AirInsight

2013 Newsletters

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Introduction

AirInsight's weekly newsletter readership has grown significantly in 2013, and we are pleased that this readership among the commercial aviation, airlines, financial community and news media has continued to steadily grow throughout the year. We'd like to take this opportunity to thank both our regular and newest readers.

We appreciate your interest in our work and your feedback on our weekly commentaries. We are fortunate to interact and work with the truly exceptional people that work in our industry that are improving and changing the way people travel every day.

Thank you for your interest in our views. Our goal is to provide the "why" and "so what" behind the news, and provide insights that illuminate the reasons behind events in our exciting industry.

We hope that you find this compilation of the 52 weekly newsletters from 2013, in PDF form, useful. Should you wish a hard copy of this compendium, it can be ordered here, without mark-up on the printing cost for $30.00 plus shipping.

In appreciation,

The AirInsight Team

No. 51, January 11, 2013: Special Report FAA Mandates Review of 787 Electrical System

In the wake of recent incidents involving the new technology Boeing Dreamliner, with multiple recent incidents causing flights to be delayed, the Federal Aviation Administration today launched a review of the Boeing 787's electrical system. The incident earlier this week when a Japan Air Lines 787 caught fire after landing, which was traced to the lithium-ion batteries on board.

Lithium-ion batteries tend to be more volatile than conventional lead-acid batteries, and two cargo aircraft that crashed with a cargo of such batteries resulted in FAA restrictions. Sixteen months ago, the FAA ordered the replacement of lithium-ion batteries in the Cessna Citation 525C business jets due to a threat of fire, and the use of lithium-ion batteries on the 787 was permitted with a "special condition" that recognized the heavy fire shielding around the battery. Nonetheless, the recent fire has rekindled safety concerns. We are somewhat surprised that no service bulletin or airworthiness directive has emerged regarding the potential replacement of these types of batteries, which are known for their volatility, and expect a future order to replace those batteries with more conventional, but less volatile designs.

Combined with four earlier incidents related that resulted from faulty circuit boards in a main power distribution panel, which caused a United flight from Houston to Newark to make a precautionary landing in New Orleans, the FAA has decided to review the entire electrical system of the 787 to ensure that no design problems exists and to reassure the public that the aircraft is safe.

Because the 787 incorporates a number of cutting-edge technologies on board, its critical systems rely on more power than previous generation airlines, which rely more heavily on hydraulics and pneumatics. As a result, the electrical system for the 787 must accommodate higher voltages, and the electrical system has a more robust design to handle the higher load.

Compounding the issue, Boeing outsourced much of the work on the electrical system to subcontractors, in this case, the Hamilton Sundstrand division of United Technologies, which had design responsibility for those components. In the past, Boeing would have defined the requirements in detail and asked its suppliers to meet those specifications. With the 787, Boeing parted from its traditional practices and provided only the top-level requirements, outsourcing the detailed design of those subsystems to its suppliers. With the design created in several locations, this will complicate the FAA review process.

At a joint press conference today announcing the review, Michael Huerta, FAA Administrator, Ray LaHood, the Secretary of Transportation, and Ray Conner, President and CEO of Boeing Aircraft discussed the review.

Ray LaHood indicated that the first priority is protecting the safety of the traveling public, and that DOT and the FAA will go the extra mile when it comes to safety. The FAA and Boeing will be conducting a comprehensive review of the design and production of the 787, covering critical systems of the aircraft, including design, production, and assembly, with a goal of finding the root causes of the recent issues to be sure they don't happen again. He indicated that the FAA spent more than 200,000 hours reviewing the 787 prior to certification. During the Q&A session he said he would have no reservations boarding a 787 and taking a flight.

FAA Administrator Michael Huerta indicated that they will work with Boeing to review systems, production and design, and will assure that proper quality procedures are in place. They want to look at the entire picture, with a special emphasis on the electrical systems, including the batter, power, and interaction with other systems. He also emphasized that the 787, like all aircraft, has multiple backup systems and is confident in the safety of the aircraft. During the question and answer session, he reiterated that nothing we have seen suggests that this airplane is not safe, and that they care about maintain public confidence that the airplane is safe.

Ray Conner, Boeing CEO, emphasized that the 787 has completed the most rigorous testing program in aviation history, that Boeing believes they've accomplish a safe aircraft as a result of that process, and highlighted that the 787 has now logged more than 50,000 flight hours and safely delivered more than 1 million passengers since introduction into service. He indicated that every new commercial aircraft has issues when entering service, that this entry is on par with their experience with the 777, and that it has been more than 15 years since a new aircraft has entered service in the United States. His indicated that if this joint review with the FAA results in improvements with the 787, they are happy to do this.

The Implications for Boeing

Just when Boeing appeared to be turning the corner from the troubled history of the 787, with the program delayed by more than three years from its original schedule and the re-work required to correct problems with the initial batch of aircraft, nagging problems began to emerge on the aircraft. The fire on the JAL problem was serious enough to attract the attention of regulators and call for a review of the program, which is not comforting to potential passengers or investors.

This is the first comprehensive FAA review of an aircraft design since the crash of an American Airlines DC-10 in Chicago in 1979. Of course, with no crashes and no loss of life, this situation is more precautionary than the review and subsequent grounding of the DC-10, and no one in the industry expects the 787 to be grounded. Boeing will continue to produce and sell the airplane, and airlines will continue to operate, albeit with a closer watch for potential problems. But, while Boeing, DOT and FAA all characterize this review as a continuation of normal processes, such reviews are very rare, and haven't occurred since the DC-10 for a commercial program.

The labor negotiations with the SPEEA Engineers will be impacted, as engineers are essential to this review process. This review just placed another arrow in the quiver of the union, changing the dynamics of the labor negotiations. A strike by the engineers could delay the review process, making the situation more difficult, something Boeing management can ill afford at this time. As a result, the problems with the 787 are likely to result in a higher than anticipated costs for Boeing.

Perspective

As Ray Conner indicated, every new aircraft program entails problems and issues that need to be worked out once the aircraft enters service and they can be identified, and cured. Many prior problems were much more serious.

The 727-100 had a series of fatal crashes until pilots were trained to deal with their sink rate with new procedures. The Lockheed L-188 Electra had a design flaw called "whirl mode" that caused the wing to sheer off on two aircraft in flight, resulting in fatalities, before it was corrected. The DC-6 and Lockheed

Constellation had design flaws resulting in fires and fatal crashes, the Martin 202 used a new metal alloy that was prone to metal fatigue, resulting in a wing falling off, and the de Havilland Comet, the first passenger jet, suffered several fatal crashed resulting from metal fatigue.

In the last 60 years, we've come a long way in aviation safety. Engines and systems are much more reliable, and the redundancies in back-up systems dramatically improved. Compared to past programs, the 787 problems to date have been irritating, but not life threatening. While the frequency of incidents has generated more media interest than similar problems that emerged with the 777 EIS in 1995. Today's media, including the ramifications of social media, tend to magnify the situation to perhaps more than it deserves. Nonetheless, this review will ensure that the irritations are solved, and that any safety of flight issues is precluded.

No. 52, January 22, 2013 The Boeing 787 and Airbus

The grounding of the Boeing 787 on January 16 virtually over shadowed the Airbus year-end results press conference the next day. Officials did not address the fate that befell their competitor, but the first questions from reporters sought reaction of Airbus to the Boeing misfortune.

Airbus officials were walking a fine line. Despite the bitterness that often emerges between the two companies, Airbus officials were sensitive to avoid any appearance whatsoever of gloating and reveling in Boeing's misfortune. Instead, they were empathetic, fully cognizant of "there but for the Grace of God go [we]." Memories of the troubles endured by the A380 before and after entry-into-service are seared into the Airbus memory, and officials are still dealing with the wing rib brace crack issues on the giant jet. The A350's first flight in expected in June or July, and with lithium ion batteries used for some of the systems, Airbus was peppered with questions from reporters seeking comparisons and what's different between the A350 and the 787.

Officials told us that there had been a lot of debate in the early days over whether the A350 should also be an all-electric plane, following Boeing's path on the 787. John Leahy, COO-Customers, acknowledged he pushed for this. Engineers studied and studied the issue and resisted Leahy's demands, concluding that going all-electric would only reduce fuel consumption by 1%, and this wasn't worth the technological risks, design and maintenance costs that would be entailed.

Airbus chose to retain hydraulics and pneumatics for many functions and to use traditional engine bleed air for deicing, cabin heating and cooling and so on.

The A350 will have lithium ion batteries—assuming the FAA and EASA don't outlaw them in the wake of the 787 incidents—but the A350 relies on electric power lower than used on the A330 due to design efficiencies and less than one quarter of that used by the 787.

The Japan Air Lines 787 battery fire involved the battery used to start the Auxiliary Power Unit. The A350 will use two batteries, drawing the same power as the 787, but spreading the load over two batteries instead of one.

There have been thousands of news stories about the 787 issues, so it's not necessary to repeat many of the issues here. There are a couple of issues we'd like to address.

Outsourcing

Some have raised the issue whether outsourcing work on the airplane is responsible for the battery and, if relevant, the system issues that led to the JAL fire and the ANA meltdown.

We say "No." Here's why.

Batteries simply are not what Boeing would design or build; these are products Boeing would purchase from a vendor, in this case from Japan. The related electrical components, which may or may not have had anything to do with the incidents, are also routine vendor-produced items. Boeing, of course, would require the products to meet certain specifications and requirements, including safeguards to prevent over-charging, which appears to be emerging as the chief suspect in the JAL and ANA incidents. But too

little is known, as of today, to draw conclusions except to say we don't believe outsourcing, as broadly thought of for the 787, has anything to do with this issue.

Congressional Meddling

The Chicago Sun Times reported that Congress plans to hold hearings on the 787. What a waste of time. Not only is any hearing premature, frankly it's none of Congress's damn business—at least not yet, if at all.

No lives have been lost and the FAA is well aware of the issues without Congress meddling into this affair. At the very least, the investigators need time to do their job.

There is certainly a legitimate issue over the reliance by the FAA on Boeing and its supply chain to design, produce and certify the 787, but this has been the practice since—forever? The FAA and its predecessor, the Civil Aeronautics Administration, never had the budget or expertise to do the job themselves. Nor is it likely they ever will. Congress can huff and puff but unless it's willing to provide the budget, the FAA has no choice but to rely on the very industry it regulates.

We don't like it, but them's the facts, folks.

No. 53, Jan. 29, 2013 Rough Year for Boeing Shaping Up

It would be natural to focus on the Boeing 787 issues in today's analysis, but when you come right down to it, what definitive is there to say? We still don't know what the cause of the Japan Air Lines fire is nor do we know what's behind the ANA smoke incident. Until we do, pretty much everything else is speculation.

