



MAX v Neo

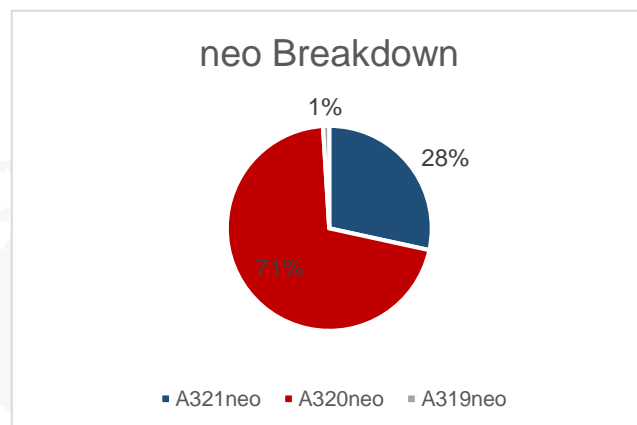
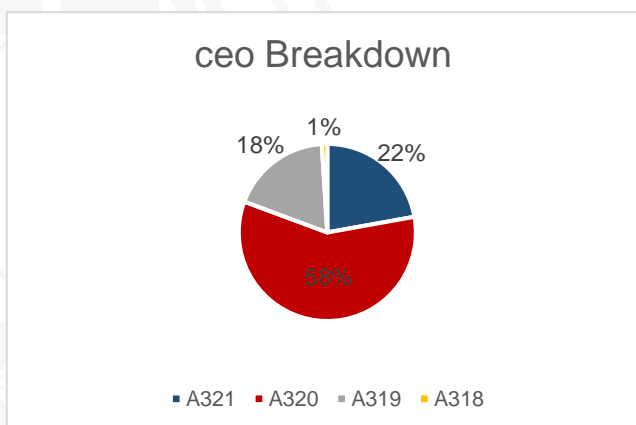
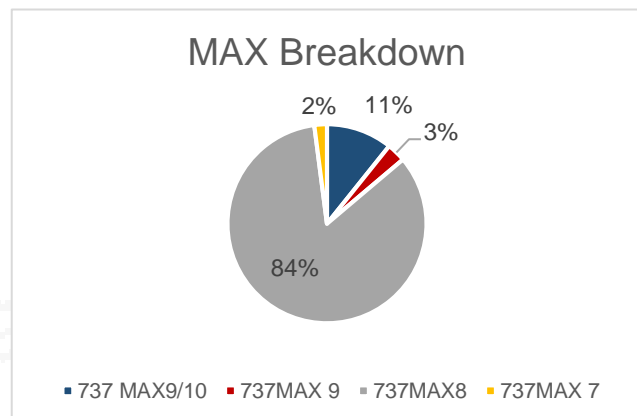
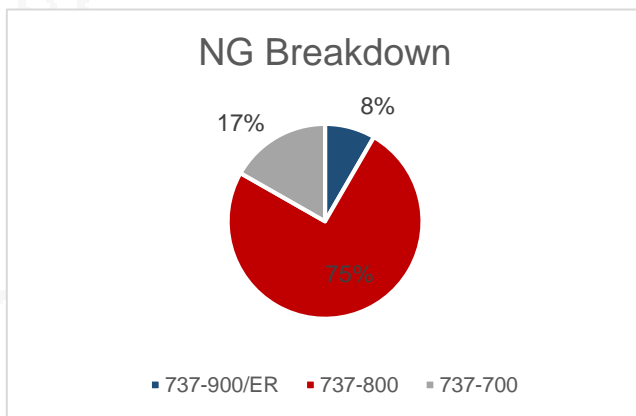
January 11, 2018

Airbus and Boeing Rivalry

When Airbus launched the A320 to compete against the 737 family of aircraft in 1984, it was competing against a mature company with a distinct first-mover advantage. It took Airbus a good number of years to catch up to Boeing's order books, cementing both the A320 and the 737 as two of the most successful aircraft of all time, in terms of orders. With the advent of a new generation of aircraft, we have seen a slight advantage of one manufacturer moving ahead, though it is still early days for both aircraft families. As of November 2017, Airbus commanded a healthy lead with 5,254 neos on order compared to 4,065 MAXs on order and a first-mover advantage in the 200-240 seat segment with the A321neo edging out over the MAX9 and MAX10.

