving toward imposing more sustainable financing goals with a focus on new technology only. Even with a stunted recovery, growth predictions for the industry show that passenger demand will exceed capacity in 2023. The industry needs new aircraft, and once those productions delays are ironed out, the industry will also require the return of a more sustainable and plentiful source of capital. "The bank market is not a regenerating market; the amount of capacity that you can get from the bank market is relatively fixed. Once you tap it, it will take some time before it can regenerate," says Lee. "The bond markets are a much deeper and regenerating source of capital."

The bond markets may provide a deeper pool of capital but investment grade lessors have been able to tap into the bank market, particularly SMBC Aviation Capital, which raised US$2.54bn five-year syndicated facility to partially fund its acquisition of Goshawk that closed successfully at the very end of 2022 (more on this in *Chapter Three-The Age of Leasing*). The SMBC Aviation Capital financing comprised a $1,830 million term loan and a $710 million revolving credit facility – upsized from a base size of $1.5bn on the back of strong investor interest despite the volatile market. The deal attracted 32 banks in total – 20 of which are new relationship banks for SMBC Aviation Capital. This was the largest funding transaction in the aircraft leasing sector in 2022 and one of the largest ever unsecured banking loan transactions conducted by a lessor in the Asia loan market. Citi and New Zealand Banking Group acted as joint global coordinators to a syndicate of Asia-Pacific, European and North American lenders.

Other significant bank transactions in 2022 include JetBlue's $3.5bn 364-day senior secured bridge acquisition facility to fund its bid for Spirit Airlines, the Apollo-led consortium's $1.9bn financing for its acquisition of Atlas Air, and LATAM's debtor-in-possession-to-exit financing that comprised a $1.1bn Term Loan B facility in addition to the $11.15bn senior notes piece.

JetBlue's bridge facility – led by joint global coordinators Goldman Sachs and BoA that were also bridge lenders with BNP Paribas, Credit Suisse, Credit Agricole-CIB, Natixis and SMBC – is secured by the TrueBlue loyalty programme along with certain slots, JetBlue's brand as well as certain aircraft and engines. The flexible facility, priced at SOFR+300bps with a 50bps step up every 90 days, allows for subsequent take-out financings (including loans and debt securities) based on the most efficient markets and collateral at the specific time.

"We have always funded in the public markets and we will continue to do so, but there's no gun to my head to do that right now. We can use this period as a chance to expand our debt portfolio, maybe additionally through bank means."

John Plueger, Air Lease Corporation

Structured secured debt products have become a favoured avenue for aircraft financing over the past decade, but none more so than Enhanced Equipment Trust Certificates (EETC), which first appeared in the late 1990s and have continued to evolve. EETCs have always been an efficient way for airlines to finance new aircraft deliveries. But the rising interest rate environment coupled with the drop in demand for new funding since airlines raised record volumes of liquidity during the pandemic using other means, effectively reduced the airline EETC channel in 2022. Some deals have closed, however.

In March, Sun Country closed a $188.277 million EETC in two classes of notes on a private placement basis, arranged by structuring agent and lead placement agent Goldman Sachs. The $142.83 million nine-year A notes have an LTV of 55%, a WAL of 5.1 years and priced with a 4.84% coupon and UST+270bps, while the $45.447 million seven-year B notes have a 72.5% LTV, 4.2 WAL and priced at 5.75% with a spread to treasuries of +360bps. The notes are secured on an all-737-800 portfolio with an average age of 11 years. The transaction is reported to have been well received by investors, achieving a blended cost of 5% in a volatile market.

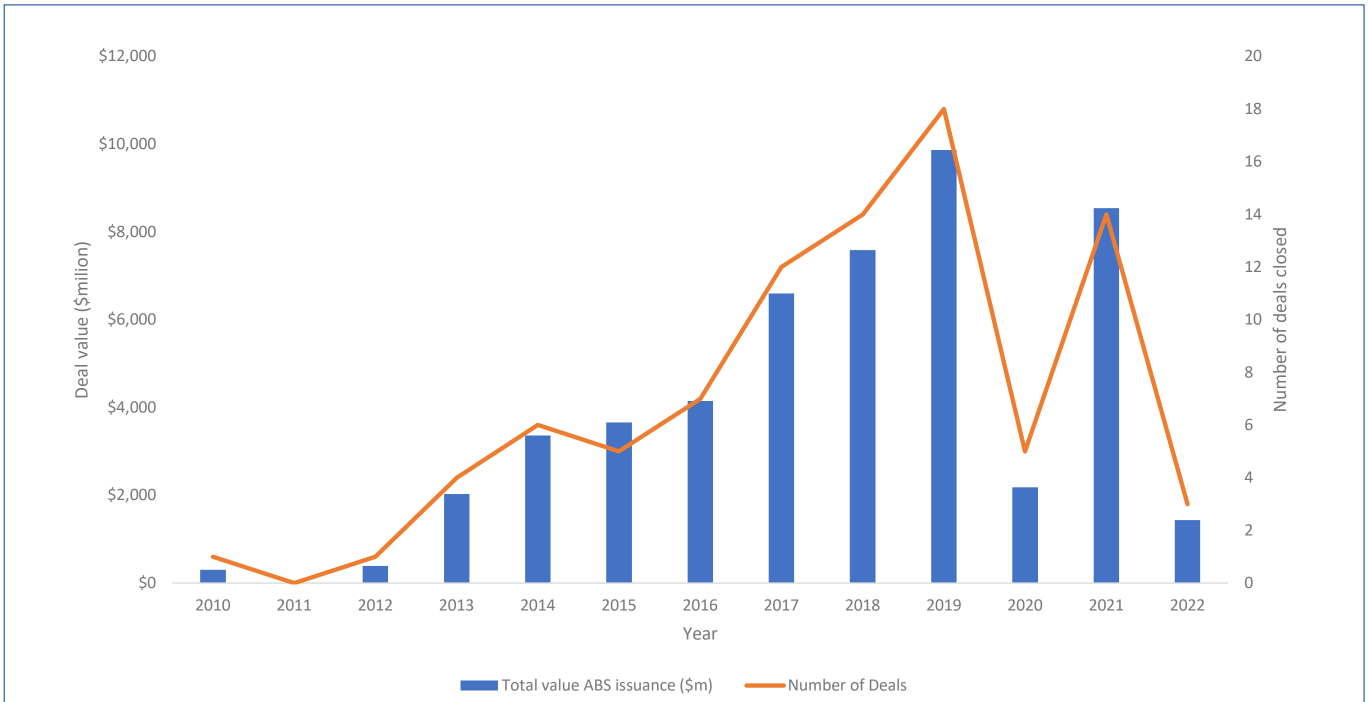
Vista Global, under VistaJet Malta Finance, raised $287.5 million through an EETC offered in two classes comprising $250.5 million A notes and $37 million C notes. The notes were secured on a portfolio of 17 business jets and despite the market volatility in August, Vista achieved a blended coupon across both classes of notes of 7.14%. Citi was the sole structuring agent on the deal.

In September a new issuer came to the EETC market when WheelsUp priced its inaugural transaction a $270 million single Class A tranche at 12.00%, which was secured on a large portfolio of 134 corporate jets.

IAG-owned airlines, British Airways (BA) and Iberia, both utilised the EETC market in 2022 using sustainability-linked structures joined with Japanese Operating Lease with Call Options. BA has used a similar structure in 2021 but now both airlines have raised financing using this product.

In April, Iberia entered the market with a $322.987 million sustainability-linked EETC with JOLCOs to finance five aircraft – three A320neos and two A350-900s – that comprised two tranches: a $260 million Class A notes, with a 13.7 year tenor and 57.4% LTV; and a $62.987 million 102. Year and 71.2% LTV Class B notes. Under the sustainability structure, the certificates are tied to a pre-determined fuel efficiency target of 69.0 gCO2/pkm for the FYE 2025. Should the airline fail to reach this target, the coupons of both classes will increase by 25bps. This transaction, arranged by JPMorgan, was the first sustainability-linked EETC to be funded in the private placement market. BA followed with a similar private deal, arranged by Citi, raising $299.57 million to fund two new A320neos and two new A350-1000s again using a single A tranche, with an LTV about 70%, WAL of 8.2 years and a 13-year tenor.

US carriers are notably absent from the EETC market but as mentioned they have been using available cash to purchase aircraft thanks to their very substantial cash positions. Helane Becker recalls that United CFO Gerry Laderman commented at the 2022 *Airline Economics* Growth Frontiers Dublin conference that he was in the process of writing checks to pay cash to buy aircraft which he has never done before. In December, he reiterated this point following the airline's bumper order for 100 787s, and exercised options for 44 737 MAX aircraft to arrive between 2024 and 2026 and 56 more of the MAX planes in 2027-28. "We will have the luxury of actually using our own cash flow to pay for these aircraft or finance them



Source: Airline Economics Research

FIG.16: AVIATION ASSET-BACKED SECURITISATIONS (ABS) DEAL VOLUME AND VALUE 2010-2021

to the extent that we find capital markets financing attractive," Laderman said on a media call.

United ended the third quarter of 2022 with over $20bn of liquidity, including an undrawn $1.75bn revolving credit facility. Speaking on an earnings call in October, Laderman notes that such a high liquidity cushion allows the airline to "maintain flexibility as we meet the uncertainties that remain in our industry". United paid for almost all of its aircraft delivered in 2022. Laderman noted that "every aircraft purchased for cash today increases our pool of unencumbered assets, which further protects our future".

Becker says that having the novel ability to purchase aircraft with their own cash is "true for most airlines" particularly those in the US with very substantial cash positions. "They are using cash and taking penalties to pay down debt speedily," she says. "Instead of refinancing their debt, they're using their cash to work down the debt. As interest rates start to stabilise, airlines will return to financing and use those unencumbered assets to pay down debt."

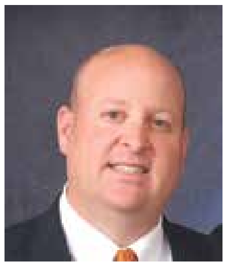
United and other airlines have the ability to pay down some or most of their outstanding debt raised during the pandemic at par, which will help them to pay down debt and restore their balance sheets. "In the current rate environment, it is a tremendous benefit to have the flexibility to prepay debt, continue to pay cash for new aircraft or access the financing markets opportunistically for new aircraft deliveries," said Laderman.

Although EETCs are mostly suited to airline finance, lessors have used the structure in the past. Over the past two years, however, more and more leasing companies have been using the structure in the private placement market. EETCs are being used by lessors that have several aircraft on lease to a single top tier airline to leverage the credit worthiness of the lessee. BBAM has been a frequent issuer – closing one deal in July 2022 that financed four narrowbody aircraft but is believed to have closed 5/6 deals. Avenue Capital (which issued the Stellar 2021-1 Aircraft ABS in 2021) and Castlelake are known to have closed similar transactions.

The repricing of sector risk also seeped into the asset backed securitisation (ABS) market for aviation assets, effectively freezing the market. The decade-long low interest rate environment had caused ABS issuance to steadily rise from 2013, peaking in 2019 with a record 18 deals closing with a total value of almost $10bn. In 2022 only three deals closed. Global Jet Capital closed its sixth ABS transaction in May. The $609.96 million

"This environment feels very similar to when we first came to market in 2014 when the pricing was very similar."

Robert Korn, Carlyle Aviation Partners



BJETS 2022-1, secured on a portfolio of business jets, was offered in three tranches: $512.8 million A notes, $60.3 million B notes and a $35.8 million C tranche. The blended spread was 253bps over treasuries. Deutsche Bank, Citi, Bank of America, TCG and KKR were structuring agents on the deal.

In June, Carlyle Aviation issued an ABS transaction under its AASET moniker led by structuring agent and lead left bookrunner Goldman Sachs. However, the $522.464 million was issued as a single senior A tranche with a 6.00% coupon and 350bps spread to treasuries. CEO Robert Korn explains that a B tranche will hopefully follow. "This environment feels very similar to when we first came to market in 2014 when the pricing was very similar. We had managed to issue a B note but we struggled and we didn't even try to issue a C tranche," he told Joe O'Mara in New York in October. "This time around Goldman Sachs developed a very unique structure for the A tranche, which we issued, and we ultimately expect as the markets become more constructive to be able to issue a follow-on B tranche."

The transaction featured a unique uni-tranche structure that optimised the Class A leverage with a more defensive liability mix, increased ongoing liquidity, and other debt friendly structural features, including an improved covenant package, including a higher utilization trigger (90%) and a monthly collections test (85%), as well as increased pay down upon disposition of assets (110%).

Airborne Capital was the final issuer in the ABS space in 2022 with a $303.7 Marathon Asset Management transaction (MAST 2022-1) formed of single A tranche of senior notes, secured by a portfolio of 15 narrowbody aircraft. Mizuho was the sole structuring agent and sole placement agent.

The notes were rated A- by KBRA, with an initial loan-to-value (LTV) ratio of 61.1%. The notes are listed but the deal was privately placed. The A notes priced just below 7% with a +300bps spread – a great achievement in a market environment where secondary market aircraft ABS paper was trading at all-time highs of around +400bps spread and during a time when there was no market for a widely distributed deal.

During this transaction process, Ramki Sundaram, chief executive officer of Airborne Capital, gained a clear perspective on the investor mindset from discussions with investors. "There are two aspects to the market – firstly, there is clearly lower liquidity with more focus on relative value, crowding out demand for esoteric aviation ABS issuances. Secondly, increased market risk has driven higher uncertainty of issuance pricing, driven by the last dollar that comes in from those smaller investors," he says. "The larger players in the market do have intrinsic appetite but they also have the ability to be selective in terms of the kinds of transactions they consider." Sundaram notes that the main themes from investors is their concern over the quality of the assets in the ABS portfolio and the quality of the servicer. "Pre-Covid the size of the servicer was more important than the quality of assets, but this has changed with the quality of assets now as important, if not more important than the servicer. The quality of the service, rather than its size, has also gained importance."

Mizuho's Srinivasan, who structured the MAST ABS, explained how the macroenvironment impacted the ABS product during 2022. "The Federal Reserve was pumping money into the system because of COVID – behaving the same way that they did during the global financial crisis – which kept interest rates low into 2021," he says. "Almost every investment grade lessor issued as much unsecured debt as they could in that environment, so they are set for a while, and then the ABS issuers also all issued debt-only deals without equity notes, so there were no portfolio sales. In 2022 rates have gone up, which means that the five-year rates used for the aircraft ABS structures that were 150bps in 2021 are now 450bps. Credit spreads that were about 150bps have now widened to 350, which adds another 200bps to the 300bps interest rate rise, equating to a 5% increase in debt issuance cost in the aircraft ABS world. The lease cashflows cannot support the same amount of leverage seen in 2021 under the new interest rates and yields."

These increases have effectively tripled the cost of an aircraft ABS transaction in six months. With the accepted lag between interest rate rises and lease rates, it will still be some time before the product becomes more attractive relative to cashflows. "Lease rates are sticky and they haven't yet moved up to adjust creating a limbo situation where any ABS issuance would reduce leverage," says Srinivasan.

The lack of affordable ABS channel for aircraft finance has led to a substantial increase in the number of warehouse facilities provided by commercial banks, many quasi-structured facilities that serve as a stop-gap solution to the capital markets. Many of the deals mandated in 2021 for 2022 issuance in the ABS market had to be repackaged for warehouse deals, however those warehouses will eventually need to be refinanced more efficiently once rates level off. "Many warehouses were refinanced in 2021 so those will have availability into 2024 so there is no urgent need to refinance right now," says Srinivasan. "Typical warehouses comprise two or three-year revolving capital facility and a three or four-year amortising period that features a step-up in pricing. By the time the step-up pricing kicks in it will be into 2024. If the interest rates stay high for that long and there are no other products that make sense at the time, then there will be a squeeze. But I don't see that happening as banks and alternative lenders are being very supportive, lending at 200bps – they see this as an opportunity to step up for their clients."

The lack of ABS debt has also impacted the trading environment since it has become a major supporter of portfolio and aircraft sales since it can provide non-recourse debt to the purchases. Srinivasan notes: "Without certainty of how much leverage you can achieve over the long term and the cost, its creating uncertainty with the buyers over what they can afford to pay for aircraft – that could vary quite dramatically, and it is absolutely affecting the trading environment."

Certain frequent ABS issuers have been required to construct new sources of funding. Castlelake's business model used to be heavily focused on refinancing in the ABS market but has currently pivoted to alternative options. "We believe we were the largest issuer and servicer in the aviation ABS market and we believe we are still the largest servicer today," said Joe McConnell, Deputy Co-Chief Investment Officer at Castlelake in conversation with KPMG's Joe O'Mara in December. "It was an attractive financing tool for a long time and would still be today if the debt was appropriately priced."

McConnell notes that pre-pandemic there was a rush of capital into aviation as many start-up leasing companies entered the sector with a lot of money to spend, which he believes led to a loosening of underwriting standards. "We believe that incentives became misaligned in many cases, with very small teams managing large pools of aircraft," says McConnell. "When all of the aircraft were on lease, some investors felt there was no need for a large technical or servicing team. The pandemic changed that and exposed many of the flaws we saw developing over 2018 and 2019. The challenge today is that many of those outstanding portfolios now appear to have real cashflow issues. With some 20-40% of the aircraft off lease in certain structures, we believe that some trust has been lost in this marketplace." McConnell believes that distrust is continuing even into the recovery period demonstrated by the high price of secondary paper. He doesn't see prices coming down until the performance of those portfolios improves.

"We saw some of these cracks form in 2020 and 2021, which is why we decided to establish Castlelake Aviation Limited in the fourth quarter of 2021," he says. "It allows us to continue taking advantage of attractive opportunities on the buy side with the ability to fund assets through debt financing issued in the unsecured market, the Term Loan B, private placement, and recourse market. We're not dependent on the ABS market anymore and we feel confident about our debt funding and ability to continue deploying capital and finance it attractively."

Castlelake also has the ability to lend via its recently established direct lending platform. "We have also developed a direct lending business, which we set up in 2020 in the middle of the pandemic; and we have now originated, purchased or committed approximately $5bn in direct lending capital," says McConnell. "This is typically senior secured investment grade risk to both airlines and leasing companies. We have also recently developed a reinsurance business that enables us to help airlines and leasing companies secure attractive financing rates by providing reinsurance products, as well as an aviation-focused credit opportunities business, which covers alternative assets including loyalty programmes, slot gates and routes, as well as exit financings for airlines."

> **"The challenge today is that many ... outstanding portfolios now appear to have real cashflow issues. With some 20-40% of the aircraft off lease in certain structures, we believe that some trust has been lost in this marketplace."**
>
> *Joe McConnell, Castlelake*

Alternative Lending

The contraction of the bank market and the freeze in the capital markets has created a temporary funding gap that in some places is being filled by alternative lenders that have recognised opportunities in the aviation sector. Castlelake Aviation is just one of a group of alternative lenders that have expanded their aviation portfolios over the past few years. others include: volofin, Valkyrie, Muzinich, Ashland Place, as well as more established players like PK AirFinance. "We have seen instances where the bond markets shut down, where traditional investors haven't been able to buy a certain security, and where the bank markets weren't able to do something that was in the capital markets, when alternative lenders – usually private equity-backed credit funds – stepped up and were able to provide funds in significant size, and receiving very attractive yield for their efforts while filling an important role," says Goldman Sach's Greg Lee.

