Commercial Aerospace

Takeaways from the 16th BofA Commercial Aerospace Forum

Industry Overview

05 January 2024

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Ronald J. Epstein
Research Analyst
BofAS
+1 646 855 5695
r.epstein@bofa.com

Mariana Perez Mora
Research Analyst
BofAS
+1 646 855 5696
mariana.perezmora@bofa.com

Andre Madrid
Research Analyst
BofAS
+1 646 725 3107
andre.madrid@bofa.com

Jordan Lyonnais
Research Analyst
BofAS
+1 646 855 5204
jordan.lyonnais@bofa.com

Samantha Stiroh
Research Analyst
BofAS
+1 646 855 5725
samantha.stiroh@bofa.com

16th Annual BofA Commercial Aerospace Forum

Yesterday, we hosted our 16th annual BofA Commercial Aerospace Forum. Our event was attended by industry experts, thought leaders, corporates, US Department of Defense (DoD) personnel, and the investment community. We note that while the primary focus of the day was on commercial aerospace, there was still significant discussion around defense spending. The main takeaways from the conference, in our view, include:

The defense community needs urgency and funding

We hosted Air Force Secretary Frank Kendall as our keynote speaker on Day 2. He stressed the need for urgency within the DoD in recognizing the rising threat in the Indo-Pacific. Additionally, his comments largely covered the need for increased spending to deter this rising threat. Much in the same vein as Kate Kaufer did a day prior, he expressed the need for bipartisan budgetary support in order to pass appropriations. Kaufer expressed optimism that a budget could be passed, given that there has been enough consensus to reach two continuing resolutions (CRs) thus far. We continue to expect a partial CR/shutdown after the first CR expiration on January 19, which will likely bring lawmakers to the table to pass appropriations ahead of the final CR expiration on February 2. We anticipate defense spending will be held around the $886bn level proposed by the FY24 NDAA bill and expect over $100bn in supplemental funding as well.

2024 might not be as soft as expected for defense

We continue to believe that 2024 could be a stronger year for defense than expected. Much conversation surrounded the upcoming Taiwanese elections, and we believe an unfavorable outcome in the eyes of Beijing could prompt a response from China. Reunification remains a top priority for Chinese leader Xi Jingping, with talks of an 'inevitable' return in 2027. However, an earlier attempt would certainly serve as a catalyst for stronger defense spending and greater focus on defense stocks in 2024.

OEM not out of woods, aftermarket to stay strong in 2024

On the commercial side, our conversations with presenters reflected that 2024 might not be as strong of a year for original equipment manufacturers (OEMs) after all. As Alex Krutz discussed, OEMs will still be limited by how much the supply chain can ramp up. Struggles persist throughout multiple levels in the supply chain, including liquidity concerns, rising costs, operational issues, and labor constraints. Labor specifically has become somewhat of a "whack-o-mole" issue, as labor sourced by OEMs is only removing capacity from crucial suppliers. Additional, internal issues at the OEM level will make rate ramps more difficult to achieve than anticipated. For instance, Michel Merluzeau anticipates 1H24 Boeing MAX production to continue to be erratic. With that said, we expect 2024 to be another strong year for the commercial aftermarket. According to Krutz, suppliers will generally favor OEMs over MRO shops. As a result, much of the grounded fleet will be left in need of parts, for which aftermarket suppliers of PMA parts and DER services stand poised to satisfy demands.

Refer to important disclosures on page 14 to 15.
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Timestamp: 05 January 2024 04:57AM EST

16th annual BofA Commercial Aerospace Forum

This note summarizes some of our key takeaways from the speaker presentations at the Commercial Aerospace Forum.

Luncheon & Keynote – Addressing US Air Force needs

Frank Kendall, United States Secretary of the Air Force

In this panel, US Secretary of the Air Force Frank Kendall discussed the US's evolving role in the geopolitical landscape and the unique demands facing the Air Force. Our key takeaways are.

- **China, China, China – understanding urgency is crucial**. Kendall noted that he would like his lasting impression to be a sense of urgency regarding the threat of China. In the current threat environment, the DoD cannot afford to be complacent. Kendall emphasized that a potential war with China and Russia is not unlikely and could happen at any time, especially as Xi Jinping sees China-Taiwan reunification as inevitable. China has been building out its military with purpose to not just take Taiwan and control the South China Sea, but also to keep the US out of the Indo-Pacific region.