Since the launch of the 737 Next Generation (NG) and the A320ceo family, the preference in the narrowbody market has shifted and resulted in the changes culminating in the MAX and neo family of aircraft. The most distinctive shifts we have observed are the general upgauging of the aircraft and a greater sensitivity to fuel prices. The upgauging of aircraft has resulted in every version of the MAX being built larger than its predecessor. Additionally, we see an upward shift in market share of the 200-240 seat aircraft in the narrowbody market. The A321neo has increased its market share to 28% from the 22% the A321ceo held in the ceo family and the MAX 9 and MAX 10 aircraft command 14% of total MAX orders compared to 8% the 737-900 and 900ER held with the NG family.

Order Book Overview



Source: mba REDBOOK STAR Fleet November 2017, Boeing.com, Airbus.com

The Impact of Rapid Economic Growth

A large part of this upgauging can be attributed to the rapid economic growth in Asia. IATA estimates that the region will grow 4.7% annually, with China set to become the world's largest aviation market by 2024 and India displacing the UK as the third largest market in 2025. While the Asian carriers have been riding on the wave of economic growth in the region, the infrastructure has been struggling to cope with the surge in demand and is lagging behind the growth of the carriers it's trying support. To overcome these infrastructure limitations, Asian carriers are relying on larger aircraft to fly higher-density routes. A great example of this is Vietnam Airlines which has seen strong growth over the last few years but has been limited by infrastructure growth in the region. The airline operates a modern mix fleet with the smallest aircraft outside of its turboprop fleet being the A321-200 with the intention to lease 18 A321neos from Air Lease Corp and Aviation Capital Group. With the MAX and neo, we see that Airbus has had greater success in Asia, with orders in Asia accounting for 46% of the neo backlog. Boeing has taken a more balanced approach with the bulk of its MAX orders concentrated in North America at 33% and Asia coming in a close second at 30%.

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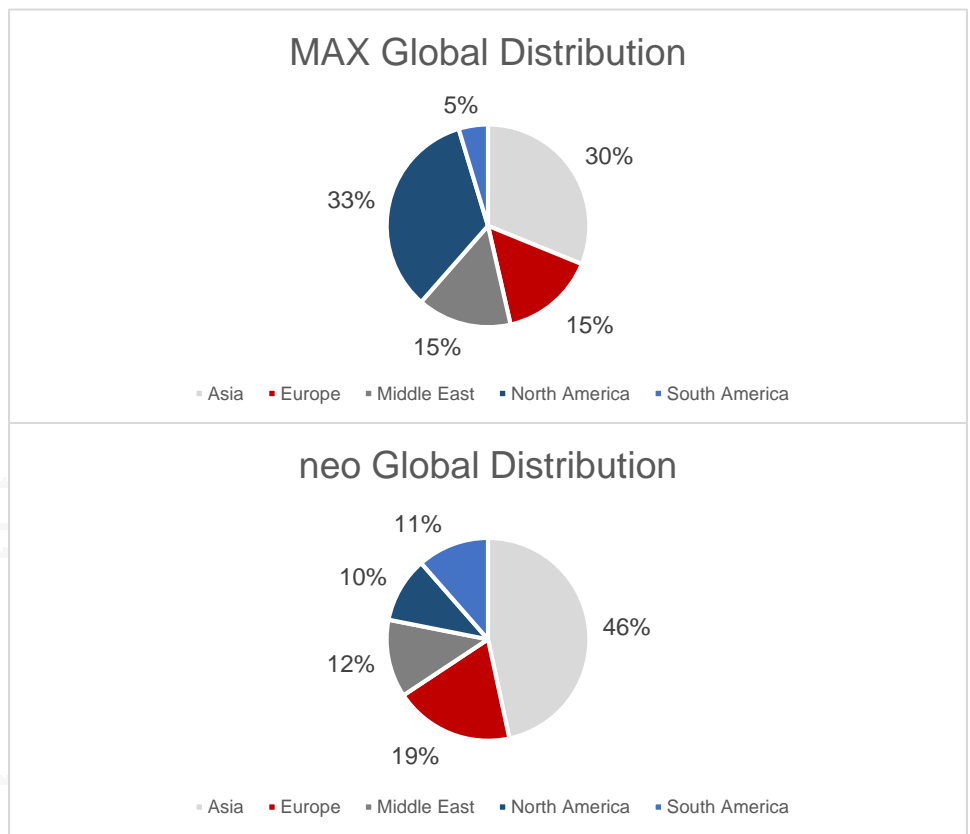
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Regional Overview of the MAX/Neo Order Books