Jean Chedeville, Global Head of Aviation Finance, Natixis, views the addition of such alternative lenders or non-banking financial institutions (NBFI) as a complement to the aviation finance sector. "We are seeing NBFIs enter into the sector, which is something that has been missing for a long time," he told KPMG's Joe O'Mara in an interview in Singapore in November. "There have been a few Japanese and Korean alternative investors in aviation, but only a few and then only on very specific structured deals. Now we are seeing investors with background aviation knowledge because they a subset of leasing companies or a private equity firm that have already invested in aviation in different forms. This is a plus for the sector. We don't see them as competing against because they have a very different risk appetite and overall risk-return expectations. These investors will bridge the gap between what banks can do today and what the capital markets were offering until a few months ago."

Chedeville describes Natixis has "product agnostic" and rather than push vanilla banking products to clients he would rather "add value" in his relationships. "A lot of lessors are struggling to find the right returns or to find the right deals mostly because their capital structure doesn't work anymore and needs to be re-engineered. In this instance, working together with this type of investors makes a lot of sense."

Evan Carruthers, Managing Partner and Chief Investment Officer at Castlelake comments that the "aviation industry provides ample opportunity for alternative lenders who really understand how to effectively structure and execute transactions and provide airlines and leasing companies with attractive debt financing. With this, we believe demand for creative financing solutions will remain high for many years, and the ability to provide tailored solutions is likely to differentiate industry participants."

Although Chedeville notes that there were many investors entering the market to capitalise on the distress in the market, that attitude is now changing with investor seeking full flight platforms and he also notes the entry into the market of Middle East investors and sovereign wealth funds as they seek to reposition the region for the post-fossil fuel era.

Saudi Arabia's Public Investment Fund (PIF) has been the most prolific investor out of the Middle East region. As part of the country's Vision 2050 project, PIF has been investing in the Kingdom's tourism industry, which include a new flag carrier, RIA, and a new leasing company, AviLease (see *Chapter Three-The Age of Leasing* for more on these developments with comments from AviLease CEO Ted O'Byrne).

Chapter Three

The Age of Leasing

The aircraft leasing industry demonstrated its incredible resilience last year by seeming to shrug off the worst disaster in its history when the Russian war in Ukraine effectively trapped 550 aircraft in the country. Although the Russian market is relatively small in terms of global air traffic, it did have an overweight proportion of leased aircraft.

The publicised impairments relating to the loss of the Russian leased fleet add up more than $7bn. Many lessors have active legal claims against insurance companies, which are refusing to pay out on the grounds that recovery of the aircraft may still be possible, but such large-scale litigation action is expected to take several years to resolve. Despite the devastating impact of another global shock event, many larger lessors have been able to cope with the loss, at least for now.

"Aircraft leasing has come through a global pandemic with a two-years shutdown, and now it has come through Russia and an interest rate shock," says Andy Cronin, Chief Executive Officer of Avolon, in an interview with KPMG's Joe O'Mara in December. "Our business has operated organically throughout that period. We have had no equity injections from shareholders, no M&A activity to change the picture; on a like-for-like basis, every single credit metric is better. Our debt-to-equity is lower, our liquidity is higher, our sources-to-uses is higher, our cash generation is actually higher this year than 2019. From that perspective, leasing has proven it is robust and can withstand very significant shocks."

All of the larger lessors, despite their heavy losses, have steered their businesses confidently throughout the double shock of COVID and Russia. Rating agencies have taken notice of the resilience of the industry.

"The way leasing companies performed during the pandemic crisis demonstrated their access to the capital markets by raising large amounts of funds at very low rates rates, which enabled them to better provide liquidity assistance to airlines," says Marjan Riggi, Senior Managing Director at Kroll Bond Rating Agency. "Once COVID started to dissipate, we stabilised all those negative outlooks we had assigned in the early days of the pandemic, even though the leasing companies are slightly higher levered than they used to be. We are very bullish on leasing companies and almost all the ratings are now stable, apart from a couple of smaller names that have other issues."

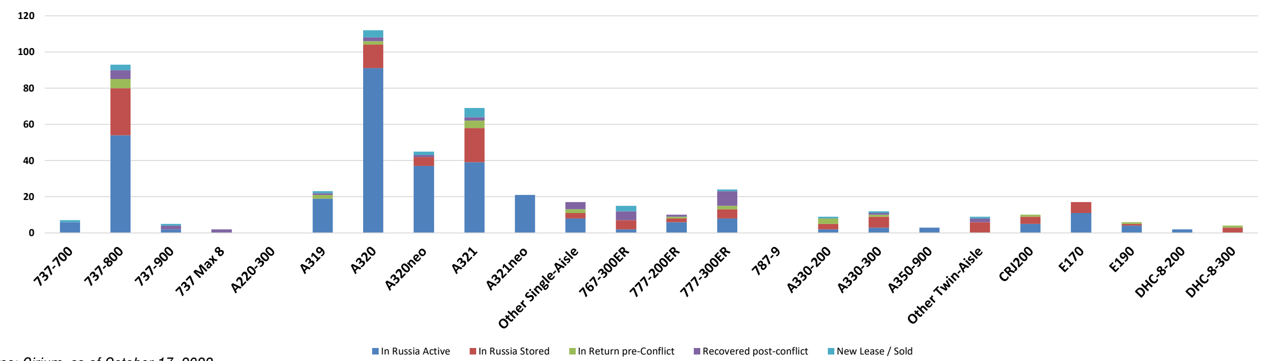
Riggi goes further to note that the leasing market was recovering well until the Russia situation began, leading to impairments for lessors with a lot of exposure to Russia as well as doubts around insurance pay outs. But she believes that the leasing companies acted in exactly the right way to manage the situation. "They were right to take impairments for all their exposure right away," she says. Once the impairments were taken and most were by YE2022, it didn't make a huge difference for their overall leverage levels. Now many are trying to file for insurance claims to get their money back but they are finding resistance and the expectation is that any pay out will take a while."

S&P's Betsy Snyder took a similar view: "We reviewed the impairment charges and still affirmed the ratings because we saw that those charges had been mitigated and there was strong demand, a reduced need for capital spending or additional debt," she said during a video interview in New York in October. "We are not factoring in any insurance recoveries because it is such an unknown."

Snyder actually goes further to view the Russian situation as a positive for the leasing sector "because there are more than 400 aircraft stranded in Russia that are out of the global fleet, reducing capacity in light of strengthening demand".

FIG.17: RUSSIAN FLEET LESSOR IMPAIRMENTS AND LAWSUITS

Lessor	Impairment (US$m)	Lawsuits
AerCap	2700	AerCap v AIG, Lloyd's of London (London, June)
SMBC Aviation Capital	1600	SMBC AC v Lloyd's of London (Irish High Court, Nov. 28)
Air Lease Corp	802.4	
BOC Aviation	682	BOC v Ping (Irish High Court, Dec 9) + BOC Aviation v 16 insurers (August)
DAE	576.5	DAE v 11 insurers (inc. Lloyd's of London, AIG, Chubb, Swiss Re, Fidelis Insurance Ireland, HDI Global Speciality, Abu Dhabi National Insurance Company, Great Lakes Insurance, Global Aerospace Underwriting Managers, Starr Europe Insurance and Axis Speciality Europe), Oct (London)
Aircastle	252	Aircastle v 30 insurers (supreme Court of New York, Oct)
Avolon	304	Avolon v China's PICC Property & Casualty (Irish High Court, Dec. 9) + Avolon v 15 insurers (Irish High Court, Nov 3)
CALC	two aircraft	
Nordic Aviation Capital	-	NAC v Lloyd's of London, Global Aerospace (Irish High Court) , filed Dec 9
CDB Aviation	105	CDB Aviation v 18 insurers (Irish High Court, Nov. 15)
		United States
Carlyle Aviation Partners	700 (claim amount)	Carlyle Aviation Partners v 30 insurers (Miami-Dade County, Oct)
Aviator Capital	147 (claim amount)	Aviator Capital v Chubb, Hive Underwriters, HDI Global and Lloyd's of London syndicates (Florida court, Aug)
Willis Lease Finance	20.4	



Source: Cirium, as of October 17, 2022

FIG.18: RUSSIAN LEASED AIRCRAFT FLEET

Some lessors have been able to reclaim some aircraft and receive special permission to fly them out of Russia, while other lessors are reported to have been able to sell their aircraft to Russian carriers under a European Union amendment to sanctions. Aeroflot confirmed in early January 2023 that it had purchased 10 stranded Boeing 777 aircraft from Irish leasing companies, and that it had purchased eight A330s in May from foreign lessors. Most of the fleet leased from foreign lessors remains in the country.

According to data from Ascend by Cirium, there has been some restitution of aircraft from Russia. At the beginning of the Ukraine conflict, 41 aircraft were outside of Russia at the start of the conflict and thought to be undergoing lease return, a further 44 aircraft appear to have been recovered from Russia after the start of the conflict, and as of November 2022 some 24 of these recovered aircraft appear to have a new lease or some other fate. The active leased fleet in Russia stands at 430 but 107 of those aircraft that remain in Russia have been classified as parked (more on the possible fate for these aircraft in *Chapter Four-Fleet and Freight Focus*).

The loss of the Russian leased fleet was an unexpected consequence of a geopolitical shock due to the sanctions imposed on Russia following its invasion of Ukraine. Previously, leasing companies had been able to repossess aircraft from Russia following bankruptcies without issue – even after Russia annexed the Crimea in 2014. The action of western states and the reaction of the Russian state was unforeseen. The incident has significantly increased the importance of country risk management and a diverse lessee portfolio.

"You cannot always predict geopolitical risk; some countries are more prone to such shocks but the industry probably didn't expect this to happen in Russia," says KBRA's Riggi who added that lessors had been able to take aircraft out of the country many times before with few problems.

Although the larger leasing companies do seem to have brushed off the impact of Russian impairments and the additional costs associated with lawsuits with insurers, smaller lessors with exposure have been more impacted and some observers feel it is only a matter of time before the further damage is revealed.

"We came out of the pandemic feeling that we had weathered this most incredible storm," says Marc Iarchy, partner at World Star Aviation during an interview in Singapore in November. "COVID was like somebody had pulled the handbrake in the middle of the motorway and stopped the entire industry. And yet we survived; most players are still broadly intact even if some underwent a little restructuring. But then we had the Russia situation, which caused higher inflation and rising interest rates, which is affecting everybody. There may be blood on the walls; but that's not necessarily a bad thing. This cleaning of the market is one of the positive impacts of the cycle."

Cowen's Helane Becker observes that the Russian situation has added a new level of country risk for lessors: "Post February 2022, lessors have been looking harder at country risk before they put their aircraft into certain markets," says Becker, which she says is resulting in increasing costs for airlines.

> **"We came out of the pandemic feeling that we had weathered this most incredible storm... we survived; most players are still broadly intact even if some underwent a little restructuring."**
>
> *Mar Iarchy, World Star Aviation*

Leased fleet expansion

The operating leasing share of the global fleet is currently hovering around 55% but during the pandemic that share is reported to have easily topped 60%. The industry debate is just how far can operating leasing dominate the world fleet as the preferred form of aircraft ownership.

Cowen's Helane Becker has reiterated every year in this report that she doesn't believe airlines should own their own aircraft at all. James Meyler, chief executive officer of ORIX Aviation, takes a similar view. "As I have said many times before, the largest hotel groups don't own any hotels and arguably airlines shouldn't own any aircraft," he says. "It's very possible, eventually that lessors will own all of the aircraft. Clearly some airlines will always either want to own their own aircraft but the 60% share is here to stay. Airlines are going to use the sale-leaseback channel to fund deliveries or lease more aircraft because it makes more sense in a volatile environment to have a more flexible business model."

Meyler believes that airlines need to refresh their fleets much more regularly than before for aesthetic and environmental reasons to remain more competitive, but also because during a crisis period lessors have proven to be better risk partners for banks.

Standard Chartered's Kieran Corr also believes that the operating lease share of the fleet will continue to tick upwards due to the popularity of the product with airlines. "Airlines are using leases as a capacity management tool, as well as a way to hedge residual risk – using sale-leasebacks to shore up liquidity and also to growth quickly to respond to new market opportunities," he says, adding that lead times for leased aircraft tend to be shorter than ordering aircraft directly from the manufacturers.

Other lessors opine that the lease fleet may have hit a ceiling around 55-60% since there will always be airlines that can fund aircraft much more cheaply and benefit from the depreciation.

BOC Aviation's Robert Martin believes the share will not advance much further. "There are a number of airlines out there that will continue to invest in aircraft themselves to take advantage of the special tax depreciation benefits over the next two to three years as they become more profitable. And there are also carriers around the world that are investment grade ratings and will continue to tap into the unsecured markets."

Gary Fitzgerald, chief executive officer at Stratos agrees that although aircraft leasing has become more efficient and lessors are able to raise funding at attractive pricing, "we're still seeing some of the largest airlines able to access cheaper funding than even the strongest lessor. We might start heading towards a 60% share, but I can't really see it get a crazy amount higher, but I'm very happy to be proven wrong over time."

Fred Browne, chief executive officer of Aergo Capital, noted in his conversation with Joe O'Mara in January 2022 that for the leasing share of the global fleet to remain at 60% lessors will need to find almost $4 trillion in funding, which may be difficult should the operating environment remain challenging.

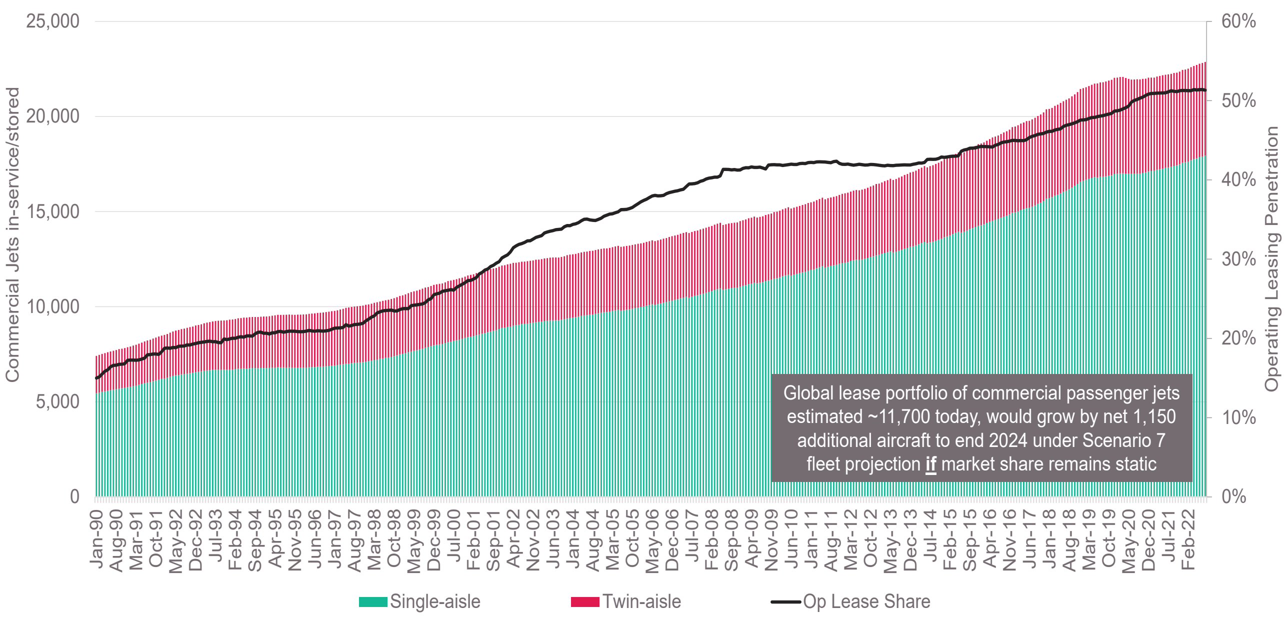


FIG.19: OPERATING LEASING SHARE OF THE COMMERCIAL AVIATION FLEET

FIG.20: TOP TEN AIRCRAFT LESSORS (BY PORTFOLIO VALUE)

Manager	TP	RJ	SA	TA	Total Portfolio	On Order	Est Portfolio Value ($mn)	Current Rank	2021 rank
AerCap	19	98	1,453	336	1,906	423	47,213	1	1
SMBC Aviation Capital			656	72	728	220	23,281	2	2
Air Lease Corporation		2	402	126	530	408	19,895	3	3
Avolon			475	124	599	219	17,193	4	4
BOC Aviation			349	89	438	210	15,256	5	5
ICBC Leasing		27	408	57	492	139	14,281	6	7 ↑
BBAM			355	110	465		14,262	7	6 ↓
DAE Capital	67		297	56	420		10,161	8	9 ↑
Aviation Capital Group			348	16	364	107	9,373	9	8 ↓
CDB Aviation		20	219	43	282	176	8,794	10	

Like many lessors, Austin Wiley, Chief Executive Officer of SKY Leasing, says that the company is very focused on country risk from a geopolitical perspective. "Unfortunately we can't buy a derivative for geopolitical risk," he says, "all we can do is manage that risk through diversification. The message to our investors is that diversification rules in this industry. When you don't know exactly what macro forces will prompt a change in the cycle, you can be more insulated and better protected when those shocks hit if you have properly diversified your portfolio by asset type, by business model, and by region."

ALC's John Plueger agrees that country risk has become more front of stage in the current geopolitical environment – Russia and Ukraine has increased global tensions but so too have the political tension between China and Taiwan.

"After Russia, many people are now very concerned about China and Taiwan" says Plueger. "Our insurers are looking at this and have almost lumped the two issues into one basket from a risk perspective. China is such a large part of the global marketplace and going forward it represents a significant market uncertainty that we don't quite know how to deal with. We've faced a strong dollar before, we've faced interest rate hikes before, and all other kinds of situations but never before have we faced what's happened in Russia and Ukraine and now what could happen on a larger scale if something happens in China."

Although the country risk has increased, China is too large market to ignore. "China will always be a big important marketplace but at the same time, if I had an opportunity to place a hundred more airplanes in China tomorrow, I would have to pause," says Plueger. "They are great airline partners and are well-run airlines, but one cannot deny the political realities. The United States and China have a very difficult relationship at this point in time, and who knows when it may spill over. It's a question of what degree of risk you want to accept. We're happy with our leases there; we've got great airline customers there that continued to pay us during the pandemic, but each new deal would have to be assessed on a case-by-case basis."

A MATURING MARKET

There is no doubt among market leaders, from airlines to financiers, that the aircraft leasing market has matured significantly. The operating leasing share of the fleet has steadily increased since its inception – spiking significantly during the pandemic as airlines levered their unencumbered assets to raise liquidity – but the sophistication of the leasing companies has also advanced. "In terms of big, sophisticated, well-capitalised institutional competitive layers, it feels like the industry has grown up a tonne in the last 10 years," says Thomas Baker, chief executive officer of Aviation Capital Group (ACG). "This has been the result of the excess liquidity seeking returns in a low-rate environment since aviation leasing – investing in US dollar secured assets that move – has proven to be a great place to invest over a longer duration."