Boeing's fourth quarter and year-end earnings call is at 10:30 ET January 30. Clearly the company will discuss the 787 situation, but we don't expect anything concrete to come out of it.

Instead, let's take a look at the broader implications of the situation:

1. Customer impact;
2. Delivery and production impact; and
3. The overhang of the SPEEA engineering contract.

Customer Impact

The grounding of the in-service fleet has obvious impacts that we don't need to go over here: schedule and passenger disruptions, canceled flights, etc. We're thinking more of the fleet planning and related issues. With the regulatory authorities grounding the airplanes and, as of last week, not even permitting ferry flights, some airlines have 787s grounded outside of their home bases. United Airlines had one aircraft in Tokyo; Qatar, in London; and LOT in Chicago. United has a large hub operation in Tokyo, so storing the 787 there was probably less problematic than for LOT and Qatar.

Delivery and Production Impact

Airlines planning on receiving 787s this year now face indefinite uncertainty on delivery dates. This disrupts fleet planning and potentially fleet retirements. We know of one charter airline that was to receive several 787s in time for the summer tour season, simultaneously expecting to retire Boeing 767-300ERs upon receipt of the 787s. The carrier has to make a decision very soon whether to tell its lessor that it wanted to retain the 767s through the summer—and if so, this means it will likely tell Boeing that it won't accept delivery of the 787s until sometime later, in order to avoid over-capacity.

Boeing is maintaining production for now, but what impact will an extended grounding have on future ramp-up rates? Remember, Boeing has a goal of ramping up to 10 a month by the end of this year. Will Boeing now be able to make Rate 10? This was considered a challenging goal under the best of circumstances. This grounding may make it more so.

Overhang of the SPEEA contract

As anyone who follows Boeing knows, the SPEEA engineer's contract expired in October. Negotiations have been contentious. Agreement was reached this month on all issues expect the pension and three or four related pension issues, over which SPEEA's negotiating team has recommended contract rejections. A strike authorization will also be sought. Ballots are to go out Feb. 4, with returns by Feb. 15. A strike, if approved, could occur seven days later.

The contract dispute, as it turns out, comes at a very awkward time because of the 787 issue. If SPEEA walks out, finding out what went wrong or coming up with a fix could be delayed. Boeing officials claim they have resources to cover a walk-out, but we're highly skeptical.

There is no way to tell how long it will take engineers and investigators to find a solution to the 787 problem, nor how long it will take to implement a fix. This could be another rough year for Boeing. Things are beginning to look like it will be.

No. 54, Jan. 29, 2013 - Turboprops

The world is waiting for the aerospace industry to provide guidance on the next generation turboprops. This is a small, even niche market, but it's seen resurgence as mainline airplanes grow in size. The regional jetliners that once dominated the 50-100 seat space have becoming economically-challenged as fuel costs shot up. The ATR-72 and Bombardier Q400 have proved to be increasingly popular alternatives to 70-seat jets. Although Mitsubishi launched the 70- and 90-seat MRJ, the smaller model has proved a difficult sell. Even the popularity of the 90-seat regional jet seems to be waning.

An interesting example of the impact of turboprops is seen at India-based SpiceJet. The airline operates in an environment which is very challenging. Internal India flights by jet airplanes incur onerous fuel taxation charges. The same airplane flying out of India does not attract these taxes. Airfares are not at levels that allow India's airlines to make profits. There is also the ever-meddlesome India government forever trying to save state owned Air India. SpiceJet did something counter-intuitive. CEO Neil Mills spoke at the Terrapinn Low Cost Carrier Conference in Singapore last week and explained that they decided to add complexity by bringing in an extra aircraft. The airline had been flying Boeing 737-800s and added Q400s. The Q400s do not attract high fuel taxes and have proven themselves adept at providing service at many Indian airports too small to handle jets. Moreover, the Q400s have the range to fly some routes beyond India's borders. SpiceJet's finances have improved markedly.

The case favoring turboprops is also bolstered by ongoing high fuel costs outside India. Bombardier has seen sales success of its Q400s of late as airlines realize the benefit of high speed turboprops. Our research indicates that network airlines are especially attracted to the Q400 performance. Non-network airlines are attracted to the competitive pricing of ATR turboprops.

The Next Generation Turboprop

ATR has been talking about a 90-seat Next Generation Turboprop (NGT) for some time. The idea is to extend the current design and add much more powerful engines and updated systems. ATR has spoken of using a 5,000+ SHP engine from GE (GE38-1B as used on the Sikorsky CH-53K has 7,500 SHP), but Pratt & Whitney will also likely bid on this design. Below is a rendering of what the future ATR might look like.

The NGTs are likely to make extensive use of the flight deck technologies seen on pure jets such as Required Navigation Performance. ATR, as part of the EDS family, will almost certainly have the Airbus ProSky company Quovadis' RNP package. The RNP system allows aircraft to fly precisely along a predefined route using on-board navigation systems and the GPS-based global navigation satellite system. Clearly this system helps reduce fuel burn and flying time - which is already an advantage for a turboprop over a jet. Since turboprops spend most of their time on shorter flights (~500 miles) time saved adds fast because of the many turns they do each day.

The next generation ATR will force Bombardier to react with its own updated airplane. Its Q400 is already called "next gen" in the company's marketing information. But an ATR looking like the rendering above would require a significant response from Bombardier beyond its current offering.

At last year's ISTAT conference, both OEMs publicly stated they could not make the economics of a 90-seat turboprop work. Here we are, nearly a year later, and ATR is pushing the idea. By deploying new materials and systems, ATR might have reached a tipping point where they can make the new, larger, turboprop work. If that is the case the competitive pressures ramp up not only for Bombardier but also for the various other turboprop programs being evaluated in South Korea and India.

No. 55, February 12, 2013 Some Observations on the Narrow-Body Market

Airline traffic has continued to grow over the last decade, despite 9-11, SARS, a financial crisis and prolonged recession. At current growth rates, traffic will double every 15 years. That requires twice the number of seats to accommodate passengers into an environment that has various constraints.

Airports in many areas remain constrained today, and new airports are needed. In some regions, including the Middle East and China, new airports are being built to accommodate additional traffic. However, in some areas, including North America and even the growing market of India, airport construction may not grow fast enough to accommodate the number of takeoffs and landings required.

At the same time, competitive elements have continued to bring down the cost of air travel in real terms, as one would expect for a perishable commodity industry with little differentiation between providers and a fully transparent electronic pricing system. The resulting fare pressures have resulted in a market dislocation for certain aircraft types as fuel prices and underlying economics change.

Combining the economic changes with constraints in air traffic control and airport capacities, the relative preference for aircraft of different sizes has changed dramatically. Perhaps the best evidence of this is that Embraer has been forced to announce a redesign of its popular E-Jet series to obtain economic improvements only nine years after entry into service.

Deliveries of jet aircraft by size category have changed dramatically over the last decade. Deliveries of jets under 90 seats in size virtually beginning to disappear.

Deliveries of 90-149 seat aircraft have also fallen, with a dramatic increase in deliveries of larger narrow-bodies with more than 150 seats.

Because orders are a prelude of future deliveries, this trend appears poised to continue for the next few years, as record orders for the Airbus neo and Boeing MAX families have had a similarly disproportionate impact on aircraft size.

There has been a clear trend away from smaller aircraft towards larger aircraft to accommodate future growth, largely because of seat-mile economics. But we believe that trend will begin to moderate as new technology smaller aircraft enter the market. The rush of 1,500 plus orders for Airbus A320 and A321 neo, and 1,000 737-8 and -9 MAX are somewhat an aberration to secure initial delivery positions, but nonetheless impressive.

However, there has been a dearth of orders in the smaller sizes of these aircraft, as shown in the table below:

Aircraft Model	Orders
A319neo	26
737-7 MAX	0
A320 & A321 neo	1,852
737-8 MAX & -9 MAX	1,164

While the neo and MAX families have been phenomenally successful, the smallest models have been a market failure, with only 0.85% of total orders.

But what happens to all of those markets currently served by 737-700s and A319s? There have been 1,086 737-700s and 1,357 A319s delivered since these models were introduced, flying to a number of markets for airlines believe they are well suited. Will all of these markets be able to fill larger A320 or 737-8MAX aircraft? We don't think so, and there will be a second wave of orders in the 100-149 seat segment.

Matching aircraft to routes to MAXimize profitability is always a goal of fleet planners, and low seat mile costs are one way to do that. But for the large number of markets that can't accommodate 150 or 162 seat aircraft, alternative are now entering the market.

The Bombardier CSeries will be the first of the new technology airplanes with the economic efficiency to potentially begin to change the dynamics and allow airlines to maintain service on routes currently served by 100-149 seat aircraft that otherwise would need to be abandoned. The CSeries will offer economics comparable to the seat-mile costs of the larger neo and MAX models, with the lower aircraft mile costs that would be expected for a smaller aircraft. This will enable airlines to profitably serve smaller markets that otherwise would be abandoned given the economics of existing A319ceo and 737-700NG operations.

And following the CSeries, the slightly smaller re-engined EJets from Embraer will also join the market, with better economics than the smallest models from Boeing and Airbus. Is the market segment into which 2,500 airliners have been sold over the last two decades going away? Hardly. But many airlines like to wait and see that new airliners fly, and meet their economic targets before jumping on the bandwagon. Later this year, as the CSeries starts to fly, we'll find out whether that adage remains true, and if the forgotten segment of the order book begins to fill up once again.

No. 56, Feb. 19-20, 2013 Split decision on SPEEA contract vote

Members of Boeing's union, SPEEA—which represents engineers and technical workers—split on approving a new contract.

The engineers voted comfortably to approve the contract but the technical workers rejected it. Both groups authorized a strike, but the engineers' vote approving the contract makes a strike authorization vote for its group moot.

The engineers voted to authorize a strike as a show of solidarity and essentially as a contingency in case affirmative contract votes were out-voted, according to one union official.

The technical workers rejection of the contract and a strike authorization means Boeing and SPEEA must return to the bargaining table for these workers. Although a strike has been authorized, SPEEA executive director Ray Goforth was clear that he wants to return to the bargaining table rather than see the union immediately walk out.

The prime issue was the pension plan proposed by Boeing. The company had largely accepted SPEEA's other contract requests—essentially extending the previous contract for another four years—but drew the line at the pension provisions. The previous contract contained a defined pension plan; Boeing's Best and Final Offer proposed switching this to a defined contribution plan. SPEEA's executive council recommended contract rejection, saying this would be a 40% reduction over the life of new workers for whom the Boeing proposal would cover. Current employees would not see a change in the defined pension plan.

Tom McCarty, SPEEA president, told us that the big issue is the pension gap between the Boeing offer and the SPEEA position (there are related issues). We're willing to compromise," McCarty told us.

