

FREIGHTER TRENDS

September 2023

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AN UPDATED TRENDS IN THE FREIGHTER INDUSTRY, P2F CONVERSION, MRO & AEROSPACE

FEEDSTOCK REMAINS VERY DIFFICULT TO ACQUIRE AS THE PASSENGER AIRLINES CONTINUE TO THRIVE

The cargo sector is returning to a more typical market growth rate. 737 market seems presently a bit oversupplied and for A321 the industry feels a bit of limited feedstock availability at the moment. Freighter Trends learnt that the trends looks same for 2024 as well with freighter capacity of aircraft out of sync with reality. Whereas, the value of new widebody aircraft "reliability" is generally recognized with new build assets, but this must be carefully weighed against time sensitivity, market competition and yield potential of 'tomorrows' cargo. Here are the details

Where is the global freighter market moving forward? What are the early indications of the air cargo market in 2024?

Brian McCarthy - VP, Sales & Marketing Mammoth Freighters LLC - Everyone is suggesting that we are in some sort of downturn, but I honestly believe that we have simply returned to a pre-covid era of cargo volumes and yields. Certainly soft times for air cargo with all sorts of geopolitical unrest and a general lack of enthusiasm that has curbed consumer spending but the inflation and ongoing cost of day to day commodities such as food has

certainly put a dent in the demand for e-commerce driven "discretionary" spending among consumers. I think we can expect more of the same for 2024 with freighter capacity of aircraft out of sync with reality. Too many narrow body conversions were commissioned when it was thought that Covid induced spending habits were here to stay.

Further, if the collective industry is really committed to our attention to emissions and urgency to strip out the waste and inefficiency of some aircraft, then many aircraft should already be retired; aircraft which were activated

during the covid crisis that now must be retired 'again'. This retirement will likely take 2-3 years.

Robert T. Convey, Senior Vice President - Sales & Marketing, Aeronautical Engineers, Inc. - The global air freight market is has been retracting for the past six months and show no near term signs of a correction. From our perspective the slow down we are currently in will continue through mid 2024 with modest recovery coming in Q3 2024.

Zachary T. Young - Over the last 3 years we have seen freighter capacity flip between

Continued to Page 3



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Continued from Page 1

deficit/surplus and the market is trending to normalize to near 2019 levels for 2024.

Wolfgang Schmid, Vice President Sales & Marketing - EFW - Elbe Flugzeugwerke GmbH - It's obviously coming back to "normal". Belly space is also available again in larger magnitude. Additional request for conversions has become much quieter. But, on the other hand our customers know that our slots are pretty full.

Waleed Sirrag - Director of Technical Services, The Aircraft Group - The global Air Freighter market is experiencing a notable shift towards the Asia-Pacific region, a trend that is projected to maintain its momentum throughout the forecast period.

The presence of major global production hubs, notably China and India, is poised to drive a substantial upswing in logistics activities over the forecast period. These economic powerhouses have emerged as pivotal players in the global manufacturing landscape, hosting extensive networks of suppliers, manufacturers, and exporters.

China's well established manufacturing prowess, backed by efficient supply chains and a massive consumer base, positions it as a critical node for global trade. Similarly, India's rapidly expanding manufacturing sector and burgeoning e-commerce market contribute to its rising significance in logistics operations.

The modest recovery of factory output in China serves as a promising early indication of the air cargo market's trajectory in 2024. This uptick in manufacturing activity signifies a potential surge in cargo shipments, necessitating efficient and timely airfreight services to meet the growing demand.