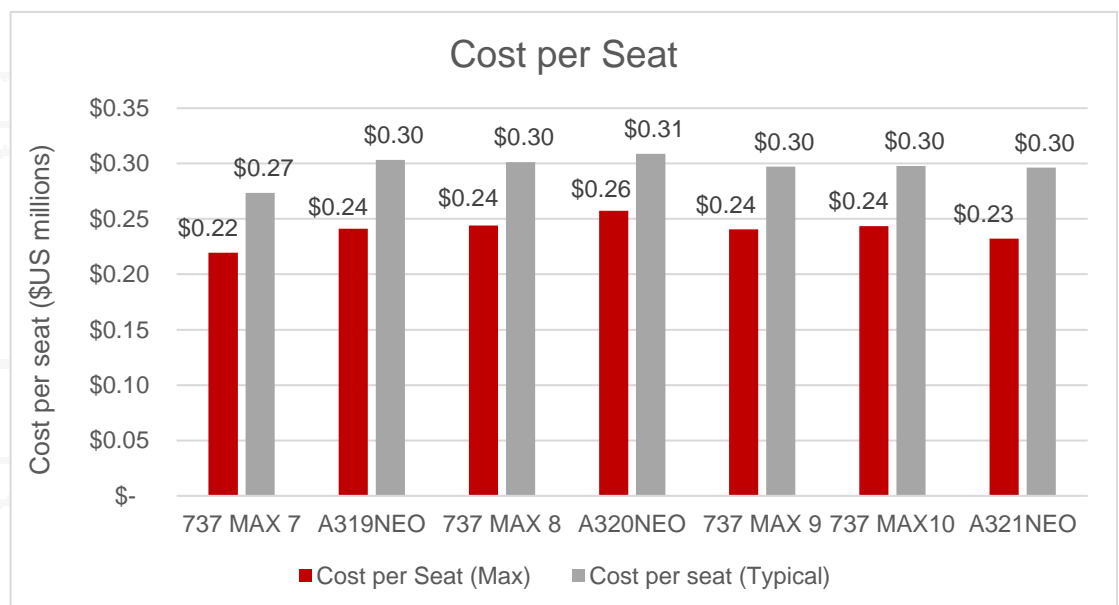
Source: mba REDBOOK STAR Fleet November 2017, Boeing.com, Airbus.com