Goforth told us early in the evening as ballots were being sorted that if the contract is accepted, he still considers the tough bargaining stand a win.

The October contract proposed by Boeing was so bad, Goforth said, that the 96% rejection led to the contract voted on Feb. 19, laying the basis for a claim to a win.

A federal mediator will participate in the contract negotiations.

Boeing issued this statement:
Boeing and its negotiations team are pleased that professional engineers represented by the Society of Professional Engineering Employees in Aerospace (SPEEA) approved their contract tonight. However, the company is deeply disappointed that technical employees rejected the company's best-and-final offer and authorized a strike.

“Our goal throughout this entire process was to make sure SPEEA-represented employees were rewarded for the contributions they bring to this company every single day,” said Ray Conner, president and CEO, Boeing Commercial Airplanes. “We believe this offer leads the market in every way.”

“The realities of the market require us to make changes so we can invest in new products and keep winning in this competitive environment, which will allow us to continue to provide a solid future for our team. That’s why our proposal to move future hires to an enhanced 401(k)-style retirement plan is so important, as we have repeatedly emphasized over the course of these negotiations,” said Conner. “Now more than ever is the time to move forward together.”

No. 57, February 25, 2013 Engine Certification, Reveal & New Order – CSeries gains traction

February 20th saw three pieces of news emerge from Canada that demonstrates the increasing traction of the Bombardier CSeries program. The PW1500G engine for the CSeries gained Transport Canada certification, and it was announced that the airplane is to be revealed on March 7th. Topping off this excellent news day for the OEM, one customer converted their letter of intent into a firm order that was significantly larger.

Engine Certification

The CSeries is powered by the P&W PW1500G, more commonly known as the GTF, or geared turbofan. We have written significantly about this engine before, and while we will not address those issues again, we would like to point out that the engine has proven to be better than P&W initially hoped – performance and fuel economy numbers are quite strong - and its design concept is scalable. P&W has now publicly stated that it is planning a much larger engine that could be considered for the forthcoming Airbus A350.

Airbus has, since the beginning of the A350 program, sought a second engine. Airbus' preference has been for a solution from GE. Absent any interest from GE, which is tied to the success of the competing Boeing 777 and 787 programs, Airbus was open to P&W to compete with Rolls Royce, the current sole supplier. Two years ago, in an exclusive interview with AirInsight, Airbus' John Leahy made it clear that Airbus was open to a solution from P&W. P&W clearly got the message.

We believe the proposed A350 engine will be in the range of 80,000 pounds thrust. Rolls-Royce has exclusivity on the A350-1000 program – a situation that is similar to the GE90 on the Boeing 777. However, the A350-800 and -900 programs are not exclusive. What might happen to the A350-800, a model that has not attracted a great deal of attention, if a GTF were to be offered? If P&W engine could achieve substantially lower fuel burn, the A350-800 could suddenly become highly disruptive in the market and a worthy successor the A330.

The certification of the GTF demonstrates that the engine is ready to go, and because it is scalable, the models for A320neo, MRJ and MS-21 will also likely be on time. Moreover, initial tests indicate that it will meet its projected performance numbers right out of the box. P&W has encountered virtually no delays in its engine program, speaking volumes about the R&D work underlying the program.

The CSeries Reveal

Bombardier stated in an earning call on February 20th that it will reveal the CSeries airplane on March 7th at its Mirabel production facility. The program has suffered a few delays – but these were expected. High technology airplane programs, as shown by 787 and A350, simply do not run on the planned schedule. As the reveal takes place an obvious fact is transmitted – the airplane's first flight is imminent. First flight for the CSeries is currently scheduled for June, and so far, there seem to be no showstoppers emerging. We expect the CS to meet its deadline, probably flying before the A350. Airbus has not said so, but the decision to switch batteries will provide an excellent opportunity it to buy some time.

There is pressure mounting for both programs. Airbus wants to fly the A350 in time for the Paris show – an event that has always held historic significance. Bombardier is also contending with a great deal of pressure. With the CSeries expected to be flying its test profile towards certification, Bombardier (reasonably) expects more current Letters of Intent to convert to firm orders after first flight in the 3rd and 4th quarters. In addition, customers with a 'wait and see' attitude are likely to emerge at this time.

But the CSeries market segment, between 100-149 seats, has been lagging as of late. Despite a combined 3,042 orders between the neo and MAX, the comparably sized A319neo and 737-7MAX are not finding market success, with only 26 orders between them.

Aircraft Model	Number of Orders
A319 neo	26
737-7 Max	0
A320 and A321 neo	1,852
737-8 and -9 Max	1,164

Moreover, Airbus and Boeing have order backlogs stretching seven years into the future, more in some cases. But this does not mean there is a lack of interest in smaller airplanes. If this were to be the case, Embraer would not have decided to re-engine its E-Jets and increase their size. The reality is that the new generation airplanes from Bombardier and Embraer are lightweight and more efficient airliners than the shrunken Airbus or Boeing models. Bombardier gets first mover advantage over Embraer by at least three years. Airbus and Boeing have not been directly competing with the CSeries, instead selling larger, rather than similarly sized, aircraft that have more comparable seat-mile economics.

Ilyushin Order

The final piece of news from February 20th is perhaps the most important news of all. Ilyushin Finance announced it has converted its Letter of Intent into a firm order. But this conversion came with a nice upside. The Letter of Intent stated the lessor was looking at 10 orders and 10 options. The conversion of the Letter of Intent into a contract added 22 more airplanes to reach 32 firm orders with 10 options. This is a significant endorsement for an airplane that has yet to fly.

The Russian market has become important to Bombardier, which has seen their early CRJs finding a home replacing older Tupolev Tu-134 and Yakovlev Yak-40 aircraft, even as their economics are no longer viable in North America. This has been followed by success of the Q400, an airplane in direct competition with the tried, trusted, but aging Antonov models dating back to Soviet era. The older model Antonov

turboprops are outclassed by the Q400, which is also well suited for cold weather operations coming from Canada. Consequently the Russians have developed confidence in Bombardier.

Orders from leasing companies are a crucial bellwether for an OEM. Airlines tend to move airplanes in and out of their fleets more often than leasing firms. For a leasing firm, an asset has to perform exceptionally well to ensure there is a margin between cost to the lessor and price to the airline. An aircraft that is more efficient will generate the highest margins in the market. The CSeries, with an economic advantage over the A319neo and 737-7MAX, should hold its values quite well. We expect to see other lessors step forward to order the CSeries. Could we see a long-expected order from a Chinese lessor during the year of the snake?

The CSeries appears to finally be gaining momentum, and if first flight occurs in or before June, as we expect, the second half of the year should bring a renewed interest and buzz about the program.

No. 58, March 5, 2013 Ray Conner speaks to JP Morgan Conference

Biggest News is Battery Effect on 787-10 and 777X

Ray Conner, the CEO of Boeing Commercial Airplanes, spoke March 4 at the annual JP Morgan aerospace conference and began by talking about the topic on everybody's mind: the battery issues for the 787.

He said little that hadn't already entered the public domain. Our greatest take-away is acknowledging for the first time publicly that development of the 787-10 and 777X derivatives has slowed as a result of the battery issues.

We had heard this from airlines who previously had been briefed.

Conner said that "clearly with the fleet down," development of the derivatives had slowed. Authority to Offer (ATO) the 787-10 came last October. The formal launch of the program had been hoped for by many by the end of 2012, along with clarity and ATO for the 777X this year. The schedules had been sliding even before the 787 fleet was grounded by the battery issues. We were told by customers following the grounding, however, that launch of the two models was on hold during the grounding.

Conner did not venture a guess as to how long the 787 fleet will be grounded. He did say that once the Federal Aviation Administration approved the solutions, "things can move quickly" toward a certification process, re-certification and re-entry into service.

Boeing is already constructing the containment boxes into which the batteries would be placed as part of the solution to isolate any fire in the future. Boeing proposed this to the FAA February 22 as part of a 10-point plan to minimize fire risk and if one occurs to isolate it from spreading.

The FAA had not approved the plan when Boeing started construction, and still hasn't as of this writing. The question, then, is how can Boeing start building a solution that hasn't been approved?

Our analysis is that the Seattle area FAA technical office has been in constant contact with Boeing and the proposed solution will hardly come as a surprise to the FAA. We believe—but hasten to add that we do not know with certainty—that Boeing must have had some pretty good indication from the Seattle FAA office that the proposed solutions were reasonable before beginning construction of the containment boxes and before heading to Washington (DC) to present its plan to the FAA headquarters.

But this doesn't mean the solution is a lock.

The National Transportation Safety Board has yet to issue its preliminary findings, which are due any day now. We believe the FAA must review these findings before signing off on the Boeing plan. How long this will take is anyone's guess.

The Japanese authorities, as well as EASA, also have to approve. Typically, reciprocal certification is a formality—but given these special circumstances involving two of Japan's flag carriers, will it?

Lab and flight testing will also take some time.

And then there is the damage to the reputation of the 787. A survey by Travel Insider resulted in 32% of frequent fliers responding saying they would avoid flying the 787 for one or two years and another 35% said they preferred avoiding the airplane but weren't as firm as the first group.

We expected reluctance. It happened after the grounding of the McDonnell Douglas DC-10 in 1979 and after two Lockheed Electras lost wings in flight in 1959-1960. The damage to the brands was so great that American Airlines removed the name of the DC-10 from the fuselage and rebranded the aircraft "Luxury Liner." Some airlines started calling the Electra merely "Prop-Jet" in timetables and the plane was essentially renamed "Electra II" after fixes occurred.

Boeing's brand generally and that of the 787 specifically has been badly damaged. Will each survive? Of course. But rebuilding the reputation of each will take a long time.

No. 59, March 12, 2013 The CSeries – Tougher Competition for Airbus and Boeing

Bombardier revealed the CSeries aircraft last week at its new production facility at Mirabel airport, north of Montreal. During the reveal, the company confirmed what had been an open secret since the Farnborough Air Show: there will be a 160-seat version of the CS300.

In confirming the CS300ECS, Bombardier also revealed the airplane has been lengthened slightly to make the baseline seating 135 rather than 130. This further improves the comparative economics against the A319ceo/neo and 737-700/7MAX.

Named the Extra Capacity Seating (ECS) option, Bombardier said the new, efficient airliner now has the same seat-mile costs as a re-engined 180-seat aircraft from the big two OEMs, but provides the right-sized airplane for markets that don't need the greater capacity.

News media immediately said Bombardier is now competing with Airbus and Boeing head on. This is true. The CSeries has been aiming to take on the two mega-OEMs from the get-go, albeit in the narrower 100-149 seats market segment. The CS100 competes against the Airbus A318 and Boeing 737-600 class (the latter finally discontinued by Boeing). The larger CS300 competes with the 737-700/7 MAX and the A319ceo/neo.