Baker states that there are many very well-capitalised, well-managed leasing platforms, but notes that the amount of capital that rushed into the space "has changed the landscape – some for the better, some the worse – but it is certainly a much more institutional business than it was even 10 years ago". He adds: "The sheer amount of capital that flooded into the sector, specifically from sophisticated private equity investors, has forced everybody to become more sophisticated, which increased the competitive dynamic in the industry. In 2019 when we were at the peak of the market, we were beating each other up for that last dollar. Today, even with the current industry challenges, there are much more investment opportunities."

CONSOLIDATION

The biggest trend in the aircraft leasing sector over the past few years has been the rise in merger and acquisition (M&A) activity. In last year's report, AerCap's acquisition of GECAS was the foremost change in the leasing market as it created

FIG.21: TOP 30 LEASING COMPANIES (RANKED BY NUMBER OF AIRCRAFT)									
Manager	**TP**	**RJ**	**SA**	**TA**	**Total Portfolio**	**On Order**	**Est Portfolio Value ($mn)**	**Current Rank**	**2021 rank**
AerCap	19	98	1,453	336	1,906	423	47,213	1	1
SMBC Aviation Capital			656	72	728	220	23,281	2	3 ↑
Avolon			475	124	599	219	17,193	3	2 ↓
Air Lease Corporation		2	402	126	530	408	19,895	4	5 ↑
ICBC Leasing		27	408	57	492	139	14,281	5	6 ↓
BBAM			355	110	465		14,262	6	7 ↓
BOC Aviation			349	89	438	210	15,256	7	8 ↓
Carlyle Aviation Partners			383	44	427	20	7,370	8	11 ↓
DAE Capital	67		297	56	420		10,161	9	9
Aviation Capital Group			348	16	364	107	9,373	10	10
Nordic Aviation Capital	209	131			340	34	2,592	11	4 ↓
CDB Aviation		20	219	43	282	176	8,794	12	14 ↑
Bocomm Leasing		10	235	30	275	90	8,223	13	13
Aircastle		14	223	22	259	16	4,284	14	12 ↓
Falko	133	113	5		251		2,074	15	25 ↑
Castlelake	7	12	140	52	211		3,825	16	15 ↓
Jackson Square Aviation			180	24	204	21	7,136	17	18 ↑
AVIC International Leasing	20	32	121	22	195		5,716	18	17 ↓
ORIX Aviation			155	33	188		4,434	19	16 ↓
Macquarie AirFinance		2	174	11	187	48	2,431	20	19
China Aircraft Leasing Company		1	165	16	182	242	4,197	21	22 ↑
CES International Financial Leasing		1	127	41	169		6,778	22	-
Boeing Capital Corp	7		143	13	163	14	1,159	23	21 ↓
Aergo Capital	59		69	30	158		2,748	24	-
CMB Financial Leasing		7	128	23	158	60	5,069	25	27 ↑
Cargo Aircraft Management			11	129	140		2,366	26	26
China Southern Air Leasing		6	101	30	137		4,312	27	-
FTAI Aviation			123	13	136		1,488	28	-
Aero Capital Solutions			134		134		1,433	29	-
CCB Financial Leasing			112	20	132	110	3,914	30	29 ↑

the world largest lessor by some margin. This year, although not quite on the same scale, there has been a healthy amount of M&A activity, principally the acquisition of Goshawk by SMBC Aviation Capital.

In May 2022, NWS and CTFE agreed to sell Goshawk to SMBC Aviation Capital for an enterprise value of $6.7bn (equity value of $1.6bn). Citi acted as lead financial adviser to NWS and CTFE. Goldman Sachs advised SMBC Aviation Capital on the deal. The acquisition was complicated by the imposition of sanctions on Russia, which stranded several aircraft in the country, posing the question of whether those aircraft could legally be acquired. Ultimately it was decided to exclude the book value of the aircraft assets exposed to Russian leases from the equity consideration. SMBC Aviation Capital acquired Goshawk and all its fleet except for the six stranded aircraft. The transaction closed at the very end of December 2022 and created the world's second largest aircraft leasing company with a fleet of 709 owned and management aircraft for a total value of $37bn, which includes the orderbook.

Peter Barrett, CEO of SMBC Aviation Capital, commented that although this was a sizeable deal, which has brought additional scale to the business, it was manageable: "[The acquisition] is big enough," he said. "It's going to really move the needle for us, but not so big that it is going to overwhelm our business." He added that the acquisition over the longer-term consolidates SMBC Aviation Capital's position "as one of the leaders of the industry".

Goshawk was an attractive acquisition for SMBC Aviation Capital owing to its similar asset profile as well as its culture. "Goshawk is a very good match for us in terms of the portfolio," says Barrett. "The team of people will add a lot to our business as well." The timing of the acquisition was also highlighted as an advantage of the company to capitalise on the post-pandemic recovery, and Barrett also noted that it was acquired for "a good price".

The transaction was financed using a combination of debt and equity. SMBC Aviation Capital raised $2.54bn to partially fund the acquisition, which comprised a five year $1.83bn Term Loan and a five-year $710 million revolving credit facility. Both the initial term loan and RCF facility had been upsized by US$815 million after launch on the back of strong demand, which was successfully raised with 19 financial institutions, of which 14 were new banking relationships for the lessor.

ANZ and Citi acted as joint global coordinators, mandated lead arrangers and active bookrunners; BNP Paribas, DBS Bank, OCBC and Cathay United Bank, were mandated lead arrangers and active bookrunners; KDB Bank, Caixa Bank and ICBC were mandated lead arrangers and bookrunners; HSBC acted as senior mandated lead arranger, with Apple Bank, KeyBank and China Everbright acting as mandated lead arrangers. Hogan Lovells was legal adviser.

Carlyle Aviation Partners raised financing for the acquisition of AMCK, which was announced at the end of 2021. The team raised a $2.5bn bridge loan financing in April 2022 that supported the $4 billion acquisition of AMCK Aviation's aircraft portfolio, which included over 120 aircraft by Maverick Aviation Partnership, an investment vehicle managed by Carlyle Aviation Partners. The financing provided Carlyle with significant flexibility to execute on its acquisition strategy in a very complex and dynamic market environment. The transaction was structured to allow Carlyle significant flexibility with respect to maximum tenor and refinancing alternatives.

Goldman Sachs was the sole structuring agent with joint lead arrangers and lenders: Société Générale, BNP Paribas, Natixis, Royal Bank of Canada and Sumitomo Mitsui Banking Corporation. UMB was the security trustee and admin agent. Milbank acted as legal counsel to Maverick. Latham & Watkins acted as legal counsel to the lenders.

Robert Korn, president of Carlyle Aviation Partners, commented that the acquisition of AMCK and FLY were both a good fit in terms of their portfolios and served the need to add aircraft to their funds, not in a conscious effort to add scale. "We were looking to acquire aircraft for our funds and [AMCK] was a very good fit," he says. "It wasn't a consequence of specifically adding scale, but certainly the result of that was a good economical transaction for both parties, benefiting us in that we have been able to enlarge the business and enter into the top 10 in terms of size and scale."

Also in 2022, Chorus Aviation completed its acquisition of Falko Regional Aircraft (Falko), which was first announced on February 27, 2022. The acquisition transformed Chorus into a premier full-service provider in regional aviation, with a portfolio of 348 regional aircraft with an aggregate value of approximately US$4.5 billion that are owned, managed, and/or operated by Chorus subsidiaries.

In June 2022, Elix Aviation merged with ADARE Aviation Capital, to create Abelo to integrate Elix Aviation's turboprop portfolio with ACARE's management expertise.

Aergo Capital Partners, which is backed by CarVal and has been slowly building up a strong portfolio since the pandemic, acquired Seraph Aviation Management for an undisclosed fee towards the end of 2022. Aergo assumed the management and administration of 88 aviation assets and boosted its owned and managed portfolio to 304 aircraft (including aircraft under LOI), valued at approximately $6.8 billion.

At the time the deal closed, Aergo CEO Fred Browne commented that Seraph was "an excellent strategic fit with our existing managed asset portfolio and which will bring Aergo to the top of the industry league table by quantity of aircraft assets under management".

Kuwaiti lessor Alafco shareholders have now approved the sale of 53 aircraft, plus the 20 Boeing 737 MAX 8s on order, to Macquarie Airfinance Group for $2.2bn.

M&A activity is continuing into 2023 with the very recent announcement that Standard Chartered intends to explore alternatives for the future ownership of its aviation finance and leasing business.

Although the large deals closed in the past two years seem to indicate a trend towards further consolidation of the leasing sector, industry leaders argue that little real consolidation has taken place.

BOC Aviation's Robert Martin sought to "destroy the myth" in an interview with KPMG's Joe O'Mara in Singapore in November. "The industry didn't consolidate; the industry has done the opposite," he said. "If you measure the market by the top two, the top five, or the top 10 lessors, it has deconsolidated since

2010. The AerCap-GECAS deal was a minor blip in the middle of that, but even that has not stopped deconsolidation. Yes, there will be more M&A but it is always driven by a willing seller. The key question is whether there are investors that want to get out of the industry or have financial problems of their own that means they have to divest. That sort of consolidation will stay at roughly the same level as we see today. I don't see significant consolidation coming. If you look at lessor orderbooks and at the orderbook concentration for the top 10 lessors, those top 10 will continue to grow proportionate to the with the marketplace." Martin concedes, however, that the reopening of the ABS market may change this dynamic and, as new managers enter the market, it may start to fragment further.

ACG's Tom Baker says that he is also squeamish around the use of the consolidation word. "To me, it's just a transfer of ownership of assets," he says. "There were 95 leasing businesses 10 years ago. There were 105 five years ago, and there are 97 now. There are mergers and consolidation for platforms, but the overall number of players and the amount of capital in the space will remain relatively stable, at least over the shorter to medium term." Baker also adds that this could change if the ABS market stays closed for longer. "If the ABS market stays closed, if those warehouses term out without the ability to refinance those assets, they will have to be disposed of in one way or another."

BUILDING SCALE

AerCap's Kelly sees further market consolidation as a positive for the industry since he says that the leasing industry "despite recent consolidation is still relatively fragmented". For Kelly scale is important and lessors realise that which is why there has been the recent M&A activity from SMBC Aviation Capital and Carlyle to name a few, and why so many other companies compete to build up portfolios rapidly to gain market share but also benefit from the many advantages scale brings.

As the world's largest leasing company with a portfolio of 1,900 airplanes and 900 engines, Kelly knows the benefits scale can bring both from a financing perspective and with the manufacturers when ordering aircraft, but he also notes advantages in other more unexpected areas.

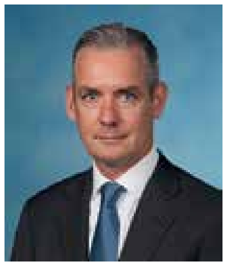
"Where scale really matters is in those areas that many observants don't see, such as maintenance," he explains. "The biggest controllable cost of a leasing company on an annual basis is maintenance. Scale has enormous advantages when dealing with MRO shops in securing your slots, as well as having the knowledge internally to know how to overhaul an engine, an APU, landing gear or avionics units, and also how to deal with the vendors of all those many components. Those are the hidden areas where scale matters."

With scale comes financial stability and most importantly an investment grade rating. Largescale lessors are able to bring larger funding deals to market and attract a larger pool of capital and more competitive pricing. "Bond investors aren't interested in just a few million – they need liquidity," says Kelly. Capital markets need volume, and as Kelly says, smaller deals will always pay a premium.

ACG's Baker says that scale means having the ability to finance your company on an unsecured basis. "Scale brings the ability to raise finance at a corporate level, attract an investment grade rating and build relationships with key lending banks, as well as having in place a global marketing and technical team – all of those mean scale to me. Lessors with scale and the ability to finance in the term loan and the capital markets, and be able to attract other pockets of capital when there is mispricing in the bond market, will be a competitive differentiator going forward."

Kelly has always maintained that scale allows a greater and deeper perspective on the global market, which has certainly aided the leasing company in predicted market trends as they develop. "An advantage of our size is that we see issues develop before our competitors," he says. Larger lessors with the ability to offer full fleet solutions for airlines also have a major competitive advantage. "Smaller platforms will always be playing second fiddle to the larger lessors when it an airline is looking for a lot of aircraft. It's just easier for them," adds Kelly. "You don't need to have a thousand airplanes but to be effective, there has to be some scale in the business with a large global platform so you can move your assets where there is demand."

> **"Scale brings the ability to raise finance at a corporate level, attract an investment grade rating, and build relationships with key lending banks, as well as having in place a global marketing and technical team."**
>
> *Tom Baker, Aviation Capital Group*



NEW ENTRANTS

The larger lessors are chasing scale and M&A activity has been steady in recent years at the same time as the volume of new entrants into the leasing space has accelerated throughout the pandemic and now into the recovery period. Even as some companies exited the business after the crisis, new investors have stepped in seeking to capitalise on the volatility in the operating environment. Many investors are also aware of the somewhat suppressed distress in the sector from smaller companies that are struggling to cope with the sharp and rapid rise in interest rates and the lag in lease rate rises.

"For a capital-intensive global industry, the barriers to entry into the leasing market have been surprisingly low, while the barriers to exit have been surprisingly high," observes ACG's Baker. "There are a lot of zombie portfolios limping around that I would have expected to disappear a while ago, but they still find a way to hang on for one reason or another."

Baker says that the future looks bleak for smaller lessors that rely on captive warehouses for funding or those that fund at the asset level or must term out existing facilities in this higher interest rate environment. "Capital will become less flexible or less visible", says Baker who sees shorter term debt and lower LTVs as a major concern for lessors as they cannot know the price of debt for the term of a lease. "When interest rate spreads were low, money was cheap, it was easy for people to make business decisions based on fleeting costs of capital. Now it's a lot harder, and I think you'll see that play out this year."

Kelly adds that the "barriers to entry and barriers to success are very different", stressing again that lessors without that global platform will struggle to compete in this more difficult operating environment.

Despite the challenges, liquidity is still flooding into the sector, albeit perhaps on a more discerning basis that in the pandemic period and after the Russian situation.

CALC's Mike Poon views the new entrants into the leasing space as a positive development: "Continuous strong rebound in air travel has attracted smart money into the aviation market as we do see start-up airlines, lessors or asset managers across various regions looking to fill the void left by insolvencies in the past three years. It is expected the additional capital brought in by new entrants will further improve secondary market liquidity."

James Meyler, ORIX Aviation, observes a reduction in certain types of investors: "Private equity investors tend to move around to where the opportunities are for higher returns over a shorter period of time," he says.

"They rightly assumed that the pandemic would provide huge opportunities for buying distressed assets but that actually hasn't materialised. Lessors have proven the resilience of their business models through the pandemic and they have been able to remain sufficiently funded to survive even though they have seen further losses from bankruptcies or in Russia. As a result, private equity interest is reducing rapidly – either fully exiting or just stopping investment in the sector."

Meyler and others are seeing more insurance investors enter or re-enter the space attracted by the long-term nature of the business and its demonstrated resilience. "This suits the insurance company risk profile. Generally speaking, yields in reality are not at the typical private equity level, whereas they are at the level insurance companies seek and, for blue chip airlines and new aircraft types, they are actually also relatively low risk, with low volatility. We're definitely seeing the insurance market money becoming a bigger and bigger player."

There has been an influx of new money into the leasing sector over the last decade that entered the leasing sector during a period of stability with low interest rates, steady macroeconomic growth and low fuel price volatility. As many have pointed out, the barriers to entry are low but managing a leased portfolio through a sharp downturn requires skill and experience as well as a global platform to succeed. "The more challenging the environment, the more the pendulum is swinging back to reality," says Baker. "The challenges we have faced over the last three years requires expertise, scale, discipline, capacity, capability, capital. With these challenges flaring up, you will see a return to normal and start to greater differentiation in the platforms."

Baker expects to see more distressed sales in the secondary market: "If capital is harder to come by and is less flexible and the tougher operating environment makes it easier to lose money, you'll see a lot of assets transition from platforms that aren't really capable of owning aircraft through challenging cycles."

Despite the challenges, experienced investors are actually doubling down on their aviation investment but are investing in the right skills sets. Mergers between larger corporations almost inevitably result in the loss of some top management. The merger between AerCap and GECAS was no exception. Some 12 founding partners formerly of ex-GECAS and/or PK Airfinance opted to join together, with investor PIMCO, to form an entirely new lessor and lending platform, High Ridge Aviation and LR AirFinance, under the steady hand of former GECAS CEO Greg Conlon.

Having recognised that the aircraft leasing market is pivoting toward managing assets rather than owning aircraft, High Ridge Aviation's business model leans towards managed assets. "The ability for one company to efficiently own billions of dollars of aviation exposure on its balance sheet is becoming increasingly difficult," explains Conlon. "We have brought together people that know the assets, that know the customers, and who know the market and can manage these specialised assets from cradle-to-grave. Teaming those experienced asset managers with institutional investors with access to a wide variety of capital sources is where the market is going. That way, you can scale if you need to scale, and size doesn't become a limiting factor in terms of market opportunities."

With backing from long-time aviation investor PIMCO, High Ridge Aviation will not be limited by size due to capital constraints. With the addition of the lending platform, LR AirFinance, the team now has an additional layer to offer the aviation market. "In addition to High Ridge Aviation originating traditional operating and finance leases, we also wanted the ability to provide debt," explains Conlon.

For many years, GECAS and PK Airfinance operated in tandem to serve the market with operating leases and sources of debt and equity capital. High Ridge Aviation and LR AirFinance seeks to evolve a similar kind of partnership platform. "A lending platform needs a specialised capital structure that is geared for secured debt returns," says Conlon. "It needs to be flexible in tenor and risk adjusted appetite. As we considered potential partners, we knew that PIMCO was the best choice– it was kind of a natural fit."

High Ridge and LR AirFinance intend to capitalise on the many investment opportunities created by the volatility caused by the pandemic and the recovery environment. Conlon is not fazed by the current market challenges of heightened geopolitical, high inflation and rising interest rates. He sees this as the ideal time to offer an alternative for debt-laden airlines. "Dislocated or choppy markets are the ideal scenario for an experienced team with the right capital," he says. "We are starting to see some M&A activity on the lessor side as some companies seek to exit the market, having either failed to meet their targeted return requirements that were either unrealistic or that the market opportunities weren't there. The smaller lessors and/or their backers, who now perhaps see the industry as less strategic, are starting to move on."

Experience investors like PIMCO are aware of the need to manage portfolios over the longterm and throughout multiple cycle. But new investors too are tooling up with experienced personnel to ensure their investment makes sense in terms of return on investment but also, for one investor in particular, that it fits with a greater purpose. The Kingdom of Saudi Arabia has a vision to develop the country into a leading global economy by 2030 and, led by His Royal Highness Crown Prince Mohammed bin Salman bin Abdulaziz, the country is following up on its bold vision with significant action and investment. Pivoting from a focus on

"A lending platform needs a specialised capital structure that is geared for secured debt returns. It needs to be flexible in tenor and risk adjusted appetite."

Greg Conlon, High Ridge Aviation

oil, KSA is working to transform Aramco from an oil producing company into a global industrial conglomerate and the Public Investment Fund (PIF), currently with $620bn assets under management, into the world's largest sovereign wealth fund.