Patrick Leopold, Director of Trading & Leasing - VALLAIR - Currently the cargo sector is returning to a more typical market growth rate. The yields have reduced and over-capacity is causing values and lease

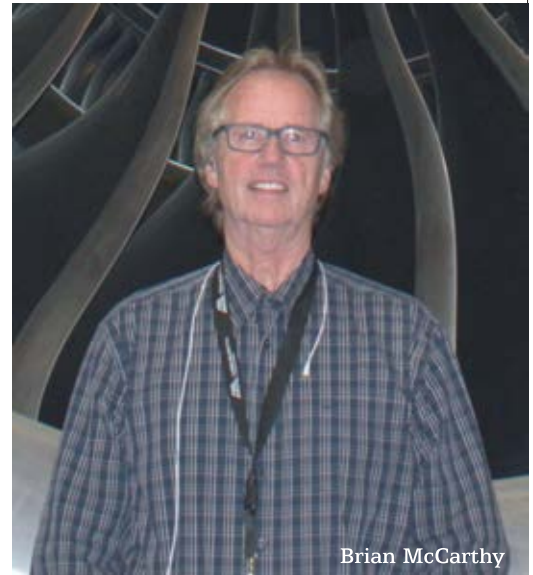
rates to ease. However, cargo carriers have managed these cycles in the past, by removing capacity or advancing fleet retirements. Barring any significant changes in the macro-economic environment, I believe the cargo industry will maintain a solid stable growth rate in 2024.

How is the e-commerce market impacting the narrowbody and widebody freighter conversions?

Brian McCarthy - For wide bodies, we are seeing evidence that traditional high density, "hard core" general cargo or heavy freight haulers are seeing a routine mix of E-cargo, express, general and integrator cargo on many of their routes. This reality is giving many operators pause while considering aftermarket, converted widebodies might just serve a role in tomorrow's lower yield, mixed cargo networks at roughly half the unit cost of new build.

Robert T. Convey - As E-Commerce continues to slow it is having a chilling impact on demand for additional narrow and widebody freighters.

Wolfgang Schmid - Not at the moment: 737



Brian McCarthy

market seems presently a bit oversupplied. No doubt is faster growing than GMF. As the slots have been full there is limited change. Especially for A321 we see already a bit of limited feedstock availability at the moment.

Waleed Sirrag - The e-commerce market has exerted a substantial influence on the landscape of narrowbody and widebody freight conversions within the aviation industry. The surge in online shopping and global trade has generated a heightened demand for efficient and rapid transportation of goods, leading to a significant uptick in air cargo volumes. To meet this demand, airlines and cargo operators are increasingly turning to converting passenger aircraft into freighters, both narrowbody and widebody variants.

In the complex landscape of the air cargo industry, e-commerce regional markets and long-haul freighter operations stand at a crossroads, compelled to strategically recalibrate their airframe and lifting capabilities.

By selecting airframes tailored to their cargo profiles, e-commerce regional markets can deftly navigate the mounting challenges posed by the ascendancy of



Robert T. Convey

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Continued from Page 3

airline belly lift. Simultaneously, long-haul freighter operations must meticulously deliberate on aircraft selection and lift requisites to withstand the formidable forces of an evolving consumer landscape. As consumer preferences pivot towards intangible services over tangible products, they very essence of cargo space requirements change. Herein lies the industry's paramount task to fortify against the surge in belly lift by fashioning a robust foundation rooted in precise airframe choices, thereby transcending the shifting tides of consumer spending patterns with sagacious resilience.

Patrick Leopold - E-commerce is here to stay, but of course cyclical demand also applies to this market segment. E-commerce, at least for the moment, is predominantly carried on narrowbody freighters, however saying that market fluctuations would only impact narrowbody freighter conversion rates is not correct, because e-commerce is also carried on widebodies and in the bellies of passenger aircraft.

Do you see more conversion lines are required looking at the current market trends for 737 NG and A320/A321 freighter conversions?

Brian McCarthy - No. This narrowbody conversion market has an uncanny way of spooling up to meet demand when a market is hot and the Covid induced euphoria fueled a private equity frenzy that will now take some time to consume the oversupply of recently converted jets. The urgency of lowering emissions may eventually favor the 321 even though it has a higher unit cost. However, the 320 is a doubtful contender because it doesn't haul enough pallets to "fed the engines and flight crew" It was clear that the conversion capacity (more or less) met the demand as we headed into 2021 with AEI and Boeing leading the charge with 737-800's, but as we headed out of 2022 the supply side was rapidly becoming unhinged from the real demand. The stage was also set during Covid for additional exuberance over the market growth when you could not open a trade publication or a wall street journal without seeing articles on the new

normal of.