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Comparing Cost Advantages

The general upgauging of the narrowbody segment has worked in Airbus' favor allowing the A321neo to pull ahead of the 737 MAX 10 due to its first-mover advantage and seat cost advantage. However, as we move down the product line we see a reversal with the MAX having a seat cost advantage over its Airbus counterpart, with the MAX 8 and MAX 7 having a \$20k seat cost advantage over the A320neo and A319neo respectively. While this may intensify the competition between the MAX 8 and A320neo, the lower seat cost of the MAX 7 may come at a cost to Boeing. The lower cost per seat on the MAX 7 is a result of increasing the capacity of the aircraft which may take away some of the advantages the 737-700 gave to its customers. The segment in which the A319 and 737-700 operate is somewhat niche compared to the larger variants, where operators care more about "right-sizing" and operating an aircraft within a narrower band of operating economics in which the aircraft is viable. Although the bulk of the sales are still expected to come from the A320neo and MAX 8, the lower end of the narrowbody segment where the A319 and 737-700 currently operate should not be neglected. With over 1,440 A319s and 1,125 737-700s in operation; and the average age of the fleet being 11.76 years and 11.8 years respectively, the 100-150 seat market may prove to be a pivotal market to capture even if the orders are solely for replacement rather than growth. With the new family of E2 jets by Embraer and the marketing efforts of Airbus behind the Bombardier CSeries, we could see a dilution of market share and an end to the long standing duopoly in the segment.

Cost per Seat Based on mba's Market Values as of 4Q17



Source: mba REDBOOK 4Q17

Robert Agnew
President & CEO

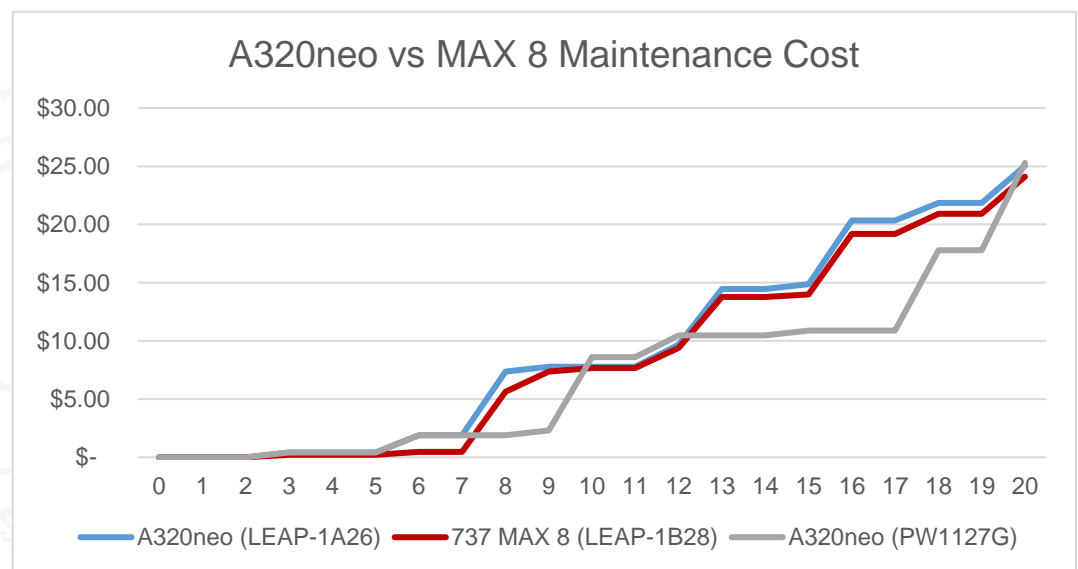


David Tokoph
Chief Operating Officer



In most other aspects, the MAX and the neo share very similar operating economics. The projected maintenance cost for both the MAX and the neo are comparable in the mid to long run. However, due to a longer interval for the first heavy check on the MAX, the A320neo has a higher maintenance cost for the first seven years. The maintenance cost over time for the neo is more gradual with cost increasing steadily over time. With the MAX, we see a spike at the 9 year mark as the first heavy check comes due followed shortly by a landing gear overhaul which runs on a shorter interval compared to the neo. Past this point, both aircraft have very similar maintenance cost as the MAX returns to a 6 year heavy check interval with the exception being the landing gear check intervals which is 10 years for the max and 12 years for the neo. This results in a higher cost for the MAX at the end of 20 years but will even out at the 24 year mark once the neo is due for the second landing gear overhaul. The lower cost observed with the MAX 9 compared to the A321neo is mostly attributed to the same engine variant being used on the MAX 9 as the MAX 8 while the A321neo's maintenance cost is valued using the more powerful LEAP-1A32 and PW1133G which has a higher maintenance cost. The spike in maintenance cost at 15 years for the GTF powered A321 is due to its second engine shop visit coming due before the LEAP powered A321, but the cost eventually evens out again at the 20 year mark with the GTF A321neo coming out slightly more favorable.