Aviation is a major part of that vision and part of the plans to transform KSA into a major tourist destination, which includes developing a new airline, an enlarged airport and a new aircraft leasing company, AviLease. PIF aims to invest SR356bn (US$100bn) into the aviation sector by 2030 as part of the Vision 2030 realisation programme, Saudi Arabia expects to triple passenger traffic by 2030, which will require a lot of aircraft.

Backed by PIF, the new Saudi leasing company – headed by chief executive Ted O'Byrne, supported by board directors Alec Burger, a former CEO of GECAS and David Power, former CEO of ORIX Aviation and current executive chairman of Aergo Structured Products at Aergo Capital – aims to "support the development of the Saudi Arabian Aviation, commercial aviation industry, and to build and scale up the company into a global competitor," says O'Byrne.

"We are 100% owned by PIF, Saudi Arabia's sovereign wealth fund, which makes us a very long-term and industrial inventor in the sector," adds O'Byrne. "We see this investment as a long-term driver of growth for the country in general, to support local airlines, but also to build up the local financial services industry and train local talent. Our perspective is quite different from other players in the sector; we really take that industrial target and mandate to heart."

AviLease is currently building up the company infrastructure, choosing the right systems, hiring the relevant skillsets, while also investing in training young talent in Saudi Arabia, to lay strong foundations for the new global company that will focus on growth. "There was a 100 million passengers coming in and out of Saudi Arabia in 2019," says O'Byrne. "The expectation is that will reach over 300 million passengers by the end of the decade. The first opportunity is to support the local airlines to finance their backlog to accompany the growth of this country. We have a very robust and large investor behind us, which gives us available capital to deploy for large opportunities in our home country and globally."

For AviLease, the ambition is to add scale in step with the capabilities of the fledgling company. Although O'Byrne notes that the company is relatively agnostic in how it builds that scale, via sale-leasebacks or portfolio purchases, he is wary of buying in problems. "We are very cautious on the M&A side. M&A can be a fast accelerator but I don't want to inherit other people's problems. I want to build a top tier leasing company with the best-in-class systems," he says. "We have very disciplined investment approach; I don't want to end up with a hodgepodge portfolio that frankly will get us into trouble in a few years' time. We want to buy the best assets, as well as the best teams and best systems."

AviLease's portfolio is now 32 aircraft after the company signed a deal with Saudi carrier flynas for the lease of 12 Airbus A320neos – two of which were delivered within four months of AviLease commencing operations – and more recently a sale-leaseback agreement was signed with Saudia Group, which owns Saudia and flyadeal, for 20 A320neos to be operated on long-term leases by low-cost carrier flyadeal.

Scale is important for AviLease, not least because it allows for a more diverse financing strategy. The team intends to reach a certain scale that would allow the lessor to access the debt capital markets and eventually to attain an investment grade credit rating, although that process takes at least three years. "2025 or 2026 is probably a good timeline for aiming for an IG rating," says O'Byrne. "In the meantime, we want to make sure that we have access to many lenders as well as the capital markets but we are in no rush to lever up."

Targeting an investment grade rating will also enable AviLease to build in discipline to its processes and financing strategy from the ground up, providing certain thresholds such as liabilities. "We plan to maintain a secured side of our balance sheet," says O'Byrne, noting that the business will not be aiming for a 99% unsecured structure like many other lessors. For a new lessor, building those financial relationships is key, which requires closing secured and unsecured transactions. "We want to make sure that we look at every pocket of capital," says O'Byrne.

O'Byrne views sale-leaseback transactions as the easiest way to deploy capital, he considers the next phase of growth as gaining access to OEM slots and trading in the secondary market. Both of which have their own challenges. With such deep pockets and a clear growth strategy, AviLease aims to become a major player in the leasing market, but O'Byrne is mindful of the market challenges. "The speed of the interest rate rises has shocked the sector," he says. "Many players have found it difficult to readjust their pricing mindset to add at least 10 basis points onto last year's lease rate factors – which has clearly not happened. Part of this lag is being driven by a number of investors that have capital allocated that they need to deploy no matter what. We are not keen on that approach; we want to stay very disciplined in our approach."

As soon as new aircraft deliveries return to a more normal delivery schedule, O'Byrne expects that sort of capital to flow away and not return any time soon. "The increase in deliveries will also see yield spreads increase – that has to happen otherwise the risk-reward ratio cannot be justified."

Lease rate factors are a constant cause of concern for lessors especially since they have been at historically low levels for more than a decade before COVID. Post pandemic there was the expectation or hope that levels would start to include but the abundance of liquidity raised kept competition high. Today lease rates are reported to be rising but not quick enough to keep pace with the hike in interest rates and to cover the increase cost of funds. The natural lag between lease rates and interest rates has been discussed throughout this report but the accepted length of that gap is debated by lessors.

"Some people will tell me it's nine months; some people will tell me it's 12 months," says ACG's Baker. "Some even say 18 months. The needle is already starting to move up. When rate volatility really started to kick up and rates really started to exceed in Spring 2021, that nine to 12-to-18-month rule would suggest that upward trajectory in lease rate factors has already begun and will continue to rise into summer to a place where people can make money. You can only put so much dumb capital to work and you can only lose so much money, before discipline forces you to rerate your business."

The challenging environment may serve to flush out some weaker competitors. In a rising rate and inflationary environment, many lessors build in protection in lease contracts, which should offer some protection going forward, but there are still many leases out there that are on fixed rate terms that could cause pain if rates continue to rise. ALC's John Plueger believes that this could reduce trading volume if buyers struggle to find financing at a cost of funding that makes sense. "Most leases around the world, especially coming from a low interest rate environment, are at fixed rates," he says. "It remains to be seen if the appetite for buying aircraft is tempered by the buyer's own ability to finance at a rate that makes that transaction feasible. All I can tell you is there's no shortage at all of demand requests." Speaking in October 2022, Plueger commented on the rise in demand for aircraft in the secondary trading market despite rising inflation and increased cost of funds. "My gut feeling is that we will see a much more robust aircraft trading environment as we go through into 2023."

Even though high interest rates may be dampening asset values as the cost of capital rises, rising inflation, although it increases costs for everyone, should have a positive impact on asset values for aircraft lessors. Avolon's Andy Cronin says that correlation between inflation and asset prices remains in place and that he "expects appraisers to put a higher level of inflation on aircraft values over year end than we have seen in past decade."

For Robert Martin, those value hikes cannot come quick enough: "Appraisers are living in their own little bubble at the moment," he says. "When the rest of the world is seeing inflation, the aircraft appraiser community is not. They need to change that and catch up with the market."

Martin further notes that higher asset values will breathe life back into the ABS market, which should increase trading activity further. Castlelake's McConnell agrees: "When the trading market finally opens up, which we believe it will and that we could get back to $30bn of trading a year (up from $5bn during the last 2-3 years), sellers will be looking for credible buyers that have committed debt and equity funding. We've seen many failed transactions in the market over the last few years where LOIs were signed but the transaction doesn't end up closing for a host of reasons."

Since the pandemic, the shortage of new aircraft deliveries from the manufacturers and the trend for lessors to keep hold of their assets due to the demand for lift from their customers and because they need to keep on top of their growth targets that stalled during the pandemic, kept a lid on trading. Leasing companies are slowly easing back into trading more aircraft. Kelly has already stated that AerCap has sold a significant number of assets in the past year and for "healthy gains".

Other market observers see a continued mismatch between aircraft bidding and asking prices. "Lessors who are looking to trade are trading off calculations they made several years ago when interest rates were very low whereas the acquirers who are basing their calculations off interest rates of today creating a mismatch," says Greg Byrnes, CFO, White Oak Aviation Management Services, an affiliate of White Oak Global Advisors. "That needs to be bridged at some point, and with new funding expected to come downstream, we hope to be ready to secure the best economics we can from an aircraft acquisition perspective."

There is likely to be a very crowded marketplace once asset values right size. Gary Rothschild, Partner, Head of Aviation Finance, Credit at Apollo, warns that the new entrants in the sector will be eager to boost their portfolios: "A lot of these new platforms are going to try and pry assets away," he says. "As deliveries ramp up, as exposures start to become an issue, there will be increased frequency and volume of trading."

"We see [AviLease] investment as a long-term driver of growth for the country in general, to support local airlines, but also to build up the local financial services industry and train local talent. Our perspective is quite different from other players in the sector; we really take that industrial target and mandate to heart."

Ted O'Byrne, AviLease

Chapter Four

Fleet and Freight Focus

Production issues and delivery delays have fed into the strong demand for aircraft during the past year. With both Airbus and Boeing missing their production targets and ongoing supply chain issues causing difficulties to ramp up production, many lessors are predicting a shortage of aircraft for the short-term future.

In December, Airbus announced that it would miss its original delivery of 720 aircraft for 2022. Due to supply chain issues, the European airframe manufacturer delivered 661 aircraft last year, missing its revised target of 700 aircraft announced in July. A delay in engine deliveries, seats and galleys, were blamed for the shortfall.

Boeing delivered 480 aircraft in 2022. Supply chain issues were partially responsible but Boeing has been struggling to ramp up production due to the backlog of MAX aircraft it needed to deliver and the fact that the MAX-7 aircraft type remains uncertified in the US. In November 2022, David Calhoun, chief executive of Boeing, commented in an investor conference on the backlog of 450 MAX aircraft: "It takes as many or more hours for us to prepare an airplane and return to service as it does to assemble it in first place". He also commented on the need for the company to restart factories that were closed for a year over the pandemic period, which he said meant the production rate restarted from zero, not from 2019 rates.

Stan Deal, president and chief executive of Boeing Commercial Airplanes, stated that the company is continuing to work the certification of the MAX and said in November that Boeing anticipates a resolution "early into 2023", adding that for the MAX 10 the company continues to work with the FAA and anticipates the closure of certification "by late 2023 or early 2024". Deal added that the 777-9 "remains on track and unchanged relative to its certification" with the first delivery still expected in 2025. Boeing intends to field the field the 777-8 into the market at the close of the decade.

The MAX programme is awaiting certification in China, which has required Boeing to re-marketing aircraft bound for China to other customers. Deliveries from the US manufacturer were also impacted by the grounding of the 787 aircraft between May 2021 and August 2022 due to quality issues. Boeing delivered only 10 787s in 2022. Boeing's 777X programme is also awaiting certification. The manufacturer delivered is final 747F aircraft in 2022 ending the jumbo-jet programme.

Stan Deal noted that the supply chain was the limiter in terms of ramping up production. "We're seeing shortages in the near-term," he said. "The major limiting factor [to] the rate being through the engine manufacturers. But we've seen near-term impacts as well… from galleys to wires to electric components and an occasional quality escape out of our supply chain which our quality management system catches and that has been a factor for our stability in 2022."

Net production of the 737 programme was 37 per month as of September 2022, but that fell to 23 when manufacturing defects caused delays. Deal said that Boeing would be able to "recover on that quickly" and "surge" to recover the delivery by the end of the year, but he noted that it was the "adverse quality" that had to be managed out of the system which caused an impact. He said that the current production rate on the MAX was 31 per month.

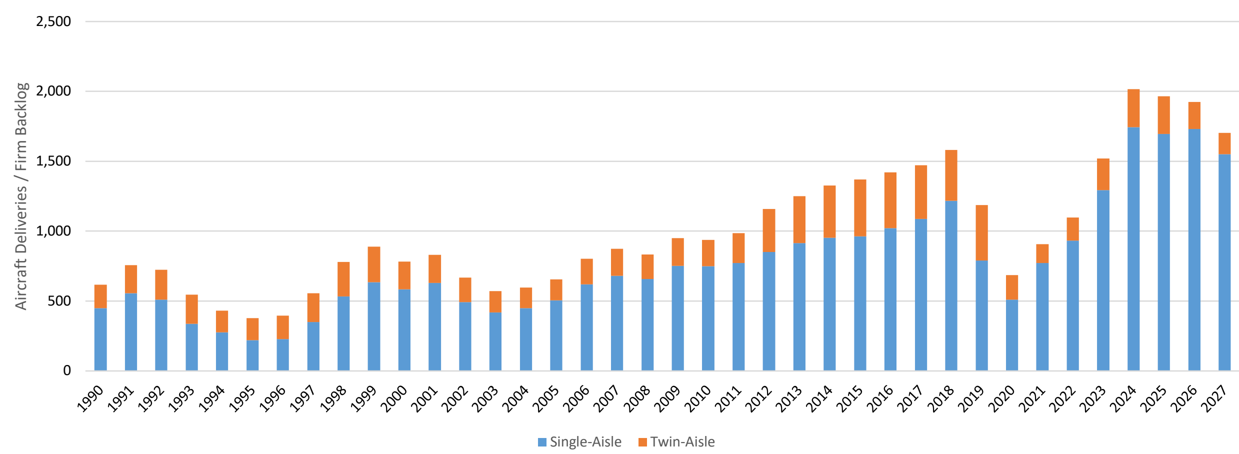
Boeing has confirmed that it is working with its supply chain to help its recovery, from assisting with recruitment techniques, to providing its own staff to help its partners. "We deployed over 320 people commercially out of our supply chain team into the supply chain," said Deal. "You may know we have a robust fabrication division in our commercial operation that fab divisions not only capacitate to produce the parts for the airplanes we have here, but we carry excess capacity to bail out and rescue distressed suppliers. And we've had several situations where we pour that capacity back into the supply chain in order to recover and assure the continuity of parts supply."

Boeing has also tapped into its inventory of engines to partially fill the supply gap – a move it considers to be a "last resort", which shows the extent of the shortages.

Airbus confirmed in December that it was progressing its production line to work toward producing 65 A320-family aircraft per month by early 2024, and

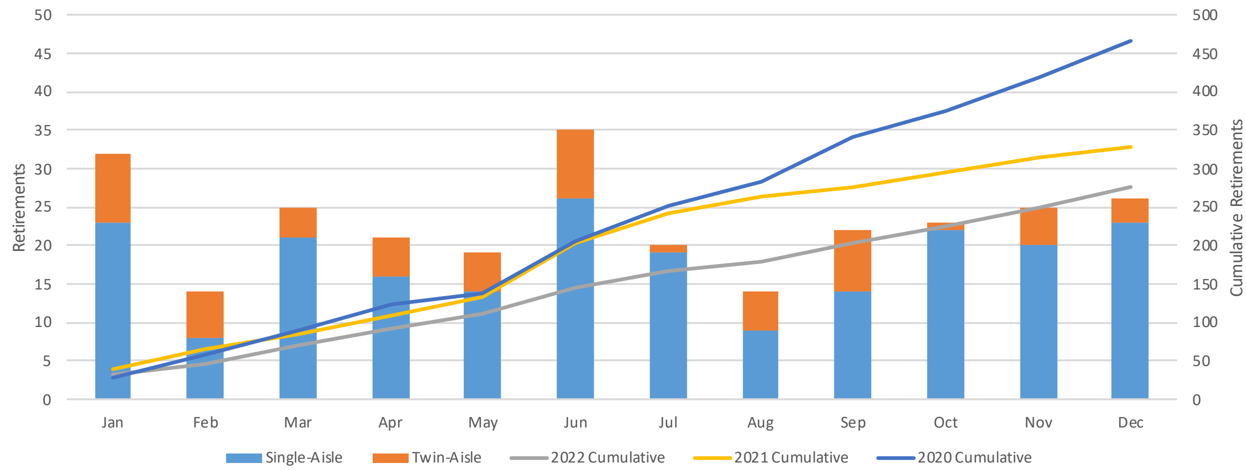
"The manufacturers could do better but clearly it is new technology and its entry-into-service has created issues"

Tom Barrett, Engine Lease Finance



Source: Ascend by Cirium

FIG.25: AIRCRAFT DELIVERIES AND FIRM BACKLOG



Source: Ascend by Cirium

FIG.26: AIRCRAFT RETIREMENTS IN 2022

up to 75 in 2025. The manufacturer is enhancing its assembly lines to meet the new rate and to ensure each line is capable of producing the A321 aircraft type. Airbus has now flown all three test A321XLRs, with the aircraft's entry-into-service expected to take place in Q2 2024.

In October, Guillaume Faury, Airbus chief executive officer, said that the supply chain "remains fragile" due to the "cumulative impact of COVID, the war in Ukraine, energy supply issues and constrained labour markets". Nonetheless, Airbus is pushing ahead with ramping up its production rate and on the widebody aircraft side, the European manufacturer says that it is "exploring, together with its supply chain, the feasibility of further rate increases to meet growing market demand as international air travel recovers".

The airframe manufacturers both mentioned delays in the supply chain, notably from their engine manufacturing partners. Speaking to *Airline Economics* and KPMG in Dublin in December, Engine Lease Finance CEO Tom Barrett commented that the engine manufacturers could improve delivery rates but notes the challenges they were experiencing. "The manufacturers could do better but clearly it is new technology and its entry-into-service has created issues," he said. "The tougher climates in which that equipment is operating has perhaps created some issues, but the problems seem consistent with new technology – it will take some time to settle down. The manufacturers have sought to increase the spares ratio initially to cover any operational entry-into-service issues, and that work continues. We are keen to play our part in either helping the manufacturers or the airlines to ensure they have the required number of spares. While they may get on top of the supply chain issues for manufacturing, there's a bit more to run on the operational piece and we'll be seeing more things that continue to create some difficulties and challenges for the next couple of years."

Labour constraints are a major factor that filter throughout the entire production supply chain, which cannot be solved in the short-term timeframe.

"The engine manufacturers for the newest generation engines have a real problem delivering to airframe manufacturer production demands," says ALC's John Plueger. "They are up against a hard limit. You cannot solve this problem with money. If it could be solved with money, it would be solved.

There's money there. That's not it. There are fundamental structural limitations in the supply chain of how much can be produced."

The fact that most contracts are on fixed rates is exacerbating the problem as interest rates rise and inflation continues to creep up. "You're going to get the same dollar for your widget until your contract expires," add Plueger. "Airframe manufacturers build escalation into their contracts, but stressed secondary and tertiary suppliers, which are smaller companies, do not and have been pushed to the financial wall ... a certain number will seek to renegotiate pricing."

Plueger also notes that during times of war, defense contracts take priority, which he believes will have a further impact on a limited supply chain especially if the US and Europe support of Ukraine continues for the medium-term.

Speaking on an earnings call in June 2022, Olivier Andries, CEO of Safran, which owns half of CFMi with GE that manufacturers the LEAP engines, noted that the company was late on LEAP deliveries but stated that he was hopeful the company had reached a "trough" and that it would catch up on its late backlog. "It's a challenge considering the supply chain fragilities," he said, adding that the company would progressively reduce its backlog but warned that because supply chain issues were likely to last until the end of 2023, it would be difficult to get back on track and that "it's an everyday fight."

Customers waiting for aircraft to be delivered have been patient and understanding considering the global shutdown and issues relating to the pandemic, however, patience seems to be running out as escalation starts to bite. "Escalation for OEM deliveries are formulas that were agreed to in some cases 10 years ago and in other cases two years ago," says Ryan McKenna, CEO of Griffin . "The inflationary environment is resulting in higher prices for newly delivered aircraft. Over time, we believe that this will shift the whole curve of aircraft values upwards, but that takes time to adjust."