- **The most important immediate task is to get appropriations funded**. Kendall is focused on identifying where the Air Force needs to modernize, where to get started, and how to go about getting resources. On the latter point, he stressed the immediate need for the appropriations bill to be passed. As older programs sunset, modern platforms are awaiting the green light to commence. However, new program starts are not able to begin in the event of a CR or government shutdown. More specifically, 12 new starts in the FY24 budget cannot commence without the passage of the appropriations bill.

- **Money is more important than innovation**. The US Air Force moves with the speed of money. While many might believe that the USAF needs innovation, Kendall emphasized that the service already knows where to find it. Instead, the service just needs ample funds to invest in these sources of innovation at scale to get them from prototype to production.

- **In space, USAF needs strong Space Force like the merchant marines need the navy**. Kendall drew a comparison between the need for a more capable Space Force with the merchant marines' need for a strong navy. China has regarded space as another theater of operation. Previously, the US mainly just collected data through intelligence agencies in space. However, China continues to field in-space military capabilities, including targeting satellites, ASAT missiles, and counter-satellite capabilities, like jammers and kinetic energy weapons. While Kendall does not wish to weaponize space, he cites the need for the Department of the Air Force to protect US space assets and counter any adversarial efforts.

- **Modern combat aircraft – all eyes on unmanned**. Kendall has long been a proponent of uncrewed aircraft in the USAF as well as in other domains. Over the last several years, the DoD has spearheaded several initiatives to further foster unmanned capabilities, including the Skyborg program, the DARPA ACE program, and Boeing's Loyal Wingman MQ-28 platform. These efforts have all culminated in the USAF's decision to launch its Collaborative Combat Aircraft (CCA) program two years ago. The program is intended to field uncrewed aircraft that are half or one-third the cost of crewed fighters to be fielded alongside the USAF manned fighter fleet. The service anticipates $5bn in funding over the next five years to develop these aircraft and contracts are already underway to do so. The initial expectation is for 1,000 units, and Kendall is unsure of the eventual total number, he expects it to be "a lot". Deputy Defense Secretary Kathleen Hicks along with the Defense

Innovation Unit (DIU) also launched the Replicator initiative last year, and there are several candidates (one in particular) currently being considered.

- **Defense industrial base – consolidation has gone too far, looking for ways to maintain competition and expand market**. Secretary Kendall has worked in or with the defense industrial base for much of his career and believes it is reasonably healthy to do what has been asked of it thus far. He agrees that there is a need to expand capacity to produce certain munitions to meet needs more rapidly. However, Kendall pointed out that the defense supply chain has consolidated more than it should have in the post-Cold War era. He emphasized the need to bring new entrants into the competition, especially on programs like CCA.

Supply Chain Outlook

Alex Krutz, Managing Director, Patriot Industrial Partners

We hosted Alex Krutz, Managing Director at Patriot Industrial Partners, to discuss the current state of the aerospace supply chain. Below are our takeaways.

- **Production volumes really drive supply chain**. Krutz maintains that we have a supply chain issue, not demand issue. Tier 1 companies have been doing better mainly because they possess more IP, something the lower tiers of the supply chain lack.

- **Three waves of consolidation in the supply chain since the late 2010s**. The first wave of consolidation among suppliers came in the wake of the MAX debacle, which saw Boeing total output slow. COVID-19 made this even worse as it created volatile demand, triggering the second wave of consolidation. Then came you get into inflation, which saw tighter risk parameters and tighter capital markets along with compounding issues of lost Russian capacity, leading to the third wave of consolidation.

- **2024 might be less chaotic, but we are far from out of the woods**. A number of issues still plague the aerospace supply chain, including misalignment with supply chain, liquidity concerns, rising costs, operational issues, and labor constraints. On labor issues, OEMs say they don't have labor issue because they are just pulling talent from smaller suppliers. Lot of talent left with Great Resignation and there's a learning curve to new incoming talent.

- **Sub-tier headwinds are being forced down**. Weare seeing a tier two crunch on operating margins, where tier 1s are making good margins but smaller suppliers making less on shorter term contracts. Tier 3 and 4 quiet consolidation came in several waves. We will still likely have some of this with small scale mergers and closures that are fatigue related.

- **Material costs continue to rise**. Material costs continue to rise, with concern around titanium supply after a 20% price uptick since 2019. The exit of VSMPO from the market has only compounded these issues. Steel is currently seeing prices 65% above 2019 levels as well. Nickel, an important material for engines, is seeing a 55% increase vs. 2019. Aluminum and composites have come down from recent highs but are still higher vs. 2019.