Bombardier has held its ground in this competition, as Airbus and Boeing are having difficulty selling their re-engined models in the 100-149 seat class. Of the 3,042 orders for neo and MAX, only 26 are for the A319neo, and Boeing has yet to sell any 737-7MAX. Due to the superior operating economics of the CSeries, Airbus and Boeing are being forced to utilize larger aircraft to more effectively compete in the marketplace.

As a result, some analysts and media have mismatched the competition by comparing the 110-135 seat CSeries, when configured comparably, with the 150-seat Airbus A320, the 190 seat A321, the 162-seat

Boeing 737-800 and the 189-seat 737-900ER. The competitors from Boeing and Airbus are in a different market segment, making this an “apples to oranges” comparison.

The 162-seat 737-800/8 is a dual first-and-coach class configuration, as is the 150 seat A320ceo/neo. The 160-seat CS300ECS is an all-coach configuration at the tightest seat pitch, using new slim-line seats that give the equivalent of 29.5 inch legroom. If the comparable Boeing were configured in the same pitch, it would contain 189 seats, and the A320 would contain 180 seats.

Bombardier claims that the CS300ECS will have the same, or better, seat-mile costs than its larger re-engined competitors. That assertion is based on better projected fuel efficiency and lower projected maintenance costs, and the CSeries' substantially lower weight, which reduces fuel burn, as well as weight-related landing fees and other related costs. As Airbus itself once said in comparing the A330-300 against the heavier 777-200ER, “physics is physics”, explaining how lower weight contributes to better economics. What’s true for Airbus will also be true for Bombardier.

At the Airbus annual press conference in January, we spoke with an Airbus salesman who told us the extra revenue from the larger A320 gives it a potential advantage over the CSeries. This is true, but only if an airline can fill the airplane with paying passengers. However, if an airline doesn’t need that capacity, all other things being equal, why would they fly around a lot of dead weight or empty seats?

This is precisely the debate going on today between potential customers of the forthcoming Boeing 777X who don’t want the Emirates Airlines version that needs the “last 5%” of capability to perform on long-range routes that nobody else will be flying.

Media and analysts continue to fret over the slow sales of the CSeries. There are a number of reasons for this:

- First, Airbus and Boeing have “poisoned the well” with massive program delays on A380 and 787, resulting in a major “show me” in correlation to Bombardier’s effort—which is now experiencing its own six month delay. Last week’s reveal was the first major indication that the aircraft is more than a “paper aircraft”. If CSeries makes its first flight in June, as Bombardier now promises, this will further satisfy those “show me” customers. Flight test milestones and data secured from these tests will provide additional “show me” moments demonstrating that the promised fuel economy and performance estimates are confirmed in-flight.
- Second, there is skepticism about Bombardier throwing its hat into the ring against Airbus and Boeing. This is understandable, particularly because of several airlines' experience with Embraer when it joined the major airline market with its EJets, and failed to deliver “world class” support. While Bombardier is aware of history and has made appropriate plans, additional “show me” moments will be required in this regard.
- A third factor to consider is negative public relations campaigns undertaken by Airbus and Boeing to denigrate both the CSeries and the market segment in which it competes. Airbus was first off the mark in May 2010 when it’s officials claimed there was no business case for the CSeries, particularly with the forthcoming A320neo option. This has been a repeated refrain, but it rings hollow with some market facts to consider.

We know that Airbus has been engaged in very aggressive pricing for the A320ceo in campaigns against Bombardier. Airbus, we have learned, is offering the A320 at prices Bombardier is unable to match for the CS300. Airbus also uses this tactic when selling the A330 against the Boeing 787: lower the capital costs enough to offset the economic efficiencies of the newer technology airplane. Pricing to the point of economic indifference is an art form Airbus has perfected.

However, if there were no business case for the CSeries, Airbus wouldn't be compelled to drop the price so dramatically on the A320. Recall that Airbus' John Leahy said at aforementioned May 2010 event that Airbus would not make the same mistake with Bombardier that Boeing did with Airbus, which was to ignore the threat. No other statements demonstrate so clearly the viability of the business case and threat that the CSeries presents.

Randy Tinseth, Boeing VP Marketing, dismisses the CSeries by saying the "market" has moved away from the 100-149 seat sector, which sales from Airbus and Boeing show to be true. We take a different view.

The market has moved away from the Airbus and Boeing products in this sector because they are no longer economically viable. The Big Two OEMs still identify a market requirement over the next 20 years of between 4,500-5,300 aircraft in this sector. (Bombardier forecasts around 6,500, a figure we think is high). These forecasts, even by competitors, indicate a large potential market for CSeries. Note that Airbus forecasts a requirement for only 1,300 Very Large Aircraft and that Boeing forecasts a need for about 2,700 aircraft in the 787-8 size category. The segment the CSeries competes in will remain robust, with more aircraft required than those two segments combined.

Meanwhile, Embraer is re-engining its E-Jet and, and according to industry sources, adding eight seats, to make the airplane more directly competitive with the CSeries.

The bottom line: It's becoming clear that Airbus and Boeing have essentially withdrawn from the 100-149 seat sector, and are now focusing on larger aircraft. Embraer and Bombardier are the new big dogs in the 100 to 149 seat range, and Bombardier will have a significant advantage with the first all new technology aircraft in this sector in more than 20 years. The 160 seat high capacity version provides an offering that will enable CSeries to better address the needs of low cost carriers and further extend its market footprint.

No. 60, March 19, 2013 Airbus, Boeing Single Aisle Battle Intensifies

The battle between Airbus and Boeing is especially intense in the single-aisle market, for which more than new 20,000 aircraft are required over the next 20 years.

In the 100-210 seat market, examining the Big Two OEMs only, Airbus currently has roughly a 60% market share of the backlog for the A320ceo/neo. Boeing's 737NG and 737 MAX has the rest. (China's COMAC C919, Russia's Irkut MS-21 and Bombardier's CSeries, for purposes of this exercise, are excluded.)

Airbus scored a coup Monday when it announced the long-expected order for more than 200 ceos and neos from LionAir, up to now an exclusive Boeing customer. This follows inroads into former exclusive Boeing customers, notably Norwegian Air Shuttle and American Airlines, each for large numbers. Boeing, to be sure, sold the 737 MAX to each of these carriers, but losing exclusivity is a blow to the Boeing prestige.

Boeing scored today with a large order for 737NGs from Ryanair, an exclusive Boeing customer. The quantity--174--is impressive but the cantankerous CEO of Ryanair, Michael O'Leary, wasn't expected to do anything else. Although he publicly flirted with COMAC, nobody (including Boeing) took his tease seriously. Airbus won't deal with him, having been played for a stalking horse in the past. That left Boeing. While all that truly counts is the revenue and backlog, Boeing would dearly like to pick off an Airbus customer (see below).

But O'Leary by-passed the 737 MAX. Vocal in his disdain for the MAX as not efficient enough, O'Leary prefers cheap prices to premium ones that accompany the MAX. That MAX continues to trail NEO by substantial numbers rankles. Boeing officials push the story that the MAX is more efficient and costs less than the NEO, which Airbus charges to be outright lies (see Pinocchio), but the numbers that matter most are the sales figures, and for this Airbus is the clear winner.

Boeing's argues that its 737 is 8% more efficient on a per seat basis than the A320, and it doesn't matter whether it is the NG vs the ceo or the MAX vs the NEO. The key difference, of course, is that the 737-800/8 nominally carriers 12 more passengers in two classes than the Airbus. Airbus argues that the delta is closer--about seven seats--but we think Boeing has the stronger point on this metric.

Airbus and Boeing, and Pratt & Whitney and CFM, engage in a war of words over the fan diameter of the NEO vs the MAX. Airbus and PW say the larger fan on the PW Geared Turbo Fan is more efficient than the somewhat smaller CFM on the NEO and the sharply smaller fan on the MAX. Boeing and CFM say the CFM LEAP-1B is optimized for the MAX and will produce equal, improved fuel consumption to the GTF. (Noticeably absent from the debate is CFM's comparison of the NEO LEAP to the NEO GTF or the MAX LEAP. Airbus says the GTF is about 1.5% more fuel efficient than the NEO LEAP.)

For all the manufacturer rhetoric, customers tell us the A320ceo and 737-800 are within two percent of each other on operating costs, in favor of the -800; the 737-900ER is better than the A321ceo and the A319ceo is better than the 737-700. For the re-engined models, nobody pays attention to the A319neo or 737-7; the RE MAX and NEO maintain the status quo; and the A321neo is better than the 9 MAX.

Boeing hopes to flip easyJet, once a Boeing customer but in recent years exclusively Airbus. easyJet says if Boeing is sporty enough on pricing, it can win the current competition. We hear Boeing may well be sporty enough. Whether Airbus will be sportier remains to be seen.

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No. 61, March 26, 2013 Cyber-Security and Aviation

Cyber-security has been in the news lately with the recent cyber-attack on South Korea, thought to be the work of the North Koreans. This follows issues in the US pointing fingers at the Chinese PLA Unit 61398. Before these news items there was a lot of coverage about Stuxnet, and cyber-attacks date back to 2007.

Cyber-attacks are attracting more attention because they demonstrate how vulnerable everyone is. The South Korean economy is sophisticated. Whereas about 28% of Asia's population has Internet access, about 83% of South Korea's population has Internet access. This means that South Korea is vulnerable to a cyber-attack - undoubtedly much more so than North Korea. Consequently we should be expecting much more news about cyber-attacks because it is a weapon offering massive damage on a very small budget.

Cyber security is something aviation needs to constantly think about. The next generation of aircraft is increasingly reliant on becoming e-Enabled. New aircraft are connected via secure IP communication allowing digital traffic to and from the aircraft. Providing an aircraft with IT network access seems an irresistible attraction. Currently the A380 and 787 are the only e-Enabled commercial aircraft, while the coming CSeries and A350 are also adopting this feature. Even the 737MAX and A320neo will be more e-Enabled than their predecessors. This means that when an airplane is deemed "airworthy" it will also be required to pass an IT test. Despite intensive testing we have seen cyber-attacks linked to terrestrial networks, reinforcing the fact that every network is only as strong as its weakest link.

To get an idea of the complexities of the e-Enablement of an airplane is, take a look at this link from Boeing detailing the 787. Of course airlines require real-time or near real-time data from their aircraft. This means they will have the ability to monitor systems on board and improve predictable MRO activity. They can send updated weather information to the crew and flight deck to optimize tailwinds or reduce the impact of headwinds, moves that will directly lower fuel burn and reduce flight times. These features alone present significant benefits. There are also benefits from other less attention grabbing issues like e-commerce; enabling the clearing of credit card transactions instantaneously, allowing an airline to reduce risks of credit card fraud. This is a not insignificant issue for long haul airlines.