Ryanair's Michael O'Leary said that the summer of 2023 was looking positive for the airline but he complained that despite the projected demand, Boeing

C919 takes to the skies

The (Commercial Aviation Corp of China) COMAC C919 cleared its final regulatory hurdle in October to be fully certified in China and took its maiden public flight on November 1 at the China International Aviation and Aerospace Exhibition in Zhuhai. On December 9, China Eastern Airlines (CEA) took delivery of the very first C919 with the registration number B-919A.

A 15-minute maiden flight of the C919 aircraft was conducted by three senior CEA pilots from the Shanghai Pudong International Airport to the Shanghai Hongqiao International Airport. After arriving at the Shanghai Hongqiao International Airport and passing through a water gate, the aircraft was officially commissioned into the fleet of CEA.

A pattern of a Chinese seal reading "world's first C919" in Chinese is printed on the front part of the plane delivered.

According to COMAC, the new C919 features an advanced aerodynamic design, propulsion system, and materials, as well as lower carbon emissions and higher fuel efficiency. The aircraft has a 164-seat configuration with a two-class cabin layout, including eight business class seats and 156 economy class seats. In the economy cabin, the middle seat in each three-seat row is 1.5 cm wider than its neighbouring ones, offering more comfort for the passengers.

COMAC expects to produce around 25 C919s per year by 2030. The first C919 is expected to be put into commercial use in the spring of 2023.

CEA plans to receive the remaining four of its first batch of C919 orders over the next two years.

At the Zhuhai airshow, the C919 collected orders for some 300 aircraft from China Development Bank Leasing, ICBC Leasing, CCB Financial Leasing, BOCOM Leasing, CMB Financial Leasing, SPDB Financial Leasing and Suyin Financial Leasing. COMAC also received orders for 30 ARJ21s.

The C919, which was designed to compete with the Boeing 737 and Airbus A320, received a "type certificate" issued by the Civil Aviation Administration of China in September, and has a list price of US$99 million. Many Chinese new outlets have this week stated that the aircraft "will reduce dependence on foreign technology as ties with Western countries deteriorate". The C919 represents a central component of President Xi Jinping's vision for China's long-term security and development.

The C919 is widely expected to take over most of the Chinese market deliveries in the aircraft class segment. The only question is whether COMAC will (or can) ramp-up production to an extent that sees the C919 rolled-out at speed to disrupt the market in the medium term of six years-plus, rather than in ten years as is currently the case. COMAC will do everything it can to outproduce both Boeing and Airbus and is also likely to heavily undercut both Boeing and Airbus on cost. COMAC needs get the C919 delivered fast and build up commercial flight hours to sell to international airlines with confidence. From that point, the only concern may be the matter of international parts and maintenance certifications for the aircraft.

The C919 is a disrupter to the airframe manufacturer duopoly that has existing for decades. But COMAC still has a long way to go before it can offer a true family of aircraft to compete across all aircraft types. That said, if the C919 performs as promised, it is now a direct Neo and Max competitor, with a far lower cost of ownership.

was a "blemish on the horizon" since he was doubtful the airline would receive all of the 51 aircraft it is scheduled to April 2023. "We do not think we'll get those 51 aircraft … I'm hopeful that we'll get between 40 to 45 aircraft by the end of June. We will not take aircraft deliveries after the end of June because we can't put them on sale for the peak period. But if we get between 40 to 45 aircraft by the end of June, I think that still puts us on track to hit our 185 million passenger target for FY [financial year] 2024."

O'Leary noted in the call that Ryanair would still hit its 185 million passenger target for FY 2024 if it received 40-45 aircraft from MAX rather than the 51 but opportunistically Ryanair had "done a deal for one additional NG that's being offered back to us, that we used to operate on an operating lease. We've got a long-term low-cost lease rate on that." O'Leary added that he would "opportunistically add aircraft in ones and twos with 737NGs, where there's a kind of a financial intent to do so".

RUSSIAN AIRCRAFT PRODUCTION

With the closure of the Russian market to aircraft manufacturers due to sanctions, Russian airlines have turned to domestic aircraft programmes to revitalise their fleets. In September 2022, Aeroflot Group ordered 339 aircraft, including 210 of the Irkut MC-21 aircraft that will become the flagship of the company's fleet. The airline will also operate Superjet aircraft. The delivery of the first six MC-21s is planned from 2024, with the rest delivering out to 2030.

According to the Deputy Prime Minister of the Russian Federation, Minister of Industry and Trade of the Russian Federation Denis Manturov, the Russian state plans to subsidise the purchase of imported versions of aircraft, fixing the delivery price for airlines so that carriers do not experience additional financial burden.

Director General of Rostec State Corporation Sergey Chemezov said that all aircraft will be delivered in an imported form – with on-board systems and units of Russian production.

With reports of capacity constraints limiting new aircraft programmes including the Superjet and MC-21, there have been reports that other homegrown aircraft, such as the Ilyushin Il-96 and Tu-214 (first manufactured in the late 1990s), could increase production. However, in December reports emerged that United Aircraft Corporation (UAC) would only produce up to 20 Tu-214s due to cost issues, with deliveries planned for 2023. UAC aims to produce 70 aircraft by 2050. Aeroflot has signed an LOI for 40 Tu-214s, with deliveries planned to 2030. UAC also plans to increase production of even older aircraft types including the Il-96 and Il-76 aircraft, which have designs dating back to the Soviet era.

ORDERS

In 2022, Boeing booked 774 net orders, with Airbus ending the year on 820 net orders.

Despite the many macroeconomic headwinds referenced throughout this report, airframe manufacturers report increased interest from customers for new aircraft and a reduction in cancellations that peaked in 2020. The demand is being fed by the shortage of aircraft caused in part by the early retirements of older aircraft during the pandemic period, by the delay in new aircraft deliveries, the scarcity of new aircraft delivery slots, and by the environmental pressure to revitalise fleets with the most efficient aircraft possible as many airlines strive toward reducing their carbon emissions in keeping with the 2050 net zero commitment.

Despite most airlines still in post-pandemic recovery mode, with a way to go to return to 2019 traffic and capacity levels, they are seeing that pent-up demand continue and increase as customer discretionary spend pivoted toward experience-based items rather than goods.

"All the discussions with the airlines are pretty lined up," commented Stan Deal in November. "Every customer we talked to believes they will still be able to grow through any kind of recessionary pressure and everything we see from a buying behaviour is supporting that. We haven't seen a pull back, a stop of


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FIG. 27: AIRCRAFT ORDERS IN 2022 (BY AIRCRAFT TYPE)

Aircraft Type	Orders	Airlines
737 MAX	236	AerCap (6); ALC (11); ACG (21); Southwest (5); United (98); Unidentified (95)
737 MAX 10	239	Alaska (47); Delta (100); Qatar (25); WestJet (42); IAG (25)
737 MAX 8	185	ALC (23); American (30); ANA (20); Arajet (20); BBAM (40); Griffin (5); Southwest (18); IAG (25)
737 MAX 9	28	ALC (16); Alaska (10); United (2)
767-300ERF	10	FedEx (2); UPS (8)
787	100	United (100)
777-200LRF	35	Air Canada (2); China Airlines (4); DHL (6); Emirates (5); EVA (1); FedEx (2); Lufthansa Cargo (2); Qatar (2); Western Global (2); Unidentified (4)
777-8F	33	Cargolux (10); Lufthansa Cargo (7); Qatar (14); Silk Way West (2)
787-9	38	AerCap (5); China Airlines (16); Lufthansa (7); Unidentified (10)
A220-300 (CS300)	123	Air Canada (15); ACG (20); Azorra (20); Croatia (6); Delta (12); JetBlue (30); Qantas (20)
A319-100N neo	16	Air China (5); China Southern (9); Unidentified (2)
A320-200N neo	367	Aer Lingus (4); AerCap (2); Air China (9); ALAFCO (10); BOC Aviation (20); BA (4); CDB Aviation (2); China Eastern (32); China Southern (23); Condor (4); easyJet (56); IAG (25); Jazeera (20); Jet2.com (35); Peach (1); Shenzhen (18); Sichuan (3); SMBC AC (3); Xiamen (25); Unidentified (71)
A321-200NXneo (A321LR)	566	AerCap (1); Air China (50); American (4); ANA (1); ACG (1); Azul (13); BOC Aviation (50); BA (2); CALC (9); China Eastern (68); China Southern (64); Condor (6); easyJet (18); Iberia (5); IAG (26); Jazeera (8); Jet2.com (3); JetSMART Chile (1); Kuwait (9); LATAM (20); Pegasus (8); Shenzhen (14); Sichuan (3); SMBC AC (12); Spirit (5); Wizz (21); Xiamen (15); Unidentified (129)
A321-200NYneo (A321XLR)	40	Air Canada (10); BOC Aviation (10); Qantas (20)
A330-900neo	9	Air Cote D'Ivoire (2); Azul (3); Delta (1); Kuwait (3)
A350-1000	12	Qantas (12)
A350-900	6	Turkish (6)
A350F	20	Air France (4); Etihad (7); Silk Way West (2); SIA (7)
ARJ21 700	30	Bocomm Leasing (10); CCB Financial Leasing (10); CMB Financial Leasing (10)
C919	300	Bocomm Leasing (50); CCB Financial Leasing (50); CDB Aviation (50); CMB Financial Leasing (50); ICBC Leasing (50); SPDB Financial Leasing (30); Suyin Financial Leasing (20)
E175	9	Horizon Air (8); SkyWest (1)
E195-E2	51	Azorra (20); Binter Canarias (5); Porter (20); SalamAir (6)

Source: Ascend by Cirium

RFPs or something of that nature. And remember, the airlines are also trying to establish and meet their sustainability goals, that is driving fleet renewal even when they may be faced with some slowing of growth."

Tim Myers, President, Boeing Capital Corporation, shares this view: "Airlines are all looking at the future in terms of ESG and the operating costs of their fleets so they're out reordering and refleeting in a big way," he says. "Both ourselves and our competitor have orderbooks that are very strong on the widebody front. With the elimination of the four-engine aircraft – we stopped production of the 747 and the A380 is no longer in production – there is a real focus on the large, dual-engine widebody aircraft. I love the 787 - we have the -8, -9, and the -10 – and all have sold well. The 777X, which is in development with a freighter version, has also sold extremely well."

The largest orders last year came from United Airlines, BOC Aviation, Delta Air Lines, China Eastern Airlines and China Southern, which booked orders above or close to 100 airplanes each.

In December 2022, United Airlines announced an order for 100 787s, with options for a further 100 more aircraft. The aircraft, which are scheduled for delivery between 2024 and 2032, are destined to replace the US carrier's 767 fleet and certain of its 777 aircraft. Commenting on the deal United's CEO Scott Kirby described the 787 as a "better replacement" for the 767 than the A350 due to its smaller size but also added that keeping with a Boeing fleet made more sense as it attempts to onboard some 2,500 pilots every year – "introducing a new fleet type slows that down dramatically," he said.

United already has 63 787s in its fleet and is scheduled to receive another 70 before 2023, but like others, it was subject to delays when deliveries of the aircraft type were paused due to manufacturing issues.

United has also ordered 56 additional 737 MAXs and has exercised options for 44 more aircraft, adding to its 2021 narrowbody order that also included 70 A321neos – complementing its order for 50 A321XLRs made in December 2019 to boost its transatlantic fleet.

2023 will be a busy year for United as it is scheduled to receive more than 179 aircraft deliveries through the end of the year, which is more aircraft deliveries in one year than any other airline in history. This is provided they all deliver on time. United stated in its October earnings call that it continues to work closely with Boeing and Airbus regarding its deliveries will provide an updated outlook for 2023 later in January.

Delta Air Lines placed its first major aircraft order in a decade in July 2022 with a firm order for 100 737-10s – the largest MAX family aircraft – with options on 30 more. The aircraft are due to begin delivery in 2025. Nearly one third of the aircraft's 182 seats will be configured with premium seating. Delta also firmed up an order for 12 A220-300s at the Farnborough airshow in July, boosting its A220 orderbook to 107 airplanes – 45 -100s and 62 -200s.

BOC Aviation expanded its Boeing 737 MAX portfolio by placing a firm order for 40 new Boeing 737 MAX 8 aircraft. All aircraft are scheduled for delivery in 2027 and 2028. The incremental aircraft takes the lessor total 737 MAX 8 orderbook with Boeing to 80 aircraft.

Combined, IAG and IAG-owned airlines ordered more than 100 aircraft in 2022 – 25 373 MAX 10s, 25 737 MAX 8s and 25 A320-200neos and 26 A320-200neo XLRs.

China Eastern and China Southern both ordered the C919 in 2022 as well as adding to their Boeing and Airbus orderbooks. CEA ordered 100 A320neo aircraft in July, which are due for delivery between 2024 and 2027, while China Southern ordered 96 A320neo aircraft with a similar delivery profile.

Airlines in China are preparing for the expected ramp up in demand for air travel. "The China market is expected to pick up in 2023 as we see further state support and signs of reopening including state aid policy announced, relaxed border restrictions and more international flights are scheduled to the year end," said Mike Poon, Executive Director and Chief Executive Officer, CALC. "We stay focused on China and ready to capture the coming market rebound as China reopening will release previously suppressed travel demand."

Game-changing aircraft

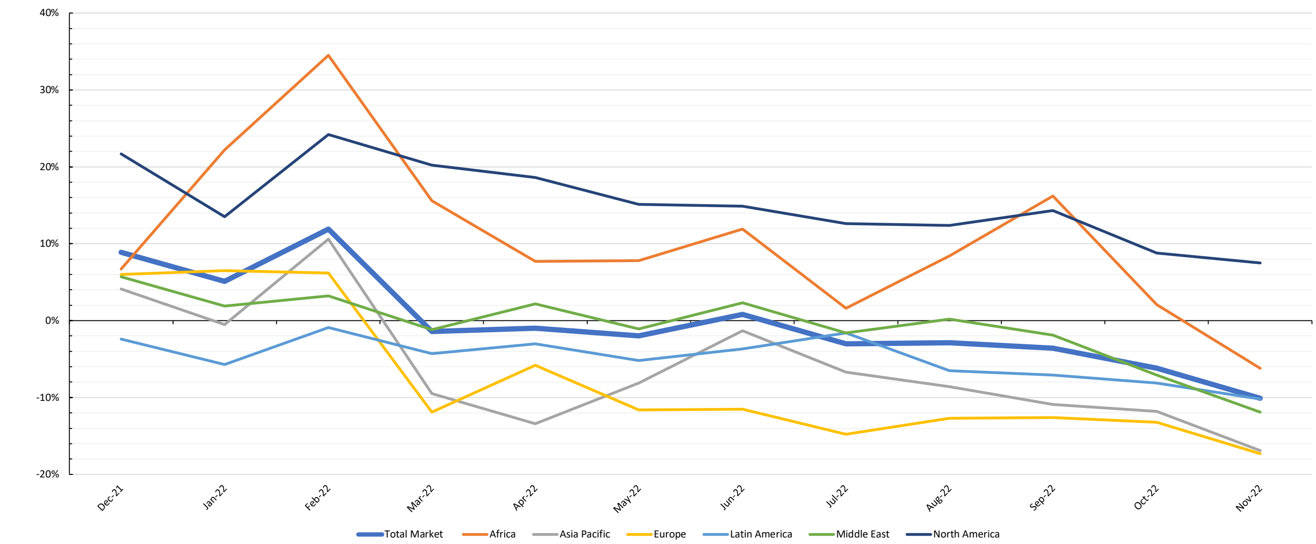
"Game-changing" is an oft used adjective to describe new aircraft on the market that promises to shake up the competitive marketplace. Ryanair's Michael O'Leary dubbed the 737 8-200 a gamechanger aircraft when the airline first placed an order for 100 with 100 options for the new MAX 8200 aircraft in 2014. With options exercised Ryanair has 210 on order. The aircraft were to begin delivering from 2019 to 2023 but the grounding of the MAX aircraft and certification and production delays meant that Ryanair only began taking delivery of the first airplanes from June 16, 2021. Ryanair expects another 52 to deliver by April 2023 and with doubts over Boeing meeting its schedule has leased a vintage 737NG to fill a capacity gap.

Ryanair calls the aircraft a gamechanger because it carries 4% more passengers and reduces fuel consumption by 16% per seat, and lowers noise emissions by 40% and CO_2 emissions by a similar amount. Speaking in November, O'Leary said that the new aircraft had enabled the airline to add capacity and lower its fuel costs at a time when its competitors are cutting capacity, allowing it to capture additional market share.

Despite clear benefits of the Boeing aircraft, Airbus has a response in the A321XLR. The Airbus ultra-long range version of the A321 has also be dubbed a gamechanger at its launch at the Paris airshow in 2019. The A321XLR is to be able to fly a smaller number of passengers of between 180-220 people over longer distances (up to 4700 nm or 8,700km), which means it low-cost carriers can offer longer-haul routes with a lower trip cost and a lower purchase price than today's widebody aircraft options. For this reason, comparisons have been made with Boeing's 757-200 but the A321XLR promises better fuel economics and emissions as well as a longer range. The aircraft's flexibility is also a major attraction since per seat economics are not impacted should the aircraft be utilised on routes that are six hours long or 12 hours. It also opens up the transatlantic market or transpacific market to more operators with reduced risk.

The A321XLR has attracted orders of more than 400 units since its launch in 2019. The expected entry-into-service remains on target, says Airbus, for the second quarter of 2024. It remains to be seen if production and supply chain issues cause that target to slip but the flight test programme is well underway.

ALC is the launch customer of the A321XLR, with an order for 27 of the aircraft at the Paris airshow in 2019, which was boosted by an additional order for 20 more units in November 2021. The US-based lessor has announced several placements for the aircraft from its orderbook. Most recently, five with LATAM to be delivered between 2025 and 2026. ALC has also placed 15 of the aircraft with Air Canada, four with Air Transat.



Source: IATA (cargo tonne-kilometres, % change v 2019)

FIG. 28: AIR CARGO TRAFFIC GROWTH

Poon added that CALC remains very optimistic about China's long-term growth momentum. "China targets to grow passenger numbers to 930 million in 2025 with CAGR over 17%," says Poon. "According to Airbus, more than 8400 aircraft will be delivered to China in the next 20 years which makes China the largest country for deliveries. Boeing's market outlook also forecasts the domestic PRC to have the world's largest traffic flow with CAGR over 5%."

FREIGHTER FOCUS

Air cargo provided the salvation for many airlines and aircraft operators throughout the pandemic, but there are signs the market has cooled in recent months fuelling a debate in the industry on whether the market has overheated or the growth in eCommerce will be permanent and has subsequently created a more stable industry.

Boeing's World Air Cargo Freight Delivery Forecast (WAFDF, published in 2020), predicted that over the next 20 years, the freighter fleet will grow more than 60% from 2,010 to 3,260 units. There are 2,430 freighters forecast to be delivered, with approximately half replacing retiring airplanes and the remainder expanding the fleet to meet projected traffic growth. Boeing forecasts that more than 60% of deliveries will be freighter conversions, 72% of which will be standard-body passenger airplanes. Of the projected 930 new production freighters, just over 50% will be in the medium widebody freighter category.

In its Global Markets Forecast, published in 2022, Airbus forecasts the world freighter fleet will reach 3,074 aircraft by 2041 from 2,030 in 2020. Airbus says that 69% of the 2020 fleet will be replaced by new-build or converted freighters, with 1,040 needed to cope with the growth in demand.