- **Balance sheet issues remain an issue for small suppliers**. Krutz stressed that cash is king for smaller suppliers. OEM support post-MAX/COVID is slowing down. However, some OEMs and Tier 1 suppliers are still buying material forward to keep suppliers further down the chain afloat. In the forgings supply chain, some companies are being paid a whole year in advance just to keep the lights on. There could be a reckoning in the coming months where larger companies officially pull their suppliers off life support. For now, the situation for some is still dire. Give than many lower tier suppliers are cash on delivery, missed payments can create serious production hiccups. Some customers have even become debtors in possession (DIP), where OEM and Tier 1 suppliers have had to take control of smaller suppliers to ensure steady supply.

- **Geopolitical tensions continue to boil throughout the aerospace supply chain**. Russian titanium and semiconductors are the biggest geopolitical concerns for the supply chain. China is also threatening to withhold raw materials from the West, which, could escalate into true material shortages.

- **2022 and 2023 had lot of quality and compliance issues**. fuselage drilling, F-35 software, 787 non-conforming titanium. The good news is that the FAA is taking a closer look and activities are underway to correct these flaws. Krutz is optimistic that these issues will subside in 2024.

- **Engine supply chain a focal M&A target area**. Raw materials and special process, components, and assemblies and modules remain attractive end markets for M&A. However, M&A will continue to be disciplined, as rates remain high, which is also driving more equity and less debt financing. A lot of deal flow will be necessity-driven as well.

- **Rate pressure from aircraft part shortages**. Part shortages are starting to get more complex. Engines, forgings, and castings are always a watch item. Fasteners and landing gear were issues in 2023.

- **Engine MRO capacity – not seen worst of GTF issues yet**. Other items included in recent airworthiness directives remain watch items.

- **Suppliers will always favor OEMs vs. MRO shops**. While this might mean Airbus might hit its delivery target, it could hurt existing fleet servicing, which could be neglected as more parts go to the OEMs.

Setting the scene for Commercial Aerospace in 2024

Adam M. Pilarski, PhD, Senior Vice President, AVITAS

Dr. Pilarski set the scene on Day 2 for Commercial Aerospace. Below are our key takeaways.

- **Economy: Recession & Inflation.** Pilarski highlights the all-time high combined balance sheets of Fed, ECB and BoJ and strong M2 levels suggest we won't see the expected "Immaculate Disinflation". He also thinks recession risks are not off the table.

- **China: slower growth at both economy and aviation.** Pilarski expects Chinese growth to continue to slow down, driven by demographic factors, deglobalization, and new economic policy. This would meaningfully impact the worldwide aviation market as China now represents almost 20% of each global GDP, air passengers, and aircraft fleet.

- **Yields: airfares will go up.** Air traffic is almost back to pre-pandemic levels, but the traffic patterns and leisure/business composition have changed. The airfares have significantly lagged other touristic inflation for decades. Pilarski expects them to catch up.

- **Bubble: several pockets of $ pursuing the same passenger demand.** Saudi Arabia has recently joined India, Turkey, and the Gulf carriers. They are all targeting the same demand and consequential aircraft orders could be creating the next bubble. A moderating air traffic growth and rising air ticket prices set a good set up for lessors and airlines, but not for OEMs.

Everything Everywhere All at Once

Richard Aboulafia, FRAeS, Managing Director, AeroDynamic Advisory

We hosted Richard Abulafia for a discussion of his view on the current state of the aerospace industrial market, broader themes, and key watch items for 2024, and transformational factors impacting the market long term. See our key takeaways below.

- **The aerospace market is clawing itself out of a pit.** In discussing the current state of the Aerospace market, Abulafia pointed to the key trends of OEM deliveries for both military and commercial. Military deliveries highlighted a relatively flat trend with only a modest dip during COVID. Commercial aerospace deliveries (excluding deliveries from existing inventory) show a significant recovery from the low during COVID, however, deliveries are nowhere near prior peaks.

- **Lousy production output may have de-risked an overproduction bubble.** 2023 was a year marred by production delays in Commercial, Defense, and Business Aviation. The strains were notable in structures, casting/forging, titanium, and commercial engines. Abulafia noted for the first time in 50 years Aerospace experience a supply shortage. Abulafia noted there may be a silver lining, and for the delays may put production output on a longer more sustainable curve which derisks the potential for of overproduction creating a supply glut.