Among the world's airlines, there is an item that could impact aviation security even outside the e-Enabled airplane. As you will have noticed in the link to the 787 article, there is an item known as Electronic Flight Bag (EFB). The A380 and 787 have the EFB built in, but there are literally thousands of EFBs in service using mobile devices. In North America it is estimated that 30,000 pilots are flying with mobile EFBs, typically these EFBs are on laptops or tablets (like iPad).

The EFB is a series of software tools that allow pilots to automate tasks such as weight and balance, along with allowing pilots to track routes with weather overlays. The main benefit of an EFB is to lessen the burden on pilots, who currently carry a 40 pound briefcase filled with charts and other paperwork, by allowing all of the data featured in the paperwork to be operable on an iPad. Having two pilots carrying an IPad each and not carrying 80 pounds of paperwork on board could potentially save an airline a lot of money. Take a look at this Alaska Airlines EFB briefing. The transition from 80 pounds of paper to tablet EFBs is thought to have saved up to 325,000 gallons of fuel per year. This is serious money.

Pilots carrying tablets with EFB apps also run the risk of their devices being compromised. This could happen when pilots go online to download emails or from web browsing. The airline industry is aware of the challenges. Leading airline industry cyber-security consultancy AvIntel has been tracking EFBs for the past four years. Their fourth annual EFB Report is on the verge of being published. In a prequel of their report being published they shared that over 80% of the airlines surveyed reported they have an active EFB program, but 40% of these airlines do not have an active EFB cyber-security plan.

Consequently we see that the next generation of aircraft needs to be made secure from cyber-attacks, but airlines also need to ensure the current generation of EFBs is made secure. Ubiquitous connectivity for EFBs means these devices are "sniffing" for signals wherever they are. The Aircraft Electronics Association has taken a look at this issue. The various firms providing software apps for EFBs are aware of this security issue. It is not the aviation side of the industry one needs to worry about. It's the other side, especially for pilots who carry tablets like the iPad. Pilots who go online in hotels or other public places to download information for their EFBs prior to heading to the airport could (potentially) be exposed to malware. Emails are the typical source of how a device gets infected and if these tablets are used for personal emails, the devices can be compromised.

Some airlines have a policy that tablet EFBs are unable to download anything but airline data. As one can imagine this does not sit well with their pilots, who would be required to carry an additional digital item for their personal use. Airlines that do not provide their pilots with tablets are no safer. Because their pilots are buying these devices for personal use, the downloaded EFB apps could be exposed to malware already on the system. This creates something of a "wild west" with EFB technology. There clearly are cases where pilots are using personal tablets as EFBs regardless of airline policies.

This week's newsletter is not to scare readers. But it is important that the issue of cyber-security continues to be highlighted. There have yet to be any security compromises due to an EFB being "infected" that we are aware of. The only known issue has been flight delays due to inoperative EFBs. The growing e-Enablement of aircraft is an issue that needs to attract more attention. If terrestrial networks are so easily compromised, the aviation industry needs to pay close attention to aircraft that have network connectivity.

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No. 62, April 2, 2013 Droning on with UAVs

The use of drones by US non-military organizations has become a target of those opposed to these vehicles. The opposition has some well-grounded issues but the hyperbole is simply droning on.

For starters, the fear that users of Unmanned Aerial Vehicles (UAVs), the proper name for the miniature airplanes and helicopters, will target and kill Americans on American soil is a bit paranoid. The use of UAVs in combat and to target terrorists (whether foreigners or Americans) who aim to kill Americans by whatever means they can and as many as they can, are clearly combat situations. When Presidents Bush and Obama use combat tactics to protect Americans, we have little concern about the use of UAVs.

But UAVs in domestic use are an entirely different matter and one where critics are a bit off the mark.

First, remember that UAVs ultimately are still flown by humans; these aren't robots. The Pentagon lawyers spent a lot of time crafting legal guidelines (we're not kidding) for the use of UAVs in combat. Certainly civilian law enforcement needs to have guidelines as well. Police agencies, border patrol and other government agencies must balance civil rights with legitimate law enforcement uses. But they have to do this anyway. Helicopters and small airplanes have been used by police agencies for decades. Border patrols also use these, and even blimps. We see little difference between UAVs and these long-used manned aerial vehicles, except the former are stealthier than the latter. They are also a lot less costly.

Stealth is one of the reasons critics object to UAVs. Helicopters are noisy and so are planes. Small UAVs are quieter. Therein lies the problem, according to critics. Police agencies can overfly your house and "intrude" without you knowing it.

True enough, but when a helicopter or airplane flies overhead—even when we hear it—there is nothing to stop the occupants from peering down into backyards.

This is where we have issues with the critics. "Plain view" is a well-established legal principal and plain view is plain view whether from a helicopter, airplane or UAV.

UAVs are far less costly to acquire and operate than are airplanes or helicopters. In today's era of tight budgets, this provides law enforcement with a major advantage. Monitoring borders would be easier and more frequent with UAVs.

During the hostage situation in Atlanta a few weeks ago, police used UAVs to maintain surveillance of the bunker where a man held a young child hostage for days. The stealth of the UAV vs a noisy helicopter gave law enforcement an advantage.

But there is also logical use for UAVs in the hands of private enterprise. Crop, power line, gas pipeline and other industrial inspections can be carried out more frequently and cheaper. The famed trans-Alaska pipeline requires regular inspection, and it's done by helicopter. UAVs equipped with cameras could do this monitoring.

UAVs can be used for disaster and environmental inspections.

There are honest concerns about the use of UAVs by non-military agencies and in commercial hands. There is, of course, the required coordination with Air Traffic Management. There are legitimate privacy and warrantless search issues. There are national security issues (bad guys using UAVs to spread terror). We could even foresee criminals using UAVs to monitor police movements.

We believe workable, middle-ground solutions can be reached. But we believe more benefit can come from allowing domestic use of UAVs than downside.

No. 63, April 9. 2013 IS BOEING BACK ON THE FAIRWAY WITH THE 787?

The good news last Friday was that Boeing successfully completed its test flight protocols for the revised battery system on the 787. The company will send data to the FAA for certification of the modifications and removal of the Airworthiness Directive restricting flight operations for aircraft once the modified system is installed.

Now it is up to the regulatory authorities to review the data generated in the test of the new system, evaluate it, and either approve or not approve the proposed modifications. Boeing's battery system modifications include insertion of additional protective materials between battery cells to better protect against thermal runaway, a stronger case to house the battery that is sealed to ensure any smoke or flammable fluids that might leak from a battery are fully contained, a tube to vent any effluent outside the aircraft, as well as modification to both the battery charging system and regulation of the current used to recharge the batteries at a lower level than the initial design.

Complicating the matter is the relationship between the National Transportation Safety Board, an investigative body independent of the FAA. The NTSB has the authority to make recommendations. The FAA and aircraft manufacturers are not required to follow NTSB recommendation, but normally are when causal factors are found for accidents. While the relationships of the NTSB and FAA have different objectives, both focus strongly on safety: the former from the perspective of "what happened and how can we fix it," and the latter from a regulatory perspective, "here's what you must do."

While not directly involved in the regulatory process, the NTSB carries considerable weight, and it would be impolitic for the FAA to take action prior to the NTSB reports.

The question for the 787 is whether the NTSB will agree that the Boeing solution is a viable long-term fix, or whether It will indicate the continued use of lithium-ion batteries, which have proven more volatile than nickel-cadmium or lead-acid batteries, provides an inappropriate level of risk when used aboard aircraft. The NTSB also has the unique perspective that has resulted from investigation of other incidents involving lithium-ion batteries, including the crash of a cargo aircraft carrying a cargo of lithium-ion batteries. The NTSB will be holding two sets of hearings this month.

First on the schedule is a forum on lithium-ion batteries on April 11 and 12 that will focus on "failure modes and other performance issues" associated with them. This forum will also examine carrying such batteries as cargo in the wake of the September 2010 UPS 747-400 crash and the July 2011 crash of an Asiana Airlines 747-400, both of which were carrying batteries as cargo.

Following that, the NTSB will hold investigative hearings on April 23 and 24 regarding its examination of the 787 fire at Boston Logan airport, focusing on both the system itself and the certification process. The FAA has been under political fire for having approved such a volatile battery system, and could be further criticized if it jumps the gun to approve the Boeing solution prior to the end of the hearings later this month. We do not expect the FAA to come to a decision on certification before that date, particularly since a portion of the NTSB efforts include a review of the initial FAA certification process for the batteries.

Assuming all goes well for Boeing, is the 787 out of the woods and back on the fairway? The answer is maybe. United Airlines yesterday quietly added the 787 to the schedule from May 31 in anticipation FAA approval and Boeing installation of the revisions.

But there are other issues as well. Our intelligence sources indicate that a large number of service bulletins for the aircraft are underway at Boeing, as a significant number of components are refined and replaced throughout the aircraft. Several sources we have spoken to indicate that some subcontractors may not have initially utilized as robust quality standards as Boeing in checking parts, and that Boeing's quality control processes, examining these parts retrospectively, is determining that replacement is necessary. That process is continuing, and we know of a specific instance in which a component was actually certified with materials that, inadvertently, deviated from specification, and were not appropriately tested for durability. The first production run of these components is being swapped out with units with the correct materials and extended reliability.

The introduction into service of a new aircraft is always fraught with difficulties. We remember Pan Am trying to hide its 747s that couldn't fly from reporters in the early 1970s when engine problems emerged during the initial month of service. So difficulties aren't new. But in this case, it appears that Boeing's outsourcing has resulted in a quality process that, unfortunately, is catching problems later in the game than usual, as their suppliers failed to fully implement Boeing processes. While we don't expect any show-stoppers, we do expect niggling problems with the 787 for another six months or while issues that should have been dealt with early on are sorted out.

It is quite unusual for aircraft number 103 to be the first production unit to meet specifications. While every airplane changes over its life, typically by the 50th unit, design and production elements are quite stable. The L-1011 "lead sleds" and A300 lap joint issues were all resolved well before 100 units were built. Outsourcing requires excellent communication up and down the supply chain, but when at atmosphere of "kill the messenger" exists internally, people tend to tighten up and not communicate effectively. The Boeing culture is partially to blame for the nagging reliability problems, high number of service bulletins, and unusual number of early airplanes that deviate from the final design.

Were we buying a new 787, we would defer our deliveries until after unit 150, just to be certain that we receive an airplane that has all the bugs "shaken out."

No. 64, April 16, 2013 Carving out a niche within a niche

The news last week that Canada's Porter Airlines selected the Bombardier CS100 for service at Toronto City Centre Airport is the third in niche orders under similar circumstances.

Bombardier previously received orders for the CS100 for service at London City Airport and Malmo Airport in Sweden. All three airports are highly constrained, either by physical characteristics or noise considerations or both. Toronto City not only has to have runway expansion, but also changes to political agreements, which in the end may prove to be more challenging than the airport itself.