Too often, the market looks to replacements as an investment validation. In some cases, this is true. However, the notion of narrow body freighter replacements is often overstated and easy



Zachary T. Young



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Continued from Page 4

to point to when presenting to investors considering such investments. These older mature freighters never die and can be resurrected and put in service within a few months. These same freighter assets tend to lag in the marketplace until they run out of maintenance "green time". However, during periods of reactivation, these assets wreak havoc on rents and fuel the fire of oversupply, especially when fuel pricing is stable or relatively low. I hate to say it but there are only three reasons why old freighters die. Fuel pricing, engine LLP availability and heavy maintenance costs. You don't need to go back in time too far to see how long 400+ Boeing 727s remained in operation long after their prime.

Robert T. Convey - Absolutely not! In fact quite the opposite is in motion with conversion providers eliminating lines to adjust for softening demand.

Zachary T. Young - I believe the 737NG conversion lines will face a reduction if not already, and the A321 lines will remain stable (for now). The rates of 737NG conversions are 2-3x higher than the A321 conversions which is not sustainable. There are approximately 200 redelivered 737-800 conversions to-date and only approximately 30 A321 conversion redeliveries to-date.

Waleed Sirrag - The prevailing market trends underscore a pressing need for the expansion of conversion lines dedicated to the Boeing 737 NG and Airbus A320/A321 freighter conversions. To capitalize on this opportunity, augmenting conversion lines is imperative, enabling the aviation industry to effectively repurpose existing airframes and tap into the burgeoning cargo segment. This strategic move will not only address



Waleed Sirrag



Wolfgang Schmid

the current market needs but also position operators to capitalize on the sustained growth of the freighter market in the years to come.

Conversely, expanding the number of conversion lines dedicated to freighter conversions introduces a spectrum of complexities, underlining the essential necessity for experienced technical representatives to be physically available onsite. These experienced technical representatives possess an acute understanding of the conversion sophistications, challenges, and potential pitfalls, ensuring that every alteration adheres to stringent standards of safety, efficiency, and compliance. As conversions are not just technical modifications but also crucial investments, the guidance of these representatives helps safeguard against delays, unexpected setbacks, and costly errors.

MRO Trend - MROs companies are strategically expanding their conversion lines to align with the prevailing market trends, particularly focused on 737 NG and A320/A321 freighter conversions. The burgeoning demand for air cargo operators to seek cost-effective solutions for fleet expansion. In response, MROs are currently enhancing their capacity to efficiently transform retired or underutilized

passenger aircraft, into dedicated freighters optimized for cargo transportation. By augmenting their conversion lines, MROs are not only capitalizing on the evolving needs of the industry but also contributing to the sustainability of air transportation by expanding the operational life of these aircraft through adaptive repurposing. This strategic alignment underscores the MRO sector's agility in addressing dynamic market shifts and reinforces its vital role in shaping the future of cargo aviation.

Patrick Leopold - The active freighter population has been growing by more than 20% since May 2019. Between 2015 - 19 it grew by 17%. That shows that even though there was the huge impact of COVID-19, the difference between those cycles is rather benign. There will need to be enough conversion lines to cover the combination of fleet growth and fleet renewal. The transition to more fuel efficient, reliable aircraft, as well as ESG considerations, and the maintenance burden of fleets are also drivers for continued renewal. Quite a few conversion lines opened recently for narrowbody conversions, especially in US and China. It remains to be seen whether the demand will continue to justify the number of new conversion lines for both types.

How much continued demand is there for regional freighters, especially when China is opening up for business? Is there any demand for widebody freighters as narrowbody dominates?

Robert T. Convey - China has all but skipped over regional freighters due to the small size. They are however continuing to take narrowbody, IE 737-800SF size freighters. As of now the demand is limited from China.

Zachary T. Young - We can continue to expect increased retirements of aging, less reliable, inefficient fleets over the next few years which have been kept airworthy longer than originally planned. The widebody fleet is aging rapidly and mass replacements are guaranteed over the next 3-5 years. Increased belly capacity across certain lanes do relieve some pressure.