- **What does China's diminishing power mean for commercial aerospace.** In the coming year, China's power and influence in aerospace is in a precarious position. Prior to the pandemic China held 23% of the world's active aircraft fleet and had a resilient economy. Today however China's economy is slowing, international RPKs are still significantly lower prior to pre-covid, and the West is actively looking to decrease exposure to China. The world is looking to new more western friendly countries to fill the void left by China, however it will take a long time until a proper replacement is found.

- **Addressing the monster in the room - double counting aircraft orders.** Abulafia highlighted the concern that although book-to-bill for the aircraft OEMs are resilient and show strong demand, there is a growing concern all of those orders may not result in deliveries. Abulafia sees the surge in orders from the Gulf States are competing for the same customer base and could lead to significant cancellations in the future. The timing is not exact due to the significant resources each nation wields, and the longer this continues the potential for a larger shock increases.

- **Boeing's surrendered future.** Abulafia argues the recent decision made by Boeing's management to not pursue a clean sheet aircraft design, removing the corporate strategy division, and lack luster execution on defense programs is paving a path forward for Airbus's dominance. The A321neo's order book has grown significantly, with airlines having only one option to choose from. Abulafia projects with the strong order A321neo adoption, and potentially an A220 stretch or A321XLR will bring Airbus to dominate 70% of the market.

The Future of Electric Flight

Kyle Clark, Founder and CEO, BETA Technologies

We hosted Kyle Clark for a fireside chat to discuss BETA and the future of electric flight. Our main takeaways include.

- **Separating the steak from the sizzle.** In a world of new tech and high ambitions, Clark broke down what eVTOL aircraft can actually look to achieve and what may be more aspirational. BETA differentiates itself in its initial focus on cargo, logistics, medical, and military markets. While he believes the industry will eventually be able to service urban air mobility (UAM) markets, it will take many incremental steps as there are currently too many regulatory, piloting, and customer acceptance challenges.

- **The rate of change for BETA and the electric propulsion industry is "awesome".** BETA now has IFR and night flying allowances, the company has achieved 50-60 take off and landings a day, and the aircraft has flown all-electric across the country. Additionally, BETA's aircraft has been executing missions with the Army, Marines, and FAA. Clark commented that even a year ago, these proof points had not yet become a reality.

- **BETA seeks to fill the gap between long haul heavy aircraft and ground transportation.** Currently, this is being filled with expensive aircraft that should be doing more sophisticated missions. However, Clark asserts that BETA's electric aircraft can do the same mission with significantly less logistical challenges such as maintenance and fuel.

- **Modularity is key.** Clark emphasized the importance of taking modular and incremental steps towards certification. BETA is working to certify the electric motor first (Part 33 Certification), which is now in the testing environment and will likely be certified this year. BETA is certifying the aircraft separately on a Part 23 basis with 0 special conditions. This allowed the company to finish the design of a Part 23 aircraft while the balance of the industry was still negotiating the cert basis of VTOL aircraft. Now, BETA is able to wrap these certifications into the necessary eVTOL certification to speed up the process.

- **Costs less and is more sustainable.** Clark highlighted several areas in which BETA's aircraft can do the same mission as traditional aircraft while offering lower costs and higher sustainability. For example, in a comparison with UPS/FedEx cargo aircraft which took $600-700 to fill with jet fuel while the BETA electric aircraft took $13-14 to fill.

- **This has the ability to be a "life of airframe" propulsion system.** Clark noted that 8% degradation of a battery makes that batter non-viable to be used on an aircraft. The cert type motor design BETA uses has flown over 15k hours and has experienced no degradation. This brings about an entirely new paradigm of the engine in which it can last the life of an airframe.

- **The economics of BETA's batteries are highly favorable.** With a life of airframe engine, only those selling the engines would make a profit. However, with BETA's aircraft, the battery is replaced every year and a half and every time it is replaced it gains ~10-15% more energy and ~20% more range. Therefore, for a ~$4mn aircraft, they will sell ~$12mn of batteries which the customer is enticed to buy because they use the asset longer and recognize capability gains. Additionally, BETA is able to sell batteries at high margins as a majority of what the customer is paying for is the type certification.

Commercial MRO Industry Outlook

Jonathan Berger, Managing Director, Alton Aviation

We hosted Jonathan Berger of Alton Aviation to discuss his outlook for the MRO Industry and key trends to watch in 2024. See our key takeaways below.