The CSeries, with orders and commitments now approaching 400, still is short of hopes and expectations of the market place in firm orders, with 148. The Porter order is conditional on airport runway and political changes, so we view this as, well, conditional. A large order from Russia's Ilyushin Finance, which would have taken the firm order count to 180, still is awaiting final approval from the lessor's board. Still, evidence is becoming stronger that Bombardier is carving out a niche (small, difficult airports) within the large niche of the 100-149 seat market sector in which it is also participating.

Bombardier continues to come under criticism for not having a similar number of runaway orders such as the A320neo family or the growing backlog of the Boeing 737 MAX family. As we've written before, we believe such comparisons are unfair. The A320neo, A321neo, 737-8 and 737-9 are in entirely different sectors: 150-210. Bombardier hasn't competed in this segment until only last month when it formally acknowledged creation of the high-density, 160-seat CS300 Extra Capacity Seating model. (Even this is less seating, however, than the high density versions of the A320/737-800/8 models).

By all appearances, Boeing seems to have forsaken the 100-149 seat market. It hasn't sold a 737-700 since 2011 and there isn't a single sale of the 737-7 to date. Airbus, which fiercely is trying to block any CSeries sales with steep price discounts for the A320ceo, has sold 45 A319neos—the CS300 competitor—and more recently, it was revealed by Pratt & Whitney that half of the order for 130 Airbus single-aisle airplanes from American Airlines will be for the A319ceo.

Critics forget that Bombardier created the regional jet market with the CRJ. Critics also forget that Embraer has successfully offer the E-190 and E-195 with 100 to 122 seats in single class density, and the planned re-engined versions (EIS of 2018) will increase capacity by eight passengers. This puts these E-Jets squarely in the 100-149 seat sector. The CSeries, however, is new technology to Embraer's blend of old-and-new.

Nature—and business-abhors a vacuum and Bombardier and Embraer see a vacuum being created by Boeing and to a lesser extent Airbus. Compared with the E-Jet and E-Jet re-engine, the CSeries offers more passengers, greater amenities, newer technology and greater range and performance.

The question remains: will sales begin to pick up after the CSeries' first flight in June? The aviation industry, burned by new airplane program delays at Airbus and Boeing, is understandably in a show-me mood. So we shall have to wait and see.

No. 65, April 22, 2013 Boeing 777X EIS keyed to engine development

Engine development progress is a key driver to the entry-into-service timeline for Boeing's proposed 777X Family.

Boeing hasn't said much about EIS publicly but it has been telling customers' plans call for a 2019 timeline. We understand this is late 2019. A public presentation by a GE Aviation official gives the clearest indication yet of the timelines.

The GE9X will be the sole-source engine for the three 777X models: the 777-9X, with the 2019 EIS; and the 777-8X "standard" and the 7778LX long range models that follow by about 20 months. The 9X will be an entirely new category airplane, for which Airbus will not have a competitor. It's envisioned as a 406 passenger aircraft, which slates it just inside the Very Large Aircraft transport category (more than 400 seats) now occupied by the 747-8i (nominally 467 seats) and the A380 (525 seats).

With engine certification listed by GE as 2018, aircraft certification typically follows by about a year.

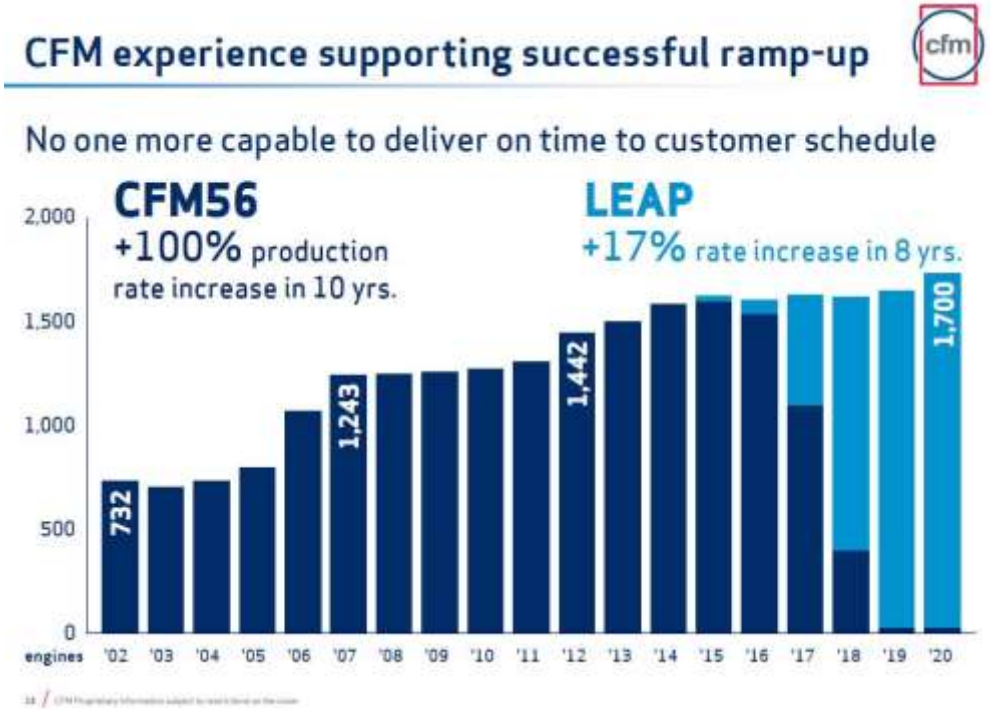
The 777-8X is conceived as a 350 passenger aircraft, directly competing with the Airbus A350-1000. The 8X is slightly smaller than the 365-passenger 777-300ER, and in previous customer conferences didn't meet with much enthusiasm. But there will be long routes that won't support the much larger 9X, and Boeing needs a competitor to the 1000, which in Boeing's own analysis acknowledges will have about 20% better trip costs than the -300ER. (Airbus claims 25%.)

The 777-8LX will be the replacement for the 777-200LR and will meet the requirements of Emirates Airlines, which seeks a plane capable of going from Dubai to Los Angeles non-stop with a full payload--something no airplane today can do.

Press reports last week quoted Emirates president Tim Clark as saying he needs some more information before gearing up to order the aircraft. Emirates is widely considered to be a key launch customer for the 777X; he's previously indicated he would place a launch order for 100. There is a customer meeting this week--on April 24--to discuss the latest on the X. The Board Board of Directors is widely believed ready to grant Authority to Offer the aircraft next week--the annual meeting is the 29th. A "soft" ATO has been in effect for some time, with Boeing's sales force making an effort to line up commitments for the plane.

It's unclear whether there will be any specific announcement at the Paris Air Show in connection with the 777X. But we fully expect orders or commitments to be announced this year that will amount to several hundred.

Separately: CFM also presented at ISTAT. The following slide caught our attention:



Note the second slide, above, does not list the LEAP-1C, the model that is for the COMAC C919. The slide immediately above shows a small number of LEAPs entering service in 2015. These must be for the Airbus A320neo, though our information has long been that the LEAP Neo would not enter service until 2016. COMAC intended that the C919 enter service in 2016, but nobody in industry believed the goal was achievable. The absence of the LEAP 1C from the second chart is intriguing.

The 737 MAX, which is exclusively powered by the LEAP (the -1B version), has a planned EIS of 2017. The slide immediately above also gives a clear indication about the wind-down of the CFM56 program as the A320neo and 737NGs exit service and only spare engines are produced.

No. 66, April 30, 2013 The Coming Bubble in Narrow-Body Aircraft

Airlines and aircraft manufacturers periodically get into trouble when they over-commit to new aircraft and the OEMs raise production rates to levels that are unsustainable. We believe that another bubble situation is currently developing, and will result in an oversupply of narrow-body aircraft, lower residual values, earlier retirements of current generation aircraft, and will negatively impact the leasing market.

The old rule of thumb was that airlines ordered airplanes in good times they often took delivery when things turned down. Fortunately times have changed, both groups have gone to great lengths to try and smooth out peaks and valleys. The speculation on delivery positions that once occurred overtly has become much more subtle - but still exists. An example of this is Lion Air, which has more aircraft on order than currently operated by all airlines in Indonesia.

Today the backlog for aircraft over 100 seats is quite robust. As of the end of last year, firm backlog for more than 7,600 aircraft was in place from the six manufacturers, as shown below:

Narrow-Body Aircraft Backlog	
as of 12/31/2012	
Aircraft	***Number***
A318	3
A319	169
A320	2,902
A321	555
737-700	237
737-800	1,402
737-900	371
737MAX	1,064
CSeries	148
E190	109
E195	31
C919	380
MS-21	241
TOTAL	7,612

In their 2012 Commercial Market Outlook, Boeing indicated that 12,610 single aisle aircraft were in service at the end of 2011. If one were to assume an average 25 year lifespan for these aircraft, replacement would require production of 504 aircraft per year.

Production rates for these aircraft are also quite robust, and growing. Airbus and Boeing have each raised their production rates for narrow-body aircraft to 42 per month from 38. Bombardier plans to produce 10 CSeries per month, and Embraer has the capacity for 17 EJets per month, with the majority of the re-engined models likely to be larger E190 and E195 models. COMAC and Irkut will be entering the market

with the C919 and MS-21 respectively by the end of the decade, and likely to produce at least five per month, and possibly more, for each model, as shown in the following table.

Projected Narrow-Body Production Rates		
# of Aircraft	per month	annually
Airbus	42	462
Boeing	42	504
Bombardier	10	120
Embraer	17	204
COMAC	5	60
IRKUT	5	60
TOTAL	*121*	*1,410*

If we look towards 2018, when all of the new models are in production, we can expect a total production of 121 aircraft per month. Discounting a one month halt in production at Airbus, for the summer holiday, this would still total 1,410 narrow-body aircraft annually.

Airbus and Boeing, in their most recent Global Market Forecast and Commercial Market Outlook, show demand for narrow-body aircraft over the next 20 years at 19,518 and 23,240 units, respectively. But if the world's airframers will be producing 1,410 per year, or roughly 28,000 aircraft over this period, assuming no further growth from today's plans, a significant overcapacity gap emerges.

That gap, unless production rates are curtailed, would result in a major supply-demand imbalance; marking an additional 43% excess supply over Airbus forecast, and a 20% excess supply over the Boeing forecast. Of course, these forecasts don't account for dramatic unanticipated events, as seen with the post 9/11 period or even the recent recession that has dampened traffic growth. What happens if we are faced with another event that causes growth to be curtailed? With current demand dropping back closer to replacement levels, even if only for a temporary period of a year or two, the pending bubble would only be exacerbated.