Boeing's Tim Myers is convinced that demand for air cargo can only continue to grow. "Boeing's Commercial Market Outlook projecting an 80% growth in the cargo fleet over the next 20 years," he says. "We saw this in 2021 with the highest orders we have ever seen for our cargo aircraft. We sold 84 new production freighters. We sold 100-plus of our Boeing Converted Freighter. We started up new freighter conversion lines to meet demand. We have continued to see demand in 2022, maybe not as strong as what we saw in 2021, but we saw orders for the 777X freighter."

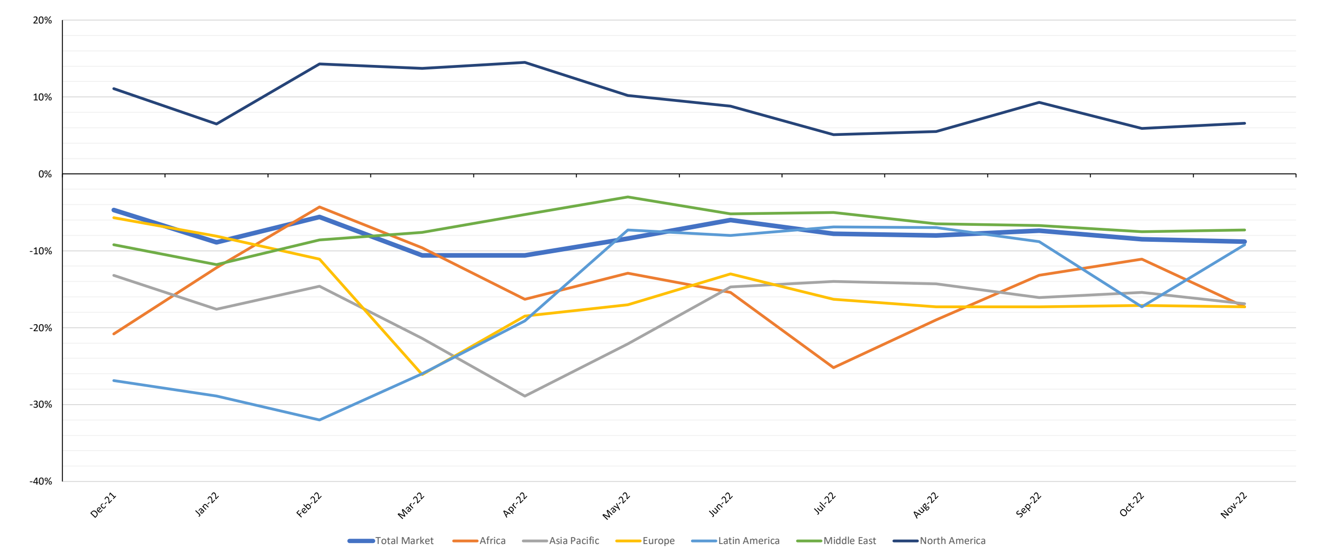
Myers continues to believe that the cargo market will remain strong.

The air cargo market grew by 18.8% in 2021 and with 65.6million cargo tonnes transported, air cargo commanded some 40% of total airline revenue in 2021 compared to the pre-pandemic range of between 10-15%. Growth cooled in 2022 dropping to 8% below 2021 levels with 60.3 million tonnes transported and a 28% share of total airline revenue. Cargo traffic has been impacted by the global economic slowdown in global GDP and there is a consensus that the boom in export orders seen in 2021 has now stabilised. Sanctions against Russia, the war in Ukraine and China's zero-COVID policy all helped to suppress cargo traffic added to which the shipping capacity has repaired over the course of 2022 while belly capacity has been steadily growing cannibalising some of the dedicated cargo traffic.

IATA forecasts that air cargo revenue will fall back further still to about 20% of total revenue – some $150bn – on the back of softer demand and lower yields. Analysts also predict that there could be excess cargo capacity in 2023 that will put further pressure on yields.

Despite the forecasts, air cargo remains an area of focus for lessors that are investing in conversions and dedicated freighter fleets while global logistic companies are creating new cargo airlines to capitalise on demand. MSC Mediterranean's MSC Air Cargo and Maersk Air Cargo (a takeover of Star Air) were both launched in 2022 by their shipping conglomerate parent companies.

Atlas Air announce a long-term partnership with MSC Air Cargo in September and will operate four new 777-200 freighters under an ACMI agreement. At the time, Soren Toft, Chief Executive Officer, MSC, commented



Source: IATA (available cargo tonne-kilometers, % change v 2019)

FIG. 29: AIR CARGO CAPACITY GROWTH

that the "strategic partnership with Atlas Air is the first step into this market and we plan to continue exploring various avenues to develop air cargo in a way that complements our core business of container shipping".

Atlas Air is the world's largest outsourcer of air freight solutions and operates the largest 747 fleet, with a growing number of 777s. The air freight company also operates a large 767, 757 and 737 freighter fleet that serves the entire market. Atlas also has long-term agreements with Amazon and Alibaba as well as other logistics providers, and as such as been at the forefront in the eCommerce boom. Atlas Air has recently been purchased by an investor group led by Apollo Global Management for $102.50 per share, valuing the company at $5.2bn.

"Air freight is at the centre of the global economy, and plays an incredibly important role in global manufacturing, global distribution, and global consumption," says Michael Steen, Michael Steen, Chief Commercial Officer, Atlas Air Worldwide and President & Chief Executive Officer, Titan Aviation. "Our industry has been affected by the economic cycles. More recently by a slowdown in the global economy, and by major events such as the war in Ukraine and the impact that's having on energy pricing, pricing in general, and driving inflation. But the core transportation element is something that has to be fulfilled, and that's where air freight plays a really important role. Even if we see a down cycle at the moment where demand has become softer, over the longer term there will still be a very high demand for dedicated freighters due to the sheer growth of the underlying economy."

Cargo carriers are reporting strong results for 2022 even if they too see a softening in demand going forward. In October, IAG Cargo reported third quarter revenue increased by nearly 40% compared to 2019 with the reduction in air cargo traffic as sea freight recovered which was more than offset than strong yields.

As passenger capacity continues to ramp up, belly freight capacity is also increasing, which has led many to doubt the continued demand for dedicated freighters will continue over the longer term. "Cargo demand is beginning to soften and world trade has begun to lose momentum in the second half of 2022," noted IAG CEO Luis Gallego Martin in an earnings call. "Yields are still high, but we see that capacity is reducing… we are flying more passengers so the space for cargo is reduced because we were doing a lot of cargo-only flights during the pandemic. And also during the pandemic, we chose where to fly. So, we could fly for example to Asia destinations that we are not flying now with passengers."

In December, the economic slowdown caused Amazon's Prime Air to consider selling excess capacity on its cargo aircraft as consumers ease up on their online spending amid a rising cost environment.

S&P's Betsy Snyder has a cautious view of the sector: "We have always viewed the cargo market as more cyclical than the passenger side," she says. "I have been a sceptic. Every single air cargo company that we have ever rated up until just a few years ago has always become bankrupt. There's always been some problem. The air cargo space has really benefited from the increase in demand for goods, and from the problems with shipping and port. But now it seems that there will be too much cargo capacity coming into this space. Everybody is converting passenger aircraft into cargo aircraft. And belly capacity is coming back as traffic to Asia Pacific opens up with more widebody aircraft coming back. I think eCommerce will continue to continue to grow, but not at the levels we've seen."

Apollo's Gary Rothschild agrees that the sector can be spiky but despite the challenges he retains a positive outlook on the sector. "We own a number of cargo aircraft at Merx and we finance a number of cargo aircraft through the PK business," he says. "We have a robust view on the cargo market, but it calls for a great deal of experience. It is spiky; you can mistime the market and there is a risk of it becoming a little bit top heavy right now."

Rothschild sees the risk of overcapacity in the converted space, believing there "will likely be somewhat of an overbuild of certain asset types in the conversion market" and that a softening in demand for converted freighters is beginning to appear but he insists demand will remain stable. "There has been a step change with respect to the volume of cargo in from the eCommerce side but clearly as more widebodies come back online and international travel ramps up that belly capacity will become available again, which could present some challenges for dedicated widebody freighter market. But across the firm we are very optimistic about the cargo space, with our private equity colleagues having recently agreed to acquire Atlas Air. Atlas is a sophisticated operator and one where we felt the management team had built in a lot of downside protection for a weaker demand environment."

Rothschild adds that the experienced freighter operator is able to play through the cycles and notes that transitioning a freighter aircraft often involves less cost and complexity than transitioning passenger aircraft. "We bought a 777 freighter years ago, and were the first to transition a 777 freighter from one carrier to another," he says, adding that overseeing the conversion process from passenger to freight requires careful management and oversight.

The global cargo fleet has been reduced by the Russian situation, which has effectively removed many freighters out of the market altogether. "The Russian crisis has had a huge impact on the very large cargo fleet because there was a lot 777s and 774 s operating in that market, which were basically deleted from the space," says Gary Fitzgerald, Stratos. "There has been a substantial hit in widebody dedicated cargo capacity this year, which has had a knock-on impact in the demand for dedicated cargo. This has only been partially alleviated by the fact that passenger aircraft bellies are being filled again."

White Oak's Greg Byrnes has seen a spike in demand for long-haul, larger freighters. "Some of the assets we invest in are the 747, which are older aircraft but their payload is very high

and competitive considering the low capital cost of the assets," he says. "Intercontinental freight will continue to be in high demand. Short-haul freight is more competitive, with more capacity, but with the growth of eCommerce and global interconnectivity, demand is likely to continue to grow in that part of the market as well."

Air Lease Corporation has also taken a view on the cargo market for the first time and has placed a small order – 10 units – for the A350 freighter.

CONVERSIONS

Avolon has invested substantially in the cargo market, specifically in the conversion programme for the A330 aircraft type. In October 2021, Avolon became a launch customer for IAI's A330-300 passenger-to-freighter (P2F) programme for 30 conversions slots between 2025 and 2028.

"In 2025, we will see the induction of the cargo conversion market for the A330," says Andy Cronin, Avolon CEO. "We've seen the impact of that on demand for the 737-800. We are a firm believer in the A330 from a cargo conversion perspective because we think there simply isn't an alternative to the 767 cargo aircraft and a replacement has to happen. We have taken a significant position with IAI for their conversion of the A330 on a multi-year programme."

Cronin believes that eCommerce is a permanent change to the global marketplace and notes that there will always be supply chain demand for fresh perishable goods that require air freight. He adds further: "The move to twin engine widebodies, away from four-engine aircraft, creates an opportunity for an increase in dedicated freighters. We see a significant opportunity in this market and a long-term shift in the market," he says. "Over the past year, we had a cyclical high due to the all the supply chain disruptions. As all channels are moving much better now, some of the heat has gone out of that, but we never invest for the spot market today. We're looking at the trend five years out, 10 years out, and 15 years out in terms of our expectations. We fundamentally believe that the freighter market is actually underserved by new capacity going in, which creates the opportunity for us to play in the conversion space in a material and significant way."

At the *Airline Economics Growth Frontiers Dublin* conference held in May 2022 many investors reported being told that it was too late to invest in freighters – new or converted – since new order deliveries slots are booked up for the next two years, while conversion slots are reported to be sold-out into 2025 and beyond. But despite the risks and the more challenging operating environment, there has been significant activity in the narrowbody conversion space, with 737-800s being converted at a substantial rate.

World Star Aviation became the largest lessor of classic freighters and the third largest freighter lessor in May 2022 following its purchase of 30 737-400 freighters. World Star's Iarchy sees the current passenger fleet of 737-800s as ripe feedstock for conversion into freighters as a replacement for the current narrowbody cargo fleet.

"There is a greater supply of 737-800s because aircraft has finally entered a price range where being converted makes economic sense and can command a lease rate that is attractive for freighter operators," says Iarchy. "There is not going to be a massive glut of these converted aircraft because demand is coming from several different areas. There are parts of the world that are still significantly underserved, such as India and China. And there are other areas where there is a decent supply of cargo aircraft but which are very old and will need to be replaced."

Eamonn Forbes, chief commercial officer of Titan Aviation Leasing, remarks that the market for 737 conversions has been growing for the past few years. "The 737 market has been a very dynamic market for conversion over the last two or three years," he says. "We've essentially gone from zero to about 140 converted freighters today across the globe. There are a lot of Boeing operators and the 737 converted freighter, which carries about 20 tons of freight, is the workhorse of the industry. The A320 is pushing its way in but to date there has only been one A320 conversion, but Airbus is coming in more strongly into that market. The 757 is another industry workhorse with Airbus hoping to replace the fleet – of nearly 600 freighters – with the A321 conversion programme, but only 12 have been produced at this moment in time."

Forbes expects the A321 to form a large part of the freighter fleet in the future but due to the lack of feedstock, this will take time. "The 757 story isn't finished yet," says Forbes.

AerCap has committed to the A321 P2F programme and in October inked a deal with Elbe Flugzeugwerke (EFW) for up to 30 A321 P2F conversions – 15 firm orders to converse the A321-200 to a freighter with options on a further 15. "Extending the life of our A321 fleet will complement the Cargo portfolio and meet the strong demand from our diverse customer base, from which we've seen a significant appetite for this freighter," said Rich Greener, Head of AerCap Cargo. "The A321 freighter is the best-in-class and most fuel-efficient aircraft to replace the B757-200 freighter. This transaction is in line with our cargo portfolio strategy of diversifying our fleet with improved economics and returns."

Iarchy notes that even with a slowdown in demand due to the economic environment, he believes that eCommerce is here to stay and that there is a large, aging freighter fleet that must be retired and replaced over the medium-to-longer term future.

Converting aircraft is a tried-and-tested way to extend the value of an aircraft but it is not as simple as it may sound. "The less experienced investors often get their fingers burned in this market by spending too much money," says Iarchy, who warns that the rising interest rate and high inflationary environment will alter the return-on-investment ratio and calm the market a little, which will also help reduce the spectre of oversupply.

Another perception in the conversions sector – although one that isn't publicly acknowledged – is that some of those occupied slots may never be taken up since certain investor may use conversion slots as an accounting exercise for an aircraft, since a conversion slot can reduce the write-down amount. There is also the chance that some booked slots may never be fulfilled since the investors are not able to fund or finance the conversion at the required time. All of which suggests more conversion slots may become available sooner than expected.

The converted aircraft sector is expected to remain busy even with a cool off in air cargo demand due to the technology gap between the retirement of the older aircraft types and the new technology aircraft coming onstream.

"The 737 market has been a very dynamic market for conversion over the last two or three years. We've essentially gone from zero to about 140 converted freighters today across the globe."

Eamonn Forbes, Titan Aviation Leasing

Chapter Five

Eye on ESG

Environment, Society and Governance (ESG) issues have not been forgotten during the global crisis, in fact they have grown in importance for all aviation companies as the industry commits to net zero targets for 2050.

At its 41st Assembly in Montreal in October 2022, the International Civil Aviation Organisation (ICAO) committed to a Long Term Aspirational Goal (LTAG) to achieve net zero CO2 emissions by 2050.

The ICAO agreement aligns with both the objectives of the Paris Agreement and the net zero CO2 emissions by 2050 resolution agreed by airlines at the 77th IATA Annual General Meeting in October 2021.

UK Transport Secretary Anne-Marie Trevelyan described the agreement as an "historic milestone, not just for the future of flying, but for the wider international commitment to achieve net zero".

US Special Presidential envoy on climate change, John Kerry, also welcomed the deal: "Thrilled to see international aviation commit at [the ICAO] Assembly to a sustainable future with a long-term climate goal… to help put aviation on the path to net zero by 2050," Kerry said on Twitter.

ICAO also agreed changes to its global offsetting scheme – the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). The changes aim to ensure airlines worldwide will begin offsetting emissions from 2024.

"The significance of the LTAG agreement cannot be under-estimated," said Willie Walsh, IATA's Director General. "The aviation industry's commitment to achieve net zero CO2 emissions by 2050 requires supportive government policies. Now that governments and industry are both focused on net zero by 2050, we expect much stronger policy initiatives in key areas of decarbonisation such as incentivising the production capacity of Sustainable Aviation Fuels (SAF). And the global determination to decarbonise aviation that underpins this agreement must follow the delegates home and lead to practical policy actions enabling all states to support the industry in the rapid progress that it is determined to make."

Commenting on the changes to CORSIA, Walsh added: "The Assembly's agreement strengthens CORSIA. The lower baseline will place a significantly greater cost burden on airlines. So, it is more critical than ever that governments do not chip away at the cement which bonds CORSIA as the only economic measure to manage the carbon footprint of international aviation. States must now honour, support and defend CORSIA against any proliferation of economic measures. These will only undermine CORSIA and the collective effort to decarbonise aviation," said Walsh.

The path to net zero will be challenging for the aviation industry as a carbon emitter but the commitment and enthusiasm of all aviation companies is clear. All facets of the aviation sector are working to reduce their own carbon footprints and contribute to the wider goal of reducing overall industry carbon emissions by 2050. Airlines have been particularly visible in their efforts to reduce their emissions and their sustainability policies – from recycling to investment in green technologies – have been well-publicised and widely reported.

"There is huge momentum around ESG and it will accelerate throughout 2023 and 2024," says Cowen's Becker. "In 2018, there was almost no discussion outside Europe on ESG and how the industry will attain net zero carbon emissions by 2050. In the second half of 2022, there was a huge acceleration of airline companies agreeing with various producers to buy sustainable aviation fuel. The problem with SAF is it is very expensive and it's not scalable. But that will change in the next decade. SAF – or a blend of SAF with fossil fuels – will probably be utilised for long haul flights. Short haul flights are another discussion."

Restrictions on short-haul flights came to the fore at the end of last year when the European Commission published its support for French government efforts to temporarily ban internal flights between destinations that are less than a 150-minute train journey apart.

The Commission said in a 2 December statement that it "believes that France is entitled to consider that a serious environmental problem exists in the situation at issue, which includes the urgent need to reduce GHG [greenhouse gas] emissions".

The Commission opined that the French law, which would halt the flights for three years, "could be justified under Article 20(1) of the Regulation provided it is non-discriminatory, does not distort competition between air carriers, is not more restrictive than necessary to relieve the problem, and has a limited period of validity not exceeding three years, after which it should be reviewed".

The Commission said the French government had informed it "of its intention to introduce a temporary limitation subject to conditions on the exercise of traffic rights due to serious environmental problems" but added that it had "received complaints from airports and airlines that the French law would be "ineffective and disproportionate to the intended objective, that it would discriminate between air carriers and that its duration would not be limited in time".

France's high-speed rail services mean shorter train travel times are possible compared to most other countries in the EU. The Commission said in its statement that "the French authorities anticipate that people will primarily switch to high-speed train rather than to coaches or cars", citing available data that "seem to point to a historical preference for rail connections amongst the people who use air connections".

Some suggest that short-haul flights could be replaced by new technology electric aircraft such as the new electric vertical take-off and landing aircraft in development, however as Becker points out there have few seats – four-six – which makes them an unrealistic alternative for shorter routes. "It is difficult for me to get behind battery-operated eVTOL aircraft, because they are so small – just four passenger aircraft," she says. "They are designed to replace ground transportation. Shorter air travel routes will likely be operated by hybrid aircraft in the future."