- **Sophies choice across OEMs, Engine MRO suppliers, and Engine piece-part suppliers.** Berger noted the supply chain constraints and quality escapes have critically limited the supply of critical engine parts. This has resulted in Engine OEMs needing to make the tough decision of who should get new parts (aircraft OEMs, airlines, or their own shops). For Engine MRO Suppliers they must decide between their parent airlines, their largest customers, or servicing smaller customers with the most risk of failing. Lastly, engine piece-part suppliers are faced with what should be prioritized engine OEM or engine model.

- **Parked fleet is rising but are they the right aircraft to disrupt MRO growth**. The parked fleet and eventual retirements may not be the silver bullet people are expecting which will solve the parts shortage crisis and lack of available aircraft. Berger noted a large majority of aircraft parked post COVID have already been stripped of their most useful parts, and would require significant investment to be operable and not warehouses with wings. Additionally, lessors are not incentivized to retire their current fleet. As fleet and engine ownership by lessors have increased significantly, in the current constrained environment they've benefited from the lack of spares.

- **Significant appetite for MRO M&A, though options remain limited**. Berger discussed the increased appetite for M&A targeting MRO providers, from both existing strategic buyers and new private equity buyers. While demand remains high, the number of companies up for sale remains low due to the significant growth available to MRO providers in the current market, as well as the increased costs of financing.

- **Inflation pricing benefiting MROs for now, likely unsustainable**. Historically the MRO industry was typically projected to grow 2-3% annually. However post-covid that view has changed significantly with the surge of inflation in both materials and labor. Labor inflation historically has been ~1% and is now expecting to increase to ~4% and is likely to be sticky. Berger argues the material inflation is even more important, and the shift has been seismic. Materials inflation has grown from the historical norm of 4%-5% to 10%-12% across the industry. Berger sees the significant increases as unsustainable and will revert to back to normal as OEM production normalizes.

- **The air travel experience is becoming more and more painful.** Berger discussed the evolution of passenger air-travel experiences over the last 20 years, which have increased the "hassle factor" for airlines customers. Strong demand for travel, couple with recent labor and supply chain constraints, has led to significant price increases, long-line, over-crowded lounges, fewer upgrades, and ever-increasing status requirements for airline credit cards. Berger anticipates the market for semi-private flight, and 3rd party airline servicing companies to benefit from customers reaching their breaking point.

Anduril’s insight into the defense market

Adam Price-Porter, Director of Corporate Development, Anduril

We hosted Adam Price-Porter for a fireside chat to discuss the evolving trends in autonomous solutions and future developments in the field. Our main takeaways include.

- **Focus on meeting urgent customer needs with fast and cost-effective solutions**. On the customer side, Anduril seeks out those with an urgent field-based need. From there, the idea is to get to market fast with an affordable solution, as seen with Roadrunner. The Roadrunner reusable subsonic missile was developed in less than 24 months, has gone through customer validation, and is already in the market.

- **C-UAS market has changed significantly in last five years**. The counter-unmanned aircraft system market has evolved significantly in recent years. In Ukraine, long range Russian and Iranian drones can fly over hundreds of miles, are sometimes jet powered, yet still relatively inexpensive. While these threats can be eliminated with a Patriot missile, that is not a cost-effective solution. Roadrunner, on the other hand, will be a fully reusable missile that can reland if it does not strike its target. The platform has already sold out its 2024 production line.

- **The interplay between software and hardware is a fundamental principle**. Historically, the defense industry is good at building hardware. However, modern threats are increasingly software driven, inexpensive, and in-exquisite. Anduril has discovered that powerful software encompassed in a hardware platform can be more effective (both from a mission and cost perspective) against these mounting threats. Half of the founding team were Palantir alumni and understand that selling software to the DoD is hard. With that in mind, Porter-Price emphasizes that in order to sell high end software, you need to wrap it in hardware first.

- **Expanding into international defense market, notably in Australia**. Australia has become Anduril's biggest international customer. Australia continues to look for deterrents for the pacing threat in the Indo-Pacific while it awaits American submarines, which are not expected to be delivered until the 2030s. Understanding this mission need, Anduril acquired Dive Technologies in February 2022. In August 2022, Anduril Australia won a $100mn contract with the Royal Australian Navy to build three Extra Large Autonomous Undersea Vehicles (XL-AUVs), which are expected to be operational by 2025. The acquisition and program win are testaments to Anduril's ability to deploy capital in crucial end markets and quickly respond to customer needs.