Why is the industry increasing production to unsustainable levels? For Airbus and Boeing, it is to try and tie up as much business as possible without giving the new entrants a foothold. Airbus and Boeing have generally conceded the 100 to 140 seat market to Bombardier and Embraer, and the marketplace agrees. Customers have not ordered the re-engined A319neo (only 26 orders to date) and 737-7 MAX (zero orders to date) in favor of larger aircraft from the Big Two, or the more cost-effective new technology models from the upstarts. Airbus and Boeing are now focusing their competition on larger narrow bodies, and also don't want the C919 and MS-21, which are similar in size to their best-selling models, to become successful. As a result, they are trying to tie up airlines both in China and Russia with new aircraft to reduce the potential impact and success of these new models.

At the same time, Bombardier, Embraer, COMAC and Irkut are trying to compete against a duopoly that is able to deeply discount their aircraft at will, in an attempt to price them out of the market on competitive deals. Bombardier has been a particular target of Airbus, who indicated they wouldn't make the same mistake that Boeing did when it ignored a fledgling Airbus, and have been quite aggressive in campaigns against the CSeries.

But superior technology will prevail, and the four new technology airplanes will be more efficient than offerings from the Big 2., Each will be using the same engine technology as the Big Two, but with more modern airframes, materials and designs, and will therefore have lower operating costs than the re-engined compromise neo and MAX solutions emerging from Airbus and Boeing.

The Bottom Line

This doesn't bode well for Airbus and Boeing being able to maintain their production rates at current levels over the longer term, unless they take lower margins and compete on pricing. That won't make Boeing shareholders happy, although it might be acceptable in Europe as jobs will be maintained.

If the market demand is really in the ballpark of 21,379 aircraft, the average of the Boeing and Airbus forecasts, and the new entrants produce at modest rates, how much will Boeing and Airbus need to reduce their production to balance supply and demand? If you do the math, the answer is right around 30 aircraft per month, a significant reduction from today's 42 aircraft per month.

A difference of 12 aircraft per month for each firm is quite significant. Having that many excess aircraft in the marketplace on an annual basis will have a deleterious impact on pricing, residuals, and the ability to recover purchase prices in lease contracts. The handwriting is on the wall, and it has been written by forecasters at Boeing and Airbus. Let's hope the other parts of their organizations pay attention, before the bubble bursts.

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No. 67, May 7, 2013 Should Boeing Bother to Build the 737-7 MAX?

One of the most interesting data points emerging in the industry this year is that despite 1,235 orders for the 737 MAX, none - zero - are for the -7MAX. The latest data show the following breakdown of orders by model:

Model	Firm Orders
737-7 MAX	0
737-8 MAX	1,081
737-9 MAX	154

The goose-egg for the 737-7 MAX really stands out, as by this point in the development of the program, at least one of the 22 customers would have been expected to order that variant--notably Southwest Airlines, which has by-passed it in favor of the 737-8. (Southwest does have the option to select the -7 or the -8.) It appears quite clear that the market has clearly rejected the smallest proposed size in the new Boeing line-up.

Let's examine the reasons why.

The first reason is seat-mile economics. The 737-7MAX has a net gain of about 4% in direct operating costs versus its predecessor, the 737-700NG. This results from a 13% net improvement in fuel efficiency, which represents between 33%-40% of operating costs for most carriers, resulting in an improvement in the 4-5% range, less likely increases in maintenance costs with the new model. Of course, a net 4% improvement in an industry that is a perishable commodity, with very tight margins, is quite meaningful.

But in planning for the future, most operators of the -700 are looking at potential traffic growth, as well as improvement in seat mile economics. Replacing a 137 seat aircraft with one seating 162 provides a gain of 18% in seats, and a corresponding improvement in seat-mile costs. Add the 4% to that, and the improvement is now quite meaningful, assuming that you can fill the airplane.

In the US, market discipline among the major carriers has resulted in averaging load factors nearing 85%, and one way to maintain discipline is to add capacity through additional seats rather than through additional frequencies.

The second, and perhaps more important reason, is new technology competition. The Bombardier CSeries, in particular the CS300, falls right into the competitive sweet spot of the 737-7 MAX. But, unlike the MAX, which is the smallest of a series optimized around the larger 737-8, the CSeries is a lighter aircraft, optimized for its size category. As a result, the new technology airframe, along with new technology engines, composite wings, and advanced systems, result in a lighter aircraft with lower maintenance costs. Bombardier projects a cash operating cost improvement over existing models in the range of 15%, not 4%. This is derived from new technology engines with 15% lower fuel burn, as well as new materials, including a composite wing and aluminum-lithium fuselage, and lower maintenance cost from components designed specifically for easy maintenance and longer life.

This double-digit advantage is cost reduction enables the CSeries, with all new technology, to outperform the re-engined 737-7 MAX and A319neo models that have new engines on older airframes. The A319 neo isn't selling well, either, accumulating only 45 orders of a total of 2,125 for all neo series.

Is Past Prologue?

Neither Boeing nor Airbus had much success with the previous versions of their smallest models, the 737-600 and A318, as their economics simply weren't competitive with the similarly sized E-190 and E-195 from Embraer. History is about to repeat itself with the 737-7MAX and A319neo against the CSeries.

To mitigate the 11% economic advantage, Boeing and Airbus are pushing airlines to take their larger models, which have similar seat-mile economics, although significantly higher aircraft-mile economics. The key for an airline, however, is generating enough traffic to fill those aircraft. Not all routes will grow to the size capable of taking a 737-800 or A320.

A recent study for a major US airline that operates 737-700 models indicated that several routes that were recently dropped as unprofitable could be successfully operated with the new technology CSeries and contribute to the bottom line.

Boeing and Airbus are obviously having difficult competing with the CSeries with their new technology aircraft in the same size class, and are competing with larger models on the basis of seat-mile economics. But more than half the routes in North America today are operated with aircraft with fewer than 140 seats. The opportunity for Bombardier and Embraer is real, and Boeing and Airbus aren't capturing that market.

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No. 68, May 14, 2013 - A350 Reveal

They say a picture is worth a thousand words. There is no argument that Airbus' A350 is a beautiful airplane. The roll out of MSN001, fresh from the paint shop, is an important milestone. Airbus reports the painting was completed in less than seven days and followed recent completion of MSN001's flight-test-instrumentation (FTI) verification. Last month the aircraft underwent engine installation and passed a subsequent intensive phase of ground vibration tests. MSN001 will soon start the final tests before its maiden flight this summer.

The A350 program will become one of the company's most important. The following table lists orders for the A350 compared with all Airbus orders since program inception.

Orders	2007	2008	2009	2010	2011	2012	1Q13
A350	290	186	27	70	10	40	34
Total	1,458	900	310	644	1,608	914	410
Share	20%	21%	9%	11%	1%	4%	8%

The program started off very well, accounting for a fifth of Airbus' orders during the first two years it was offered. Orders then slowed down as the program started to get into the development phase and ran into what have now become normal delays. There are interesting parallels with the 787 program. Also accounting about as fifth of orders in its first two years, the 787 saw a slowing in orders after the airplane's first flight (December 2009). The A350 has seen a faster order turnaround (to date from its order slump) than the 787, and should continue to gain momentum with first flight just a few months away.

Orders	2004	2005	2006	2007	2008	2009	2010	2011	2012	1Q13
787	52	197	100	285	59	24	36	45	50	42
Total	272	972	959	1,209	580	252	622	903	1,338	220
Share	19%	20%	10%	24%	10%	10%	6%	5%	4%	19%

It would appear at this stage that Airbus learned from the tough lessons after the A380 program. There have been delays to this program, but not nearly as extensive or traumatic as those from A380.

We all hope that since the A350 program reached this stage of its development faster than the A380, there are no more serious hiccups to come. This week's Kuwait Airways order for ten A350s, following shortly after a large order from British Airways, appear to show airline confidence that Airbus has learned its lessons and that the program is not expected to see further delays. Indeed, Airbus has seen a steady stream of orders come in for the A350, and it would appear the program is building some momentum. Airlines are rightly wary of committing to programs until they are stable.

Boeing had its share of traumatic delays on the 787. Those delays are lessons that have been seared into the production teams at both OEMs. Just as Airbus has apparently gotten its "mojo" back with the A350, we expect to see Boeing similarly succeed with the 787-10X and 777X as those programs start to gather momentum. With milestones upcoming for A350, CSeries, and 787-9 this year, it will be interesting to see if the OEMs bring the programs in on schedule. From what we are hearing about all three programs, things are looking up again for the airframe manufacturers and on-time performance.

No. 69, May 21, 2013 787's Grounding Has Small Impact on Boeing

Now that the Boeing 787 is returning to service and deliveries have re-started, it's only natural to wonder what the long-term impact will be on the manufacturer.

The answer is, not much.

The grounding of course cost Boeing in terms of research, design, development and installation of the fix. Estimates from Wall Street conclude this may be about $600m. Boeing, of course, won't confirm this figure and in any event said on the most recent earnings call that the cost was easily absorbed into its R&D budget. The Federal Aviation Administration estimated that installing the fix is about $465,000 per airplane.

Compensation to customers, both those who had received the 50 787s prior to grounding, and those whose deliveries have been delayed, is another cost to Boeing. The company said it is not contractually obligated to pay any compensation, but Japan Air Lines, Qatar Airways, United Airlines and others already indicated publicly they intend to seek it.

Since the grounding was due to defect—the root cause of which remains unknown—we believe Boeing will do the right thing and provide compensation in some form.

While some in the media like to press home the question of financial impact on Boeing, we like to point out that the company weathered four years of delays at an estimated cost of $22bn. If Boeing could withstand this impact, what's 3 ½ months and perhaps $1bn? Although we hesitate to characterize $1bn (if this is close to the number) as pocket change, given Boeing's size, cash position and cash flow, this is hardly a cost that will make or break the company.

What about the lost revenue from the deliveries?

This is easy. The revenue is simply shifted from the first part of the year to the second half, because Boeing anticipates catching up all scheduled deliveries and handing these airplanes over before the end of the year. Had the grounding occurred in the fourth quarter instead of the first, the revenue would have slipped to next year.

The Boeing and 787 brands certainly took a hit and it will be a while before this damage is erased. But Boeing and the customers have made a good start. The effort will get a further boost when the 787-10 is launched with solid orders from blue-chip customers. We think by the end of this year, absent any other "event," the 787 will be back in good graces with the flying public and certainly the customers.

Assembly begins this year on the 787-9, which will be another milestone in the brand recovery. By all accounts, the 9 will be a much better airplane than the 8, incorporating lessons learned, design improvements and benefitting from the general proposition that a stretch is always a more economical aircraft than the short version.

Production is ramping up smoothly toward 10 per month by the end of the year. This is another sign Boeing can point to that the program is back on track.