TRANSITIONING TO SAF

Many airlines have signed and publicised offtake agreements with Sustainable Aviation Fuel (SAF) producers to both to reduce their dependence on fossil fuels but crucially to secure access to SAFs due to the limited production. In the seven-year period since the first offtake agreement was signed in 2013 by United Airlines, which agreed to take 56.8 million litres from World Energy over a three-year period, a total of 27 offtake agreements have been signed worldwide.

The entire aviation industry expects SAF to play the largest role in decarbonising aviation, but supply remains limited and expensive.

IATA's Walsh has urged ICAO member states to focus their efforts on "ways to incentivise an increase in SAF production capacity and thereby reduce its cost. The tremendous progress made in many economies on the transition of electricity production to green sources such as solar power and wind is a shining example of what can be achieved with the right government policies, particularly production incentives," said Walsh.

The ICAO Assembly LTAG identifies several key areas of support for SAF, including requesting the ICAO Council to facilitate capacity building and technical assistance to states for SAF programmes, work with stakeholders to define and promote the transition to SAF, and facilitate access to financing for infrastructure development projects dedicated to SAF to develop the incentives needed to overcome initial market hurdles.

ICAO Member States have also been requested to: accelerate fuel certification and development of SAF including feedstock production, accelerate certification of new aircraft and engines to allow the use of 100% SAF, encourage and promote purchase agreements, support timely delivery of any necessary changes to airport and energy supply infrastructure, and consider the use of incentives to support SAF deployment.

IATA emphasised the criticality of effective implementation. "Governments must not lose the momentum that has driven the outcomes of this assembly," said Walsh. "The costs of decarbonising aviation are in the trillions of dollars and the timeline to transition a global industry is long. With the right government policies SAF could reach a tipping point in 2030 that will lead us to our net zero goal. By the next Assembly the 'aspirational' characterisation of LTAG must be transformed into a firm goal with a clear plan of action. That means governments must work with industry to implement an effective global policy framework capable of attracting the financial resources needed to put aviation on an unstoppable track to achieve net zero by 2050. There is lots of work to do, and not a minute to lose."

Many aviation companies are all supporting and investing in the transition to SAF. Most recently, in December 2022, Avolon announced that it had partnered with Boeing, ORIX Aviation, SFS Ireland, and SkyNRG, to conduct a feasibility study into the production of Sustainable Aviation Fuel (SAF) in Ireland.

A recent long-term air traffic forecast from European air traffic control provider Eurocontrol shows how aviation in Europe will grow over the coming decades along with estimates of net CO_2 emissions and a pathway to how aviation can achieve net zero emissions by 2050.

"We expect the number of flights to grow by 44% between now and 2050, taking us up to 16 million a year – compared to 11 million in 2019," said Eamonn Brennan, Director General, Eurocontrol. "Our report shows that we can achieve net zero by 2050 with a series of tangible measures requiring coordinated action by aircraft manufacturers, airlines, airports, fuel companies, ANSPs and, crucially, governments and regulators. Key will be the wide availability and uptake of Sustainable Aviation Fuels (SAF) as they will cover 41% of emissions in our base scenario. The implementation of the Single European Sky is really important – this can make a change in the near-term by 2030 in the region of 8%. Market-Based Measures (MBM) will continue to play a very significant role in helping to achieve the net zero objective, contributing 32%. Revolutionary technological changes, such as hydrogen aircraft will be in place but not at scale for large/very large transport aircraft; they are very important, but it will take longer for their impact to kick in."

The report analyses how aviation can achieve the objective of net zero by 2050. It identifies four key elements in the sustainability transition: increasing production and use of SAF; evolutionary improvements to aircraft and engines; revolutionary new aircraft technologies, such as the deployment of electric and hydrogen-powered aircraft; and more efficient flights, thanks to improved air traffic management.

The report finds that the final step to reaching net zero CO_2 will be additional measures such as carbon capture or market-based measures like the EU Emissions Trading System (ETS) which in the baseline scenario, will compensate for the remaining 32% of anticipated CO_2 emissions.

Crucially the report notes that if aviation is stronger and more profitable, companies will be better able to invest in evolutionary improvements and revolutionary aircraft technologies as well as the roll-out of SAF. In the scenario of high growth, this could mean that these elements could contribute to reducing CO_2 emissions by up to 76% in total compared to 60% in the base scenario.

LESSORS LEAD THE WAY

The aircraft leasing community is also taking a lead on aviation's sustainability journey. In October 2022, Aircraft Leasing Ireland unveiled its ALI Sustainability Charter at its inaugural Global Aviation Sustainability Day. Based on the aviation's pathway to net zero in 2050, the objective of the charter is to establish a framework for assessing and disclosing sustainability alignment for leasing portfolio and provide actionable guidance on how to achieve GHG reduction ambitions.

Airlines and many leasing companies have issued ESG reports, detailing their current emissions profile and pathway to net zero, as well as their efforts to improve social and governance aspects of their businesses. AerCap has published its ESG for several years now and remains committed to the sustainability journey but also to advancements of its own social and governance programmes. "We want to make an impact in the community we operate in," says Aengus Kelly, who points to the company's many scholarship programmes around the world – in the Faculty of Engineering at the International School of Engineering at Chulalongkorn University in Thailand and with programmes closer to home in Limerick and Dublin in Ireland. "We are encouraging more people, younger people, to come into the aviation business."

On the governance side, AerCap is focused on maintaining a positive and close relationship between the board of directors, shareholders and the management function as well as the audit functions. "Well-run, durable business are built on process, procedures, policies, and strong audit committees," says Kelly, adding that the most durable leasing companies are built on solid foundations from the ground up.

For the environment piece, Kelly points out that as the world's largest purchaser of new technology assets in the world, AerCap is at the forefront in the move toward a more efficient world fleet and has set an ambitious target to achieve ~75% new technology aircraft by the end of 2024.

Avolon has also been at the forefront of the move to a more sustainable leased fleet. In its inaugural sustainability report, published in February 2022, Avolon provides explicit commitments on its fleet composition over the medium term for the proportion of new technology assets in its portfolio by 2025. "Our customers have disproportionate demand for new technology aircraft driven by their own ESG considerations and driven by consumer behaviour," says CEO Andy Cronin. "We take this very seriously, both in the short term and for the long term, and our commitments to ESG impact our investment decisions every day."

Avolon has also been through the Sustainalytics ratings process, which assesses companies on their management of ESG issues based on a scale from 100-0, 100 being the highest risk. Avolon received an ESG Risk Rating score of 16.0, which is the low-risk category. Cronin regards Avolon's rating as "a new benchmark for the leasing sector".

Avolon has also made a highly publicised investment in future technology, with the investment in Vertical Aerospace and the order for up to 310 of Vertical Aerospace's eVTOL aircraft, the VA-X4, with options for a further 190. At the end of 2021, Avolon confirmed that it had placed its entire orderbook "within months of that first order".

"When we came across that opportunity, we saw a platform that had built a technology that was really interesting and really compelling but was low on its path to commercialisation," says Cronin. "We felt that we could bring Vertical instant access to every airline around the world through our network of airline relationships, which would greatly accelerate its journey. That was actually a massive underestimation on our part. We did not fully appreciate the level of interest in airline boardrooms around the world in taking part, getting to know and being involved in this technology. How that evolves over time is yet to be seen and there remains a debate over where such aircraft fit, into the overall transportation ecosystem."

Cronin sees demand around the world from airlines seeking to be first movers in the electrification of air travel but doesn't see it disrupting the mainline fleet. "We have capitalised on this opportunity for early stage investment in what we believe will become a large business opportunity to deploy capital over the years. Is it going to interfere with mainline? No. Do we have a first-mover advantage into a new field of technology that can disrupt other modes of transport in time? Yes."

FUTURE TECHNOLOGY

Scenarios for the successful decarbonisation of aviation all involve the transition to alternative fuel – SAF has been discussed above and is the short-term solution – but a longer-term option may be the transition to hydrogen-powered aircraft.

Boeing and Airbus are investing huge sums in research and development to design and realise the next evolutionary stage for power air flight, which includes working with engine manufacturers to make the switch to hydrogen as a propellent.

In 2020, Airbus unveiled its three hybrid-hydrogen fuel cell-powered ZEROe concept aircraft; a 100-passenger turboprop (with a range of around 1,000 nautical miles), a 200-passenger turbofan (with a projected range in excess of 2,000 nautical miles) and a futuristic ultra-wide blended wing design. Although the first of these airframes is projected to enter service in a little over a decade, Airbus' Chief Executive Officer, Guillaume Faury, confirmed in November 2022 that "a final decision on technology choices and aircraft configurations is expected by 2025".

In November at the Airbus Summit, a raft of ventures was announced that will see Toulouse-based aerospace giant team

> **"We take this very seriously, both in the short term and for the long term, and our commitments to ESG impact our investment decisions every day."**
>
> *Andy Cronin, Avolon*

SAF: ready for lift off?

Chris Brown, Aviation Strategy, KPMG

KPMG estimated CO2e breakdown from across aviation today

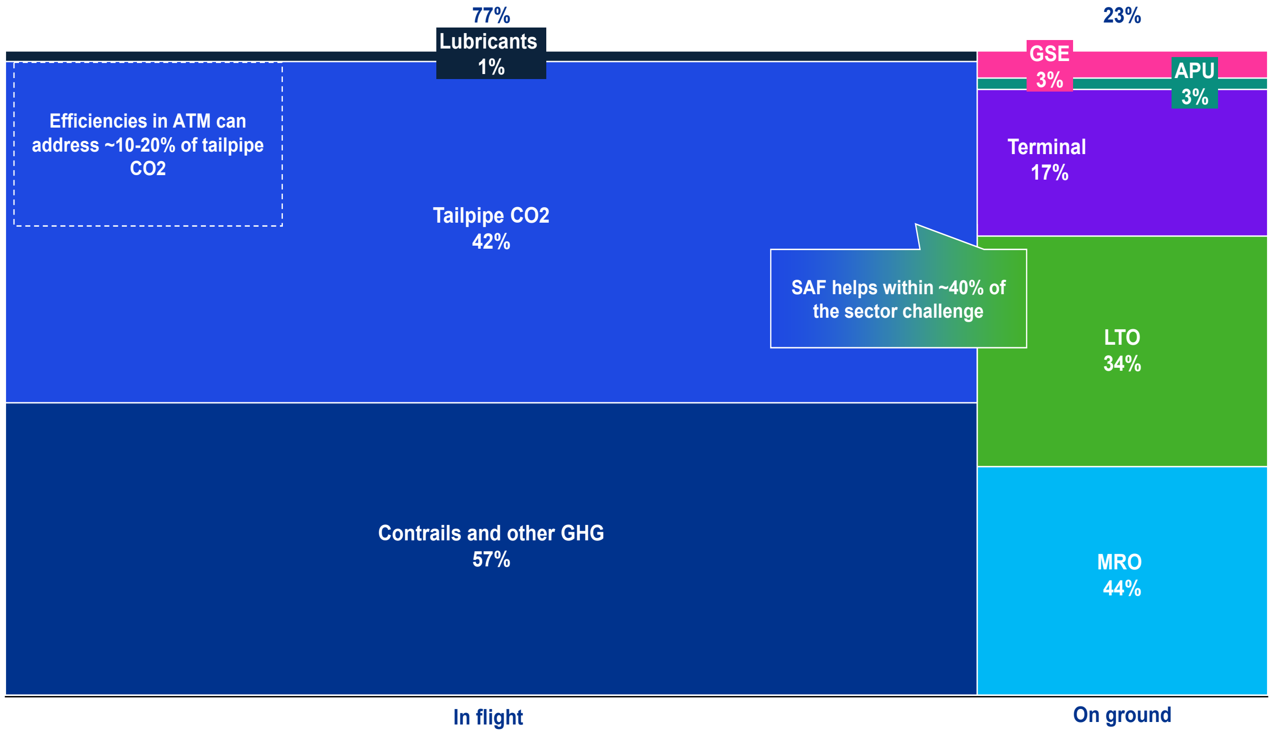


FIG.30: CO2 ESTIMATES BREAKDOWN ACROSS AVIATION OPERATIONS

With net zero by 2050 now an established objective for the sector, aviation faces a huge challenge to decarbonise.

Whilst hydrogen, hybrid and electric models offer potential in some market segments, they are only likely to become widespread in the global fleet into the 2050s. In the meantime, sustainable aviation fuel (SAF) offers substantial mitigation potential as a drop-in fuel that can be blended with conventional Jet A-1. However, SAF supplies of all types remain well below industry needs, and today's most prevalent SAF type (i.e. biofuels) faces real scalability challenges, stemming mainly from supply chain bottlenecks and doubts over feedstock sustainability.

With these barriers in mind, our view is that power to liquid (PtL) synthetic fuel, obtained from low-carbon hydrogen and CO2, represents the most scalable SAF product for long-term use. However, its potential won't be achieved without major investment in electrolysis and carbon capture technology.

SAF demand and supply

While SAF is very similar to conventional jet fuel, it delivers substantially lower greenhouse gas emissions (GHG) – typically by around 80%.

Voluntary demand for SAF from airlines is growing rapidly and is set to escalate during the 2020s. European regulators have already announced rising SAF requirements, whilst the US has set a SAF production target of at least 3 billion gallons per year by 2030, with California mandating that SAF should comprise 20 percent of aviation fuel consumed in the state by 2030.

At present, the dominant SAF type is synthesised paraffinic kerosene from hydroprocessed esters and fatty acids (HEFA). Whilst HEFA is the simplest and cheapest form of SAF, its availability will be limited by overall feedstock supply and price volatility, especially as it continues to be used in road and maritime fuel. Many HEFA feedstocks are monocrops, reliant on fertilisers, linked to biodiversity reduction, and vulnerable to climatic and geopolitical price shocks – as the invasion of Ukraine has thrown into sharp relief.

As we approach 2030, we expect to see a surge in the supply of fuel made from alternative biogenic and non-biogenic waste feedstocks, including agricultural residues, used tyres and municipal solid waste (MSW). However, feedstock constraints are once again a risk as these waste streams are sought by other sectors, such as incineration and bioenergy with carbon capture and storage (CCS), putting them in direct competition. As a consequence, the total SAF yield globally is likely to remain relatively limited, especially in

KPMG projected demand for aviation energy type, central scenario

By fuel type as % of total energy required by 2050

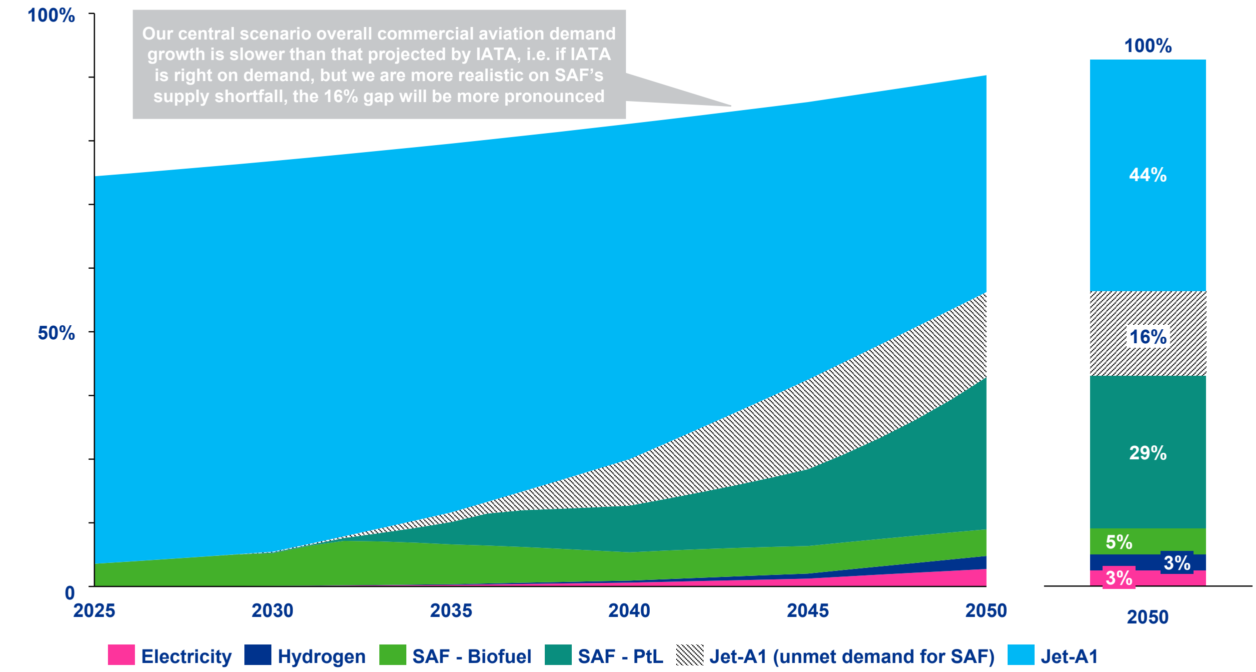


FIG.31: PROJECTED DEMAND FOR AVIATION ENERGY TYPE

the coming decade, and there remains a significant risk that SAF production levels will prove unable to meet current expectations.

The synthetic opportunity

Of the SAF types on offer, it is our view that e-fuel, or PtL offers the greatest opportunity for decarbonisation at the scale the aviation sector requires.

E-fuels are produced using low-carbon hydrogen (produced from biogas or renewable / nuclear electricity electrolysis) and captured CO_2. Their supply potential is far higher than other SAF types, and their lifecycle carbon savings relative to fossil Jet A1 can be over 90%. However, they are highly energy-intensive to produce, and will require major expansion of both hydrogen electrolysis and direct air capture (DAC) capacity to provide the necessary volumes of CO_2 feedstock. Given the sizable risks involved, such expansion will need to happen via industry collaborations across the supply chain, supported by governments.

Cost competitiveness

Future cost competitiveness of SAF with Jet A-1 depends heavily on government regulation pricing CO_2 emissions appropriately. While it remains cheaper for airlines to offset carbon emissions through trading schemes than by replacing Jet A-1 with SAF, we do not expect SAF supply to meaningfully exceed government-mandated levels. Our modelling suggests that such a pivot point may not be reached before 2040 at the current projected rate of carbon price increase.

This length of this time horizon raises important questions about the shape of the future regulatory landscape. We expect the regulatory approach to aviation emissions to evolve significantly over the coming decade, and today's focus on SAF is likely to be joined by new priorities and approaches as decarbonisation strategies are fleshed out. Direct carbon emissions will be eclipsed by total sector CO_2 equivalent (CO_2e) as the primary concern for regulators, expanding attention to contrails management, alongside the focus on ever-higher SAF blends.

Conclusions

At present we are seeing a race by airlines to secure access to HEFA supplies, both to meet immediate voluntary demand and as a natural hedge against expected supply mandates from 2025 onwards. However, given the real constraints to HEFA production expansion, we believe PtL will be pivotal to the achievement of aviation's long-term SAF usage goals. Investors will need to consider this long-term technology outlook alongside promoting sustainable, short-term HEFA supply.

up with a range of partners as part of its efforts to cut carbon emissions to zero by 2050. These ranged from car maker Renault to CERN - of hadron collider fame - as well as SAF producer Neste.