Scheduled Maintenance Costs Accumulated Over the Life of the Aircraft



Anne Correa
Director – Business Development



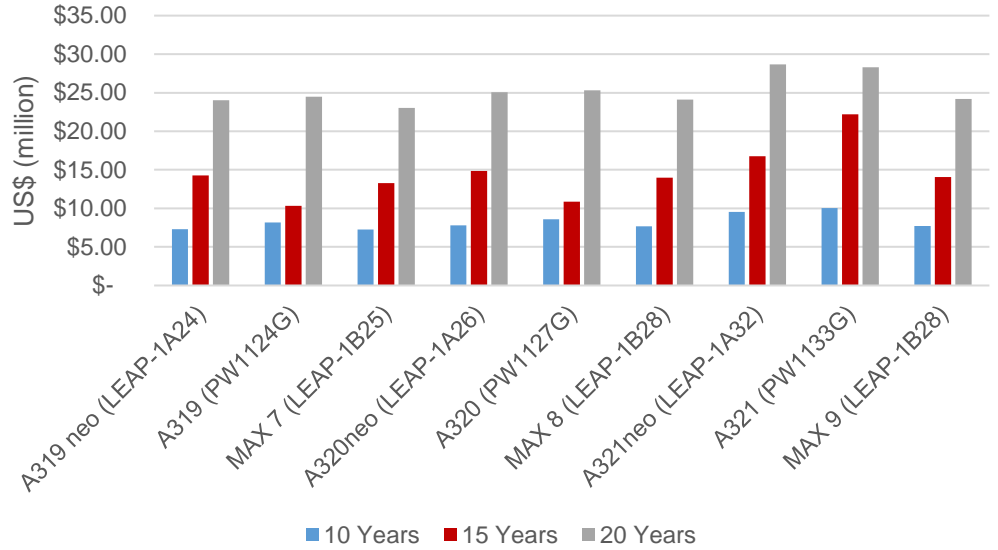
Lindsey Webster
Director – Asset Valuations