- **3x as many software engineers as hardware engineers at Anduril**. Anduril boasts that it has three times as many software engineers as hardware engineers on its payroll. This is in part because one of its founding principles is the need for autonomy. Developing autonomous systems is made easier when Anduril actively recruits engineers with the required background.

- **Focus on M&A to cut down time to market by burning off risk**. Anduril's M&A strategy involves acquiring companies that have viable technology and can shortcut Anduril's time to market. The Adranos and Blue Force Technologies acquisitions are both proof of this, as each company helped Anduril jump the development timeline, imperative for a VC-backed enterprise. However, Porter-Price also understands that sometimes it is better and more efficient to build capabilities internally, as demonstrated with the Roadrunner platform.

- **R&D – most customers don't have skin in the game**. According to Porter-Price, most of the traditional defense contractors treat product development like weddings, where they happily take their parents' (DoD's) money (R&D) so that the latter can be involved in the process and there is limited risk for the former. However, this approach does not allow traditional prime contractors to stay ahead of customer needs. Anduril takes the opposite approach, focusing heavily on internal R&D so that it can stay ahead of customer needs and be first to market.

- **Less time, less money, and more effective is the aim**. Anduril expects to provide platform solutions that are one-tenth the original cost and faster to service. The aim is to save taxpayer dollars while creating value for shareholders through software-driven attritable platforms.

- **Understanding the importance of lobbying**. Unlike some other defense innovators, Anduril understands that strong relationships on Capitol Hill are crucial.

Being a smaller company, Anduril can focus lobbying efforts more effectively in specific areas.

SAF and Alt. Propulsion Sources: Myths and Realities

Kevin Michaels, PhD, Managing Director, AeroDynamic Advisory

We hosted Dr. Kevin Michaels to discuss alternative aircraft propulsion, including electric, hybrid, hydrogen combustion, hydrogen fuel cells, and sustainable aircraft fuels (SAF). See our key takeaways below.

- **Each type of alternative propulsion has its pros and cons**.
- **Electric.** Batteries are more efficient than jet engines but have far worse energy density (2.6x better system efficiency by 44x worse energy density). While an extraordinary amount of capital is going into battery tech today, Dr. Michaels believes they will only be a viable contender for small aircraft (<30 seats).
- **Hybrid.** Hybrid aircraft carry electric propulsion equipment as well as a generator or conventional propulsion aircraft. This means that a smaller engine that is more fuel efficient can be used on a larger aircraft. Hybrid propulsion will reduce the maximum thrust requirement needed for takeoff but will add weight and redundancy. In general, Dr. Michaels is not very bullish on what hybrid can offer in the long term but does note it may find a niche in smaller aircraft.
- **Hydrogen combustion.** Hydrogen combustion has 3x better energy density than jet fuel but is 4-7x worse than jet fuel in terms of volume density (depending on liquid vs. gas hydrogen). There are several challenges that need to be solved concurrently in order to make hydrogen combustion a viable solution including. availability of green hydrogen (currently only 4% of the world's supply), infrastructure, aircraft design, certification, and maintenance.
- **Hydrogen fuel cells.** Hydrogen fuel cells are more efficient than jet engines but the waste heat it produces is much harder to get rid of. Additional technical challenges include vibration and shock, thermal stress, humidification, and Nitrogen purging. There are also economic challenges associated with Hydrogen as retrofitting existing aircraft will mean decreasing the number of seats available per aircraft (as hydrogen cannot be stored in the wings).
- **Sustainable Aircraft Fuel (SAF).** SAF can result in 50-90% reductions In emissions but the cost is 2-3x the cost of traditional jet fuel. Different types of SAF present their own unique pros and cons.
- **SAF is the most feasibly sustainability pathway, but there are concerns over feedstock availability, high costs, and carbon intensity.** While supply is growing exponentially, if current investments remain, there will be limited amount for consumption available for the foreseeable future.
- **There will be another generation of gas turbine engines.** Dr. Michaels asserts that the industry cannot wait until alternative propulsion is ready to develop new aircraft. There will likely be another generation of engines relying on jet fuel that result on aerodynamic efficiencies to reduce emissions.
- **Dr. Michaels believes a broad mandate is needed in the US to encourage the adoption of SAF.** Without a widespread mandate, there is a competitive disadvantage to using SAF (due to the higher costs). The EU already has SAF mandates in place.