Wolfgang Schmid - If I investigate our backlog list, it is even more widebodies waiting. But that may be half of the truth: Narrowbodies are normally ordered more short-term

Waleed Sirrag - With China's expanding role in international trade and investment,



Continued from Page 5

the need for efficient and timely transport of goods within specific geographic regions has intensified. As China broadens its economic partnerships and trade relationships, a cascade of cross-border transactions has emerged, bolstering demand for regional freighters to facilitate the movement of goods from production centers to consumption hubs. This heightened demand is not solely driven by China's exports; it also reflects the burgeoning domestic consumption, e-commerce surge, and infrastructure development within the country. As a result, regional freighters, whether in the form of versatile narrowbody or capacious



Patrick Leopold

widebody aircraft, are poised to play a pivotal role in ensuring the seamless flow of commodities and fostering economic growth amidst China's expanding global engagements.

While narrowbody aircraft have traditionally served regional and domestic cargo needs effectively, the surge in international trade and the growing scale of China's exports and imports necessitate the capacity and range offered by widebody freighters.

Patrick Leopold - As mentioned above, there is likely going to be continued demand for narrow and widebody freighters to cover both replacements and growth. We have seen a marked increase now that China has opened up, but of course with passenger operations back in business, the demand for cargo transport solutions will be shared between belly hold cargo, narrowbodies and widebodies.

How do the lessors see the demand for converted freighters and the air cargo market going soft?

Brian McCarthy - I think the lessors have definitely slowed down and pulled their horns in on the narrowbody side but the panning and preparation time for wide

bodies and conversion slot timing tends to flatten out the peaks and valleys of supply and demand cycles.

That said, in a world where a number of factors are starting to creep into the decision process:

- * Pilots are in short supply
- * Route authority and congested skies and airports is getting acute
- * Yields are lower
- * Time sensitivity of cargo may subside and give way to lower pricing
- * Consolidation of express, general, integrator, e-commerce is making it all looking like "cargo".

Express is becoming general cargo and general cargo is looking like express. Based on the above items, we think that a 777-300er can replace 1.5+ 767-300's or A330

For those operators that can fill a 777 routinely, it won't surprise us to see a 777 operating with one flight crew on 8 hour missions which is in the "zip code" of A330 and 767-300 mission capability.

Robert T. Convey - Lessors have stopped placing additional orders as the market continues to dry up. I believe the lessors will be back to the table once we see a modest recovery in demand.

Zachary T. Young - Late new aircraft deliveries and OEM engine issues combined with increased passenger demand have made PAX leases attractive- in some cases, more attractive than investing in freighter conversion.

Wolfgang Schmid - It is still a great option for them especially if they do not succeed to market them on higher pax lease rates.

Waleed Sirrag - Despite the recent softening of the air cargo market, lessors are observing a notable surge in demand for converted freighter aircraft. This trend is particularly intriguing given the challenges posed by the evolving air cargo market. As supply chain dynamics continue

to undergo transformation, lessors are recognizing the value of repurposing passenger planes into freighters to meet the growing demand for efficient cargo transportation. This demand surge highlights the adaptability of lessors and operators, who are keen on maximizing the utility of their existing assets to address changing market needs. This rising popularity of converted freighters underscores the industry's agility and innovation, as it navigates a complex environment while seeking out new avenues for expansion.

USM in the freighter conversion : Used Serviceable Material (USM) plays a crucial role in the context of freighter conversion, especially as the demand for both narrowbody and widebody freighters continues to grow. In this dynamic landscape, where operators seek cost-effective and timely solutions to meet the increasing cargo transportation needs, USM offers distinct advantages. By utilizing previously used aircraft components and



parts that are still in good condition, freighter conversion projects can achieve significant cost saving compared to sourcing entirely new parts. This approach also helps in reducing lead times for the conversion process, as obtaining new components can sometimes be time-consuming. Moreover, the sustainable aspect of reusing materials aligns with the industry's efforts to minimize environmental impact. As the demand for freighters intensifies, leveraging Used Serviceable Material (USM) provides an efficient and resourceful way for operators

Continued from Page 6



Robert T. Convey - Feedstock remains very difficult to acquire as the passenger airlines continue to thrive. AEI will have a backlog of 65 orders by years end.