Kathryn Peters
Director – Business Valuations & Economic Analysis



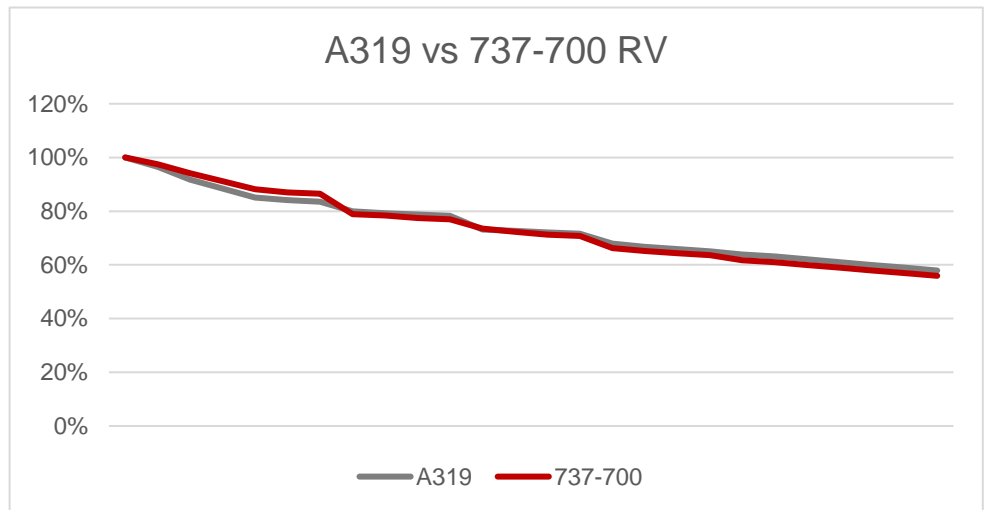
Maintenance Cost Over Time



Source: mba aircraft maintenance cost database¹

In addition, if the economic value of the current generation of aircraft is any indication of the value of the MAX and neo, both aircraft will have a very similar residual value curve with the MAX slightly ahead in all but the 100-150 seat segment where it closely trails the A319.

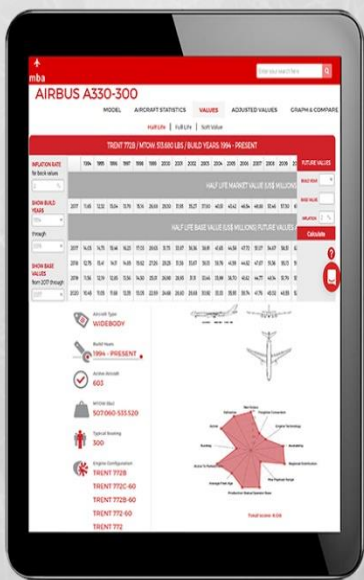
Average Historical Market Value Depreciation



¹ Maintenance cost projected using average utilization of 737-800 and A320ceo and current estimated maintenance cost. Maintenance costs and intervals likely to change as engines mature and additional in service experience is accumulated. PW1100G excludes gearbox overhaul costs.



Aircraft Values On Demand

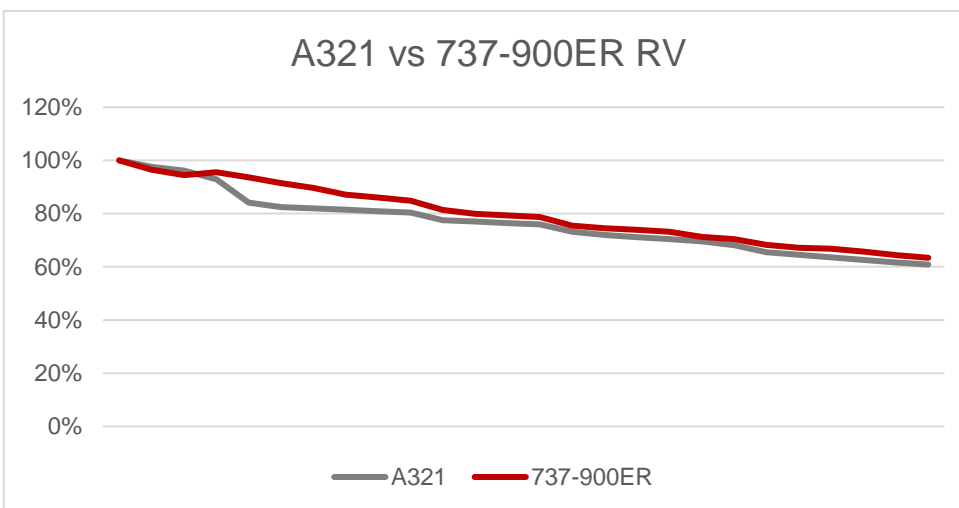
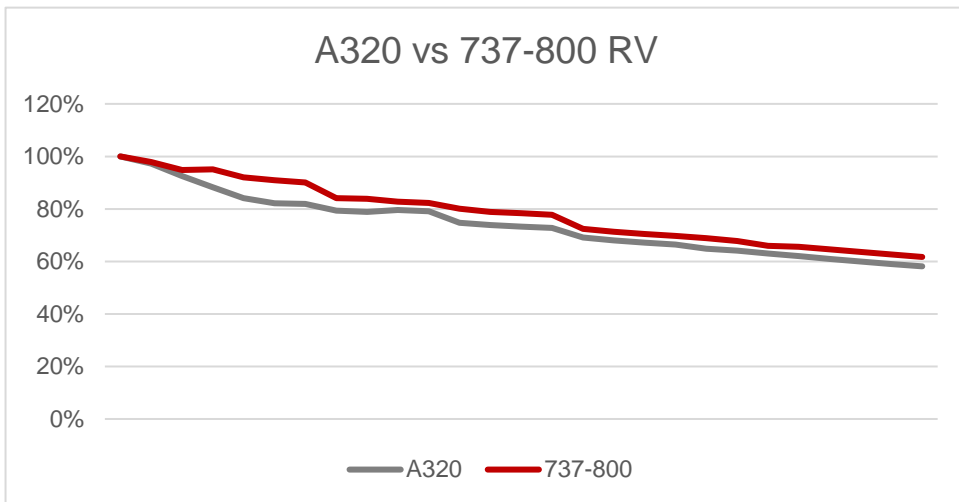