- **Direct Air Capture (DAC) remains an unknown.** The viability of SAF and other sustainability levels will depend on the prices of DAC. If DAC becomes cheap enough, it may no longer be attractive to invest in SAF and other alternative propulsion technologies.

The Outlook for the US Airlines

John Heimlich, VP and Chief Economist, Airlines for America

We hosted John Heimlich, VP and Chief Economist for Airlines for America (A4A). Below are our main takeaways.

- **Passenger volume growth should normalize in 2024, but the long-term trajectory is roughly intact.** A4A forecasts passenger volume growth of 3% in 2024, with 2024's estimate just modestly below the 5% long-term CAGR. A4A expects strong demand for Pacific travel this year, similar to the Atlantic theme in 2023 as the region becomes the last to see post-pandemic restoration.

- **Labor costs have converged, weakening the competitive position of low-cost carriers**. Industrywide cost convergence, especially for labor, has presented downward pressure to low-cost carrier margins. In 2023, the strongest pre-tax margins were enjoyed by carriers with international exposure, premium products, and strong loyalty programs, a disadvantage to the low-cost business model.

- **Remote and flexible work arrangements have altered consumer behavior.** Remote work is seen as a structural positive for travel demand going forward as remote-work days have nearly quadrupled since pre-pandemic levels. Hybrid work arrangements are the strongest flexibility-related driver of demand as personal income levels of hybrid workers tend to be better aligned with average traveler demographics than fully-remote and fully-onsite workers.

- **Large corporate travel remains in depression, but it's not ubiquitous.** While large corporate travel has hovered near 75-80% of 2019 levels, some industries have seen travel in excess of 2019 levels, as have small and midsized businesses. Strikes in the automotive and entertainment industries, which pressured travel in 2023, are now resolved. However, the tech industry remains a laggard given cost-cutting regimes and communication technologies adopted during the pandemic.

- **2024 will be a heavy re-fleeting year.** 2024 airline capex is expected to exceed 2023 levels as airlines, especially larger carriers, take a significant number of aircraft deliveries after pandemic-related deferrals and OEM constraints. Higher gauge and larger premium sections are a general orderbook theme as carriers seek product and unit economics improvements.

- **Air traffic control constraints continue to present an operational headwind.** Staffing shortages at air traffic control centers continue to challenge operations, especially in areas of congested airspace. Carriers have responded favorably to FAA slot waivers at New York area airports by reducing total flight volumes while upgauging aircraft. The expansion of the FAA's training capacity beyond its principal academy in Oklahoma City is a key priority to eliminate bottlenecks, mainly through additional support for colleges and universities with ATC training programs.

Investing in the Future

Edward Espiritu, Senior Manager, United Airlines Ventures

Robin Riedel, Partner & Leader, McKinsey's Aerospace & Defense Practice

Sonny Tahiliani, Executive Director & Technology Lead, RTX Ventures

Jacob Markish, VP of Strategy, Marketing & Corp. Dev., Thales North America

We hosted Edward Espiritu of United Airlines Ventures, Jacob Markish of Thales North America, Robin Riedel of McKinsey's Aerospace & Defense Practice, and Sonny Tahiliani of RTX Ventures, for a discuss on corporate ventures and investing of the Future of Aerospace & Defense. Each speaker presented a unique perspective on their views of the Corporate Venture Capital (CVC) space, below are our takeaways from each.

- **Investment decisions and measuring value creation goes beyond just ROI**. The panel shared the consensus view that no one KPI dictates their investment decisions or can measure the success of their investment. Across the group the key questions that overlapped the investment decisions where - "How will this investment better service my commercial or Department of Defense customers", "Why is the investment case stronger than a partnership or investing in internal capabilities", and "How can we benefit this start-up without suffocating their growth". These questions also inform the measures of success and as Tahiliani noted measuring the financial success is always important, but the benefit that CVCs have when the Board is supportive, is having the stomach to withstand investments that fail or only reach break-even.

- **How do customers view pursuing the CVC space?** Across the board, the panelist agree customers (both internal and external) are supportive of investing in start-ups and pursuing new approaches to tech at the edge. Espiritu, representing a solely commercial focused CVC, noted having customers see the brand as pushing boundaries by investing in new capabilities is important and creates a unique differentiator in a crowded market.