Zachary T. Young - Speculative freighter builds by lessors have slowed due to increased PAX demand for the same airframes, increased cost of capital, and market uncertainties during this "normalization" phase. In 2021-2023, the demand for converted A321s exceeded capacity. I see the demand for A321s throughout the remainder of 2023 and into 2024 matching existing capacity.

Wolfgang Schmid - We are not expecting that many orders as we already got them into 2026. All our orders are confirmed and paid.

Patrick Leopold - The A321 F is still gaining momentum in the marketplace with around 30 a/c having been converted to date and a solid pipeline of B737 NG freighters being supplied to the market.

to capitalize on the market growth while optimizing their investment and operational efficiency.

Patrick Leopold - Currently there are more than 700 freighters that are more than 30 years old and will need to be replaced sooner or later. So even if growth eases, the current active freighter fleet is not getting younger so there will be a need for

a baseline of converted aircraft.

What are the latest feedstock trends of the narrowbody P2F in the market and how many confirmed orders are you expecting by the end of this year?

Brian McCarthy - Tight. Passenger market is so hot, that conversions are not in the cards until the passenger market cools off.

What impact do you see on the factory built 777s and A350F vs converted 777s, which both are under process, from customers perspective? How has been the demand so far for 777 converted freighters?

Brian McCarthy, VP, Sales & Marketing Mammoth Freighters LLC - Mammoth has received a warm reception from the market and the order books ahead of any certification are evidence that we are seeing preparations for a sizeable replacement wave that will continue for several years. Our competitor in Tel Aviv appears to have a similar market reception.

The value of new aircraft "reliability" is generally recognized with new build assets, but this must be carefully weighed against time sensitivity, market competition and yield potential of "tomorrows" cargo. A valid question: Are these new build 777 and A350 passenger aircraft programs being spawned from the need for flight and fuel efficiency that is leaps and bounds ahead of the aircraft they are replacing or are these new build passenger aircraft and their freighter variants being presented to the market because of the prohibitive costs associated with major passenger cabin refurbishment, engine shop visits, connectivity & IFE technology advancements needed for the marketing departments of passenger operators?

It appears that we are in a market where surplus 777 wide bodies being retired are very close to the current GE 90 engine technology with only minor design enhancements that must be combined with new wing and winglet designs to bring the new build to market under the emissions wire. I think that the market is always prepared to pay a premium for flight and fuel efficiency if it is a big leap, but, the question that needs to be answered is: With 800 777-300ERs on the feed stock horizon, are these new build OEM freighter variations enough to "feed the engines, pilots and bottom lines" of tomorrows cargo operators facing competitive pressure together with the prospect of lower yield cargo at a time when the unit cost of new build freighters is obviously extreme in contrast to aftermarket conversion.

We honestly have turned allot of heads with big cargo airlines with our program because you get very similar payloads and range for \$100m less capital cost.

Competition is getting fierce and every drop of fuel,



pound of CO2 and kilo of cargo will matter going forward and the 777 is far more fuel efficient and modern than what you would typically see in the conversion feedstock pool.

The reality of after-market converted 100-ton wide bodies going forward requires operators to rework their network routes to accommodate the 777-300ER converted aircraft. There is a sweet spot for this aircraft.

This will be a case where operators will have to adapt the cargo and sector planning to the aircraft available.

The factory 200LRF is a great aircraft for some of the cargo airlines that haul military and industrial payloads with all of its built in utility but in the integrator, express and e-commerce market, these new generation wide bodies may actually be considered "too much aircraft" for the 6-8 lb per cubic foot cargo being routinely hauled. This mixed market needs the volume but they don't want to be saddled with the physical weight of the "all singing and dancing" cargo handling equipment as well as the structural provisioning that they do not need or want.

Observation:

Usually, new generations of passenger aircraft are presented to the market long before the production freighter variant rolls off the production line but the OEMs are wasting no time developing freighter variants at an alarming pace, well before all the bugs are worked out by the passenger variant. This may explain the pause we are hearing in the market for new build freighters.