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Source: mba REDBOOK historical aircraft values

Fulfilling Engine Expectations

As previously mentioned, an observed change in the market is that operators are becoming far more sensitive to fuel prices compared to 30 years ago. With the current fuel prices hovering around US\$50.00 a barrel, the need for fuel efficient aircraft is dampened, however it was due to a spike in fuel prices that led to the inception of the re-engined aircraft families currently entering the market. A major draw of the MAX and neo is the promised fuel burn advantage over current generation aircraft. At the core of the advertised double digit fuel burn advantage touted by both plane makers is the new generation of engines.

On the power-plant manufacturing side we see little change as the two existing incumbent OEMs, Pratt & Whitney (P&W) and CFM, continue to be the majority providers of engines in the 75-240 seat segment. Outside of the V2500 engines, most of the other P&W powered aircraft are nearing retirement, as such P&W has hedged the company's future in the commercial aviation market on the success of the geared turbofan. So far, both the CFM LEAP and PW1100G have delivered on its promise of lower fuel burn, lower life-cycle maintenance cost and good dispatch reliability. However, the introduction of the new generation of engines has not been without hiccups. The PW1100G had two main issues that plagued its entry into service, namely a fault with an air seal and a combustor issue that P&W claims is isolated to aircraft operating in India. To compensate, P&W has had to divert some of the engines to a spare pool. This combined with supply-chain shortages has resulted in a failure to meet its scheduled deliveries.

At the same time, CFM's LEAP engines have not had a trouble free introduction into service. During a borescope inspection, several LEAP engines were found to have premature deterioration of the ceramic matrix composite coating on the turbine module. While both engine manufacturers have promised fixes for the respective issues, there has been a slight order advantage for CFM engines which have received around half of the neo orders and is the sole engine provider for the MAX.

The low fuel price environment and abundance of capital looking for yield in the aviation sector has resulted in a slightly tempered response to the new generation of aircraft and lease rate ranges have been wide. The sale-lease-back market has seen rates for A320neo and MAXs in the low \$300k's in some cases, trading closer to where one would expect last off the line ceos and NGs, but also up to \$400k in others, with many lease rates falling in between. The 25% swing in lease rates can be attributed to other lease parameters such as the lessee's credit, term, return conditions and multiple aircraft placement deals; however it also shows a fragmented market with some operators unwilling to pay a premium during low fuel prices, and lessors have been willing to bend to gain market share, and others desperate for new aircraft to support fleet growth. Keeping this in mind, it is important to note that the lower rates are more reflective of the state of the capital markets and not reflective of the technical performance of the future generation aircraft.

In Summary

Despite the engine setbacks during the initial entry into service and the entrant of new competitors, the MAX and neo families of aircraft look poised to become economic successes for Airbus and Boeing. Although there have been initial leaders in the segment so far, it will not be surprising to see the competitive landscape re-adjust itself to look like the current generation of aircraft with a few new partnerships in the mix.