Airbus and Renault agreed to pair up to "accelerate both companies' electrification roadmaps" and will work on the finer points of getting more life out of lighter batteries and seek the "best pathways to move from current cell chemistries to all solid-state designs which could double the energy density of batteries in the 2030 timeframe".

Airbus' UpNext subsidiary will also pair up with the European Laboratory for Particle Physics - or CERN, as it is better-known - to look into how superconductivity can contribute to the decarbonisation of future aircraft systems".

The duo are to develop a Super-Conductor for Aviation with Low Emissions (SCALE) demonstrator, which they said "aims to promote the adaptation and adoption of superconducting technologies in airborne electrical distribution systems".

How soon such a project could have an impact on carbon emissions remained unclear, but Raphael Bello, CERN's director of finance and human resources, was confident the two companies' technologies "have the potential to be adapted to the needs of future clean transportation and mobility solutions".

The event also saw Airbus flag a memorandum of understanding (MoU) with Neste to advance the production and uptake of SAF, and would work with HyPort, ENGIE Solutions and the Regional Agency for Energy and Climate in Occitanie (AREC) "to support the development of one of the world's first low carbon hydrogen production and distribution stations" at Toulouse-Blagnac airport.

In February 2022, Airbus' ZEROe demonstrator (the first A380 MSN1) was launched "with the objective to test a variety of hydrogen technologies both on the ground and in the air" (although flight testing is not expected to commence before 2026).

It's not just Airbus investing in the potential of hydrogen propulsion. FlyZero – a research project established in 2021 by the Aerospace Technology Institute (ATI) and backed by the UK government – has developed three concept aircraft (regional, narrow body and midsize) aiming to "show that hydrogen can be competitive on a mission energy basis with SAF powered aircraft". And alongside speculative concepts, the conversion of existing airframes is already being considered. Cranfield Aerospace Solutions' nine-seat Britten-Norman Islander hydrogen retrofit programme (phase one of a four-part 'Project Fresson', funded by a £7.1m grant from the ATI) hopes to achieve a commercial product by 2025. In November 2022, Air New Zealand also announced its intention to replace 23 de Havilland Dash 8-300s with either hydrogen or battery powered aircraft in 2030.

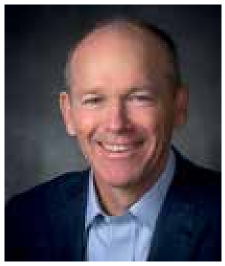
In November 2022, Rolls-Royce and easyJet (with whom a partnership was signed in July) successfully ground tested a hydrogen-fuelled AE 2100-A (usually found in turboprop configurations) in what was considered a world first. Next up, "the partnership plans a series of further rig tests leading up to a full-scale ground test of a Rolls-Royce Pearl 15 jet engine". From 2023, Rolls-Royce also promises "all MTU engines and conversion kits will be available for 100% hydrogen"; acknowledging that hydrogen "will offer options in shorter range segments and has the potential to progress onto larger segments as the technology is proven and hydrogen fuel becomes more readily available".

Hydrogen is a compelling option to give lift-off to zero-emissions jets, the problem is the storage tanks, which would need a complete overhaul since they need to keep hydrogen fuel at a constant -235 degrees. Airbus technicians have come up with a prototype tank which they are testing with nitrogen, for which a temperature of -196 will do. The aim is to have a hydrogen fuel tank ready to install in a demonstration A380 by 2026-28.

Speaking in November, Boeing CEO Dave Calhoun said that he didn't think that hydrogen was the answer. "We don't think hydrogen's the answer," he said. "It doesn't mean we're not going to work on hydrogen. We've got a long history of working on it. But I don't think hydrogen is going to get us from here to there in the 2050 timeframe."

"We don't think hydrogen's the answer… We've got a long history of working on [hydrogen]. But I don't think hydrogen is going to get us from here to there in the 2050 timeframe."

Dave Calhoun, Boeing



The main obstacles Boeing sees with hydrogen as a fuel source is safety and infrastructure. Christopher D. Raymond, Chief Sustainability Officer & Senior Vice President, Global Enterprise Sustainability at Boeing, said that the main problems were safety, loading it, transporting it, refuelling it, controlling temperature, controlling pressure, as well as infrastructure, airports and airplanes. He adds: "We spend a lot of our time thinking about airplanes like the future flight concepts and how our planes would have to be configured. But our view is, if we're serious about reducing the carbon emissions by 2050, we need a lot of fleet renewal with these more Fuel-efficient airplanes. We need to scale sustainable aviation fuel in this industry. And more green hydrogen could be used as a very effective ingredient in sustainable aviation fuel production to make it even cleaner and greener."

Boeing is investing in electric lift and has developed Wisk – a small eVTOL aircraft, which it sees as a key part of its strategy sustainability, but also which it is using to develop autonomous flight. Raymond says that "first and foremost" the company's sustainable strategy is about, "investing in fuel-efficient airplanes, new airplanes replacing older, less fuel efficient airplanes". Raymond points out that the industry will see "tremendous benefits on carbon emissions when the fleet renewal occurs by what's in development today", in addition to improvements in operational efficiency. He adds though that Boeing has been a big proponent of sustainable aviation fuel. "We've been involved in it since 2006. The first SAF-powered flight with Virgin Atlantic took place in 2008 on a Boeing aircraft. But there is scepticism on how fast SAF can scale up. It's a hard problem… when you see what's happening in the automotive industry to electrify, these big trends, I believe, give us optimism that this industry is going to solve this problem and find a way to have a lot of sustainable aviation fuel."

Embraer and ATR are also working on their own visionary, greener aircraft concepts, which with their smaller size arguably have an easier starting point.

In July 2022, ATR unveiled its plans for the next generation of its family of regional aircraft by 2030, the ATR EVO.

The plan foresees advanced design features and a new powerplant with hybrid capability to offer customers the next generation of ATR aircraft. Incorporating a new eco-design that includes new propellers and enhanced cabin and systems, it will remain a two-engine turboprop that can be powered by 100% Sustainable Aviation Fuel (SAF).

"Our next generation of aircraft will be a step forward in responsible flying through further incremental innovation," said ATR CEO Stefano Bortoli. "When it enters the market, the new ATR 'EVO' will pave the way towards a decarbonised future for aviation. Key benefits include a 20% overall fuel improvement and 100% SAF compatibility. This means that the aircraft will emit over 50% less CO2 than a regional jet when powered by kerosene. When using 100% SAF, its emissions will be close to zero."

Fabrice Vautier, ATR SVP Commercial, claims that the ATR EVO will be even more economical, with double digit operating cost savings achieved through 20% lower fuel burn and 20% overall maintenance cost reduction. "This means airlines can serve thin routes more profitably, and communities can benefit from more connectivity, more essential services, and more economic development. Our aim is to continue to offer customers and society ever more inclusive and responsible air transportation," he said.

Stéphane Viala, ATR SVP Engineering, confirmed that the company has issued a Request for Information to the main engine manufacturers for the development of the new powerplant that will combine existing and future generation engine technology. "The ATR EVO will feature improved performance in terms of time to climb and an enhanced cabin, with increased use of lighter bio-sourced materials. Recyclability will also be at the heart of our new design."

In the coming months, ATR plans to work with airlines, engine manufacturers and systems providers, with the aim to launch the programme by 2023.

In December 2022, Embraer unveiled two new concept aircraft as part of The Energia Family.

A year on from Embraer's Sustainability in Action in event, which detailed the study of four new aircraft concepts powered by new technologies and renewable energies, the company has been focusing on two 19-30 seater designs for hybrid electric and hydrogen electric propulsion.

The Energia Hybrid (E19-HE and E30-HE) – originally revealed as a nine seater in 2021 – Embraer is now exploring a 19 and a 30-seater variant, which will feature: parallel hybrid-electric propulsion, rear-mounted engines, and promises up to 90% CO2 emissions reduction when using SAF. The aircraft is forecast to be ready to launch to market in 2030.

The Energia H2 Fuel Cell (E19-H2FC and E30-H2FC) – revealed as a 19 seater in 2021 – is now being explored as a 30-seater variant, featuring hydrogen electric propulsion, rear-mounted electric engines and zero CO2 emissions. Technology readiness is forecast for 2035.

While still at the evaluation phase, Embraer says that the architectures and technologies are being assessed for technical and commercial viability. The Energia Advisory Group has also been launched to harness inputs and collaboration from partner airlines.

Arjan Meijer, President and CEO, Embraer Commercial Aviation, said, "I believe we have set bold but realistic goals for these concepts to come to market. Since we announced our Energia concepts last year, we have been busy evaluating different architectures and propulsion systems. These efforts have resulted in the updates of our concepts that we are sharing with you today. Several airlines are part of our Energia Advisory Group, the experience and knowledge they bring to the study will be key to accelerate to the next phases."

"As new propulsion technologies will be first applied on smaller aircraft, Embraer is in a unique position. The 19 and 30 seaters are sensible starting points for focused studies since they are likely to present earlier technical and economical readiness," said Luis

Carlos Affonso, Sr. VP of Engineering, Technology and Corporate Strategy, Embraer. "While the challenges of net-zero are significant, in less than 25 years our commercial aircraft have already reduced fuel burn and CO2 emissions by almost 50% on a seat/mile basis, using only conventional fuels and propulsion – I'm convinced net-zero is a goal we can reach".

MONEY TALKS

The growing importance of ESG and sustainability efforts for banks and financiers has partially prompted this move towards embedding a more formal ESG programme for all companies.

"Every loan, every facility that we have with clients has a colour level from dark brown to dark green with all the shades in between, says Natixis Jean Chedeville. "Aviation today sits in the middle since our business model is mostly focused on new generation aircraft." The bank is focused structures with airlines that have committed to transition to net zero journey. Today, Chedeville notes that ESG issues ae not yet impacting borrows directly but adds that in the future there will be some restrictions for companies that haven't started that journey or for certain assets. "At some point as an institution, we will want to ensure we have a greener colour mix in our portfolio and at the moment we have a mix of colour on our books."

It has long been suggested that aviation finance industry need to create a similar framework to the Poseidon Principles, which integrate climate considerations into lending for maritime shipping. Six global aviation banks — Bank of America, BNP Paribas, Citi, Crédit Agricole CIB, Société Générale and Standard Chartered — have taken the lead on this, forming a partnership with RMI's Center for Climate-Aligned Finance to help decarbonise the aviation sector through the formation of the Aviation Climate-Aligned Finance Working Group.

"Our work across shipping, steel and now aviation shows that collaboration is key to meeting climate commitments and to decarbonising the hard-to-abate sectors," said James Mitchell, director at the Center for Climate-Aligned Finance. "We commend the Working Group banks for taking this important step toward creating a global platform for accelerating the decarbonisation of the aviation sector. The hard work begins now."

The Working Group aspires to create a collective climate-aligned finance (CAF) framework that defines common goals for action for aviation sector decarbonisation. The aviation CAF framework will be based on the experience gained from the Poseidon Principles, which were launched in 2019 with 11 banking signatories. Today, Poseidon counts 29 signatories covering more than 50% of global ship finance. The aviation CAF framework is intended to be designed for similar rapid adoption by aviation financiers globally.

The CAF framework is a commitment by participating financial institutions to annually assess and disclose, consistent with the UN-convened Net-Zero Banking Alliance, the degree to which the greenhouse gas emissions from the aircraft, airlines, and lessors that they finance are in line with 1.5°C climate targets.

The Working Group is creating an industry-supported CAF framework, which will create consistency and transparency in reporting, establishing a level playing field for measuring progress against climate targets. With the CAF framework, financial institutions will be able to assess the emissions of their aviation loan books and work with their clients to report their emissions, fund lower-carbon solutions and support investments in new technologies.

At the *Airline Economics* Growth Frontiers Middle East & Africa conference held in Dubai in October 2022, Jose Abramovici, global head of asset finance at Credit Agricole CIB, provided an update on the progress made by the Aviation Climate-Aligned Finance Working Group to create a collective CAF framework. The Working Group is working on forging the measurement methodologies, emissions benchmarks, data pathways and governance structure of the CAF framework in collaboration with existing decarbonisation initiatives. Abramovici has been working on the aviation

> **"Every loan, every facility that we have with clients has a colour level from dark brown to dark green with all the shades in between."**
>
> *Jean Chedeville, Natixis*

roadmap with Citi's Munawar Noorani. Currently, there is only one roadmap covering all institutions. Even though the roadmap needs to be considered to credible and recognised by many global NGOs, an aviation roadmap also needs to be endorsed and adopted by the aviation industry. Abramovici explained that to develop a credible aviation roadmap, the industry needs transparency, granularity, and the ability to monitor progress and emissions as well as facilitate annual reporting. At the base level, there is quantity of carbon to spend between today and 2050, and the debate between aviation bankers is whether this quantity of carbon will be spent on a linear basis along a straight line, or whether a softer ramp up that would accelerate over time taking into account that fact that new technology is only promised to come online after 2035, and maybe even not until 2040. Air cargo also needs to be integrated into the matrix, added Abramovici, who noted that these conversations are ongoing and the team expects to have a better vision on the final aviation roadmap early in 2023.

SUSTAINABLE FINANCING

Sustainability-linked financing is being taken up by more airlines and alongside different aviation products. On such example from July 2022, is Cathay Pacific Airways' first sustainability-linked JOLCO in Asia-Pacific to fund one A321neo. The terms of the financing are linked to Cathay Pacific achieving certain targets in respect of predefined sustainability-linked indicators. In this transaction, performance targets focus on the proportion of new generation aircraft in Cathay Pacific's group fleet and the gradual increase of SAF use in the carrier's fuel consumption. Crédit Agricole CIB acted as global arranger and sustainability structurer, facility agent and security trustee and as a lender.

IAG-owned airlines, British Airways and Iberia, have both also closed sustainability-linked EETCs transitions this year in the private placement market.

ESG issues have become a central focus for investors, regulators and consumers, which will require aviation industry participants to adapt to new regulators and expectations.

The Net Zero Banking Alliance (NZBA) has brought together the world's largest banks to focus on delivering the banking sector's ambition to align its climate commitments with the Paris Agreement goals with collaboration, rigour, and transparency. The alliance is working on setting its 2030 targets for hard-to-abate sectors such as oil and gas, power generation and transportation, including aviation. The intention is to set targets with these industries with a view to engaging with the sector and clients' transition plans rather than withdraw from financing those industries. Once those targets are set, the NBZA intends to disclose progress against a board-level transitional strategy that sets out proposed action and climate-related sectoral policies.

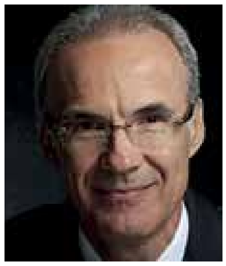
Speaking as the first local bank in the Middle East to sign up to net zero at COP 26, Sarah Pirzada Usmani from First Abu Dhabi Bank confirmed that it was critical for the sector to review its Scope 3 emissions and to ensure they are working with key clients in those hard-to-abate industries to help them transition to net zero without restricting access to financing.

Scope-3 emissions are all indirect emissions that occur in the value chain of a reporting company. For an airline, they would include the emissions involved in manufacturing the plane and in preparing the food that people eat in flight, for example. For aircraft leasing companies, Scope 3 emissions would relate to how their airline customers use their aircraft, which is difficult. However, some lessors are taking a more proactive approach here and are working on building in sustainability-linked clauses in their lease contracts. Some lessors are also encouraging their clients to invest in sustainable aviation fuel (SAF) production.

Aviation banks are seeking to meet their own net zero targets by restricting financing to new technology aircraft, which have the most efficient fuel burn statistics, with many engaging with their airline clients specifically regarding their strategy to pivot to the use of SAF and where the banks can help in supporting

"While the challenges of net zero are significant, in less than 25 years our commercial aircraft have already reduced fuel burn and CO2 emissions by almost 50% on a seat/mile basis, using only conventional fuels and propulsion – I'm convinced net-zero is a goal we can reach."

Carlos Affonso, Embraer



the ramp up in SAF infrastructure and production.

For the aviation industry to have any chance of meeting its net zero targets, SAF production will need to be increased substantially. The investment needed will be way beyond even such a larger alliance of global banks and will depend on the backing from governments. Embraer's Matheus Piorino explained Brazil's existing commitment to the production of biofuels as well as Embraer's investment into the development of the production and increased output of cleaner fuel. Embraer has already successfully tested its E2 aircraft using 100% ethanol, which has now been certified, and the manufacturer is continuing with testing for the development of a hybrid electric and hydrogen propulsion engine. These initiatives form part of Embraer's ESG Flight Plan with sustainability goals, moving from carbon neutrality this year, to carbon neutrality in all operations by 2040 and supporting the industry toward net zero targets for 2050. This plan includes projects such as ensuring the company's production and supply chain is 100% powered by renewable source electricity. Piorino has expressed doubts that financiers are yet interested in funding new technology projects and are more likely to become involved later down the development timeline. Although Usmani disagreed noting that banks needed to be at the forefront in funding new technology in the journey toward net zero.

Today, banks can and intend to finance SAF production and infrastructure development, as well as invest in future technology and fuels such as green hydrogen.

Meanwhile, also in 2022, Ryanair partnered with Citi to become the first European airline to deposit funds in its new Sustainable Deposit Solution. This new solution will enable Ryanair to invest excess cash to support different sustainable financing projects across Citi's portfolio, such as renewable energy, water conservation, healthcare and education in emerging markets.

The initiative supports Ryanair's sustainability agenda. Funds invested are allocated to finance or refinance assets in a portfolio of eligible green and/or social finance projects, based on the criteria set out in the Citi Green Bond Framework, Social Finance Framework and Social Bond for Affordable Housing Framework.

Ryanair's Director of Sustainability, Thomas Fowler, said: "Ryanair is proud to be leading sustainable aviation in Europe, which is further evidenced by our partnership with Citi to deposit funds in their new Sustainable Deposit Solution. This will not only help us manage our finances more sustainably but will further drive our sustainability agenda in whole as we support several sustainability projects across Citi's portfolio, from water conservation to affordable housing and beyond."

Citi has committed to financing and facilitating $1 trillion in sustainable finance by 2030 as part of goal to further the acceleration to a sustainable, low carbon economy. David Tsui, Global Sustainability (ESG) Head of Deposit and Investment Products at Citi, said: "Citi is helping our clients to progress their own ESG priorities by providing the opportunity to support eligible environmental and social projects in Citi's portfolios."

This announcement is only the latest in a long series of initiatives from Citi, which is committed to pushing the sustainability agenda forward in the aviation industry.

"Besides engaging with the Climate-Aligned Finance Center in creating a framework for banks to report our decarbonisation efforts under NZBA commitments, Citi is also working on products that would help our clients achieve their sustainability goals. We are very happy that Ryanair is the first European airline to have participated in our Sustainable Deposit Solution," added Munawar Z. Noorani. Citi's Global Co-Head of Aviation in a conversation with *Airline Economics*.

ESG issues have remained at the forefront of the global economic and corporate stage throughout the pandemic and into the recovery period. Specifically environmental issues and the move to decarbonise the aviation is a constant and foremost challenge for the entire industry, which is proceeding to work together to meet the commitments made to net zero in 2050.

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Munawar Noorani, Citi

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