- **What are the most exciting areas being looked at today?** Riedel shared the sustained investments in Advanced Air Mobility (AAM), Drones, and AI all present unique opportunities for competition and sees foundational changes to the Aerospace & Defense industry as each matures. Thales (JACOB XXX) had the view opportunities in Space are creating real near-term opportunities to create inroads in a rapidly expanding market, in addition to new advanced work taking place in next generation of electromagnetic phenomenon. Espiritu pointed to the advanced in hypersonic travel, as well as eVTOLs moving from development to operationalizing the service as an area of intense interest which will open new opportunities for passengers and airlines. Tahiliani sees advancements in AI being developed for design and engineering efforts being coupled with bleeding edge additive manufacturing capabilities as fundamentally changing both Aerospace & Defense production.

Business Jet Outlook – Changing winds ahead

Rolland Vincent, President, Rolland Vincent Associates

We hosted Rolland Vincent to discuss the business aviation sector.

- **Demand rebalanced in 2023 after post-covid highs, however the sales outlook is now starting to look cloudier.** This is largely due sluggish economic growth and troubling geo-political conditions. Additionally, customer optimism has remained sluggish throughout 2023.

- **Vincent is forecasting 2023 deliveries to be up ~750 units in 2023 (~9% Y/Y) but up only 4% in 2024.** He sees 8,5000 deliveries in 2023-2032 ($258bn market), most of which is back end weighted.

- **The OEM order backlog has been replenished to 18-24 months of production**. Much of this was written at attractive prices and strong margins. Textron and Embraer in particular have seen huge growth in their backlog.

- **There is continuing strength in US fractional portion of the business, which Vincent noted is the "sticky" part of the market.** He remains bullish on the sector and believes fractional ownership will end the year up.

- **Charter activity is starting to drop off.** This is significant as charter activity changes very quickly with the mood of the market, reinforcing the sluggish customer optimism.

- **In general, the mood of the market is fairly balanced between optimists and pessimists.** Following the pandemic, the mood rebounded quite significantly, however net optimism has dropped off to just around 0%. According to Vincent, the decline in North American mood is likely to due to the increased cost of money.

- **The slowdown in business jet activity will likely push pilots back into the commercial sector**. As airlines continue to ramp, they tend to look to business aviation as a source of talent. However, Vincent highlighted that this will likely result in higher pilot pay and more expensive operating costs for business jets.

Boeing Near Term Observations and LT Scenarios

Michel Merluzeau, Director, Aerospace Market Analysis & Strategy, AIR

Aerospace & Defense Strategic Advisory

We hosted Michel Merluzeau, Director of Aerospace Market Analysis & Strategy at AIR Aerospace & Defense Strategic Advisory. Our main takeaways were.

- **Delayed MAX-7/-10 certifications**. AIR expects MAX-7 certification in 1Q24 and highlights that MAX-10 might be delayed until 2025.

- **Challenging MAX production ramp**. Merluzeau anticipates 1H24 production to continue to be erratic but is more positive about 2H24. However, he doubts that Boeing will be able to ramp up 737 production to 50/month by the end of 2024. He thinks Boeing will be producing at 42-45 per month by the end of 2024 and at 50-52 per month by mid-2025.

- **Deliveries to benefit from inventory burndown**. Merluzeau thinks two 737MAX aircraft have already been delivered to China. This is a good sign of administrative challenges related to Chinese deliveries being resolved. He expects Boeing deliveries to benefit in the short term from inventories being shipped to China, but highlights ~100 of them have been stored for a long time. As a result, putting them in shape to get delivered could take time. Beyond aircraft in inventory, he is not that optimistic about incremental orders from the Chinese airlines on geopolitical pressures.

- **Positive outcome for IAM negotiation**. The contract covering 30k Boeing machinists (IAM) in Washington state expires in September 2024. Merluzeau is optimistic about a contract negotiation before the deadline.

- **Concerning customer concentration**. Top three Boeing narrowbody customers represented almost 60% of 2023 operators (Southwest, United Airlines and

Ryanair). This is highly concentrated compared with Airbus's narrowbody customer base, in which the top three only represent 20% (IndiGo, Delta, and Wizz).

- **There is a case for a new Future Single Aisle**. Boeing is not only in an unfavorable position vs. Airbus in the narrowbody market, but also could start to see pressure from new entrants in the market, like JetZero. He thinks Boeing will have to launch a new single aisle. The question is not if, it is only when it's going to be announced.

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