By next year, the aviation industry can get back to normal: Boeing vs Airbus and the fierce rivalry—and the news coverage—this enjoys.

No. 70, May 27, 2013 STRETCH AND SQUISH - THE CHANGING NARROW BODY MARKET

The aircraft market, particularly for narrow-body airplanes, has been changing dramatically over the last two years. Airlines are seeking better seat-mile economics, both by ordering larger aircraft and by increasing seat density on existing aircraft to accommodate traffic growth. The implications are quite interesting for both aircraft manufacturers and aircraft lessors.

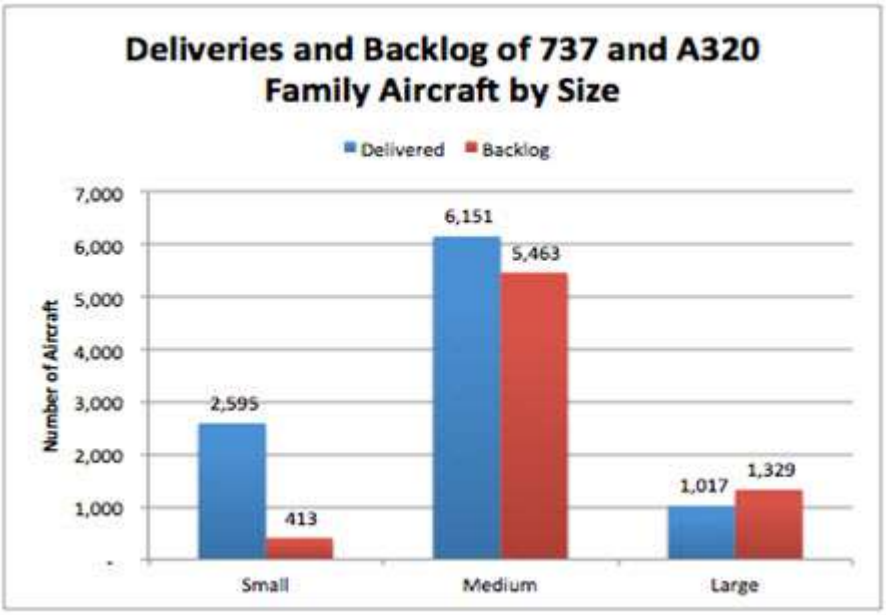
The Trend to Larger Narrow-Body Aircraft

The current trend in the narrow-bodied market can be shown in a comparison of narrow-body aircraft that have been delivered, and those yet to be delivered in backlog for current and forthcoming models from Boeing and Airbus.

Both manufacturers offers aircraft in three sizes. The A319 and 737-700 have 124 and 126 seats in two class configurations, representing the smallest in size. The A320 and 737-800, at 150 and 162 seats respectively, are the mid-size, and the A321 and 737-900, at 185 and 180 seats, represent the large size. The Boeing 737MAX models, -7,-8, and -9, correspond to the current NG models in size.

The following chart compares historic deliveries with backlogs at the end of the 1st quarter 2013. It is quite clear that that the proportions of small, medium and large airplanes are changing, and quite dramatically, from historic levels.

The once strong market for the A319 and 737-700 has all but disappeared in favor of the larger sized aircraft. While aircraft of this size have accounted for 26.6% of program deliveries to date, they only represent 5.7% of future volume. The medium and large size models are taking a higher proportion of future deliveries, while medium size aircraft moving from 63.0% of deliveries to 75.8% of backlog, and the large sized aircraft from 10.4% of deliveries to 18.4% of backlog.



At a recent conference in Phoenix, Airbus Americas' CEO Barry Eccleston noted that of Airbus' 394 single aisle aircraft orders from the first quarter 2013, 225, or 57%, were for the largest variant, the A321. With slimline seats, Airbus has already raised the single-class capacity of this aircraft to 236, and is now looking at slimline lavatories to further increase capacity for airlines in effort to maximize the number of seats. He remarked that in 2007, airlines were looking at the A319 as the right sized airplane for opening new markets, but today, the decision metrics all center on seat mile costs.

In six short years, the market has completely changed. We expect this trend to continue as airlines find it more cost-effective to fly fewer, but larger narrow-body aircraft. With a slow capacity for growth, particularly in the United States, load factors have increased to record levels, and using larger aircraft represents a "safer" growth strategy than adding additional frequencies and risking excess capacity.

The Squish Factor

Airlines are also introducing slimline seats and reducing seat pitch to add additional seats to narrow-body aircraft. Lufthansa has increased the capacity of its A320s by 8% through the use of thin-line seats from Recaro.

Similarly, Southwest in the US is introducing new thin line seats that allow an additional row of seats in their 737-700 aircraft (137 to 143 seats) with a one-inch reduction in pitch, a 4.3% increase in capacity. Others are certain to follow this trend.

These new technology seats are unique because of their contours, which enable the same amount of space between seats at tray table level, yet allow an increase in the number of rows on the airplane. The manufacturers claim that passenger comfort is equivalent, and that the additional room from the smaller frames makes up any difference. We will have to wait and see whether our rear-ends agree with that assessment.

The Bottom Line

The trend towards larger narrow-bodies is now quite clear. What it means is that the 737-7MAX and A319neo might not be as sound an investment for an airline or aircraft leasing company, as demand is moving away from that sector, likely impacting residual values. This is also impacted by the forthcoming entry into service of the similarly sized Bombardier CSeries that offers much better seat-mile economics.

But it also means that investing in the larger A321neo and 737-9MAX will likely find increasing demand, higher residuals, and will be easier to re-market in the future than today's large models. If I was I a betting man, I'd wager the larger models will continue to increase their market share and hold residuals better than their smaller counterparts, and favor the larger aircraft in financing transactions.

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No. 71, July 2, 2013 The Really Big Picture

Understanding the commercial aerospace industry sometimes benefits from stepping back and looking at it from a distance. This chart shows that the average domestic air fare, when adjusted for inflation, has continued to decrease in recent years.

This next chart enables us to step back even further for more perspective. The recovery in 2009 is driven by ancillary fees (those bag fees).

These two charts provide industry watchers with what may be the single most important driving force in commercial aerospace. Air travel has become, and is continuing to be relatively cheaper every year. We would suggest that everything about the industry be viewed through this prism. The airline industry is fundamentally a commodity product in which the low cost producer wins. When coupled with the perishability of the product, as an empty seat can never be re-sold, the drive for lower costs impacts the entire supply chain.

Because airlines need to relentlessly provide more seats at continually lower costs of production, the industry supply chain behind the airlines must also to follow the same path. Every company that provides products or services to the airlines must also relentlessly work to cut its costs. And since fuel costs have been rising steadily in recent years, even more pressure is placed on the remainder of the supply chain.

The Impact on Airframe OEMs

One interesting take away from examining the big picture is the implications for the two big aircraft OEMs. They have the largest amount of capital at risk, and the largest labor forces in the industry. Keeping the price of new aircraft (and operating costs) low is critically important to airlines, and the OEMs have dramatically increased both their productivity and held the ground with inflation-adjusted aircraft prices in recent years.

A decade ago, there was a great difference between the final assembly lines at Boeing and Airbus, and the difference in the number of personnel between the highly automated Airbus factories and older Boeing factories was quite noticeable. Today, both companies are at the forefront of automation, and both Airbus and Boeing are moving towards an even greater deployment of robots. While such devices may have a significant up front cost, they will not incur the long-term costs of labor. No holidays, no pensions and no health care premiums. And they never get tired or take the weekend off.

Boeing provided an example of how compelling the impact of robots is on the 777 wing painting last week.

The compelling benefits shown in the chart above resulted from simply painting the 777 wings using robots instead of the traditional, more labor intensive, methods. Of course, the real benefit is consistency, as the production output from the task is the same every time, for as long as the system runs. Every factory manager has dreams of consistent, high-quality output. The CFO loves the fact that savings mount daily.

Consider the impact from a people and shareholder point of view. Airbus and Boeing have different core shareholders – EADS's core shareholders are nations within the EU. These nations want their ROI measured in providing and protecting a highly skilled and well paid labor force. Such shareholders provide EADS with fabulous flexibility because EADS executives do not have to worry about the next quarter's numbers to the same degree as their counterparts at Boeing, which does not have government shareholders. Consequently Boeing has to deliver sparkling financial performance every 90 days or risk scathing feedback from Wall Street, which they have recently experienced through the multiple 787 challenges. Opinions vary on which model is more efficient or better, but both companies are run rationally by their management teams to satisfy their shareholders and stakeholders.

From a longer-term perspective, each model has different characteristics. EADS, through Airbus, is able to offer its customers more stable production rates than Boeing can. Airlines love stability and predictability. Moreover, EADS/Airbus can offer very competitive pricing because its shareholders are not dividend focused. Remember the primary dividend for EU nations comes by way to well paid, high skilled citizens paying high taxes.

Boeing has had a fractious relationship with its labor force. As orders wax and wane, Boeing shrinks or swells its labor force. As with EADS, their labor force is also highly skilled and well paid. Boeing's unions are legendary and may be among the most powerful in the US. Boeing's use of an expanding global supply chain could be seen as a part of the attempt to gain even greater labor and cost flexibility.

The force driving change, lower yields, will make the future for both OEMs more complicated. Neither business model can drive down production costs without making fundamental structural changes in their processes and skill-set. But robotics and automated manufacturing will provide an interesting alternative. Boeing benefits from using robotic production because it provides them with a predictable cost structure that can (literally) be switched off when necessary to adjust to the cyclical market. The improved production efficiencies and lower costs are delightful additional benefits.

EADS cannot flex its workforce in the EU so easily. So having factories outside the EU, in China and Mobile, Alabama, provide an excellent place where to grow or slow production – while keeping EU plants humming at a predictable pace. It also helps that EADS made sure it went to a location (Alabama) that is "right to work" friendly, as did Boeing with South Carolina. Location and automation are two factors working against the union efforts to maintain jobs and a strong labor force. Both OEMs are trying to build in as much flexibility as they can to ensure they deliver products to customers as competitively priced as possible.

The Next Generation and the Talent Shortfall

But there is another twist to make it even more interesting. We are seeing a global shortage of skilled aerospace engineers. The shortage looms even more as older engineers retire. There are thousands of

aerospace engineers at Airbus and Boeing who hail from all over the world as contractors to help alleviate the shortage. Airbus is moving its design facility to India – taking the jobs to where it hopes the people are.

We have seen the aerospace industry become thrilled over tenths of a percentage improvement in fuel burn. Why? The answer is because we have reached the pinnacle of current technologies, and needs another breakthrough to achieve another level in efficiency. But paradigm shifts are disruptive, and the aerospace industry must manage disruption because it operates in a more fine balance than ever. This is why Boeing is working future programs as derivative models. It is a much safer play. MAX, for example, is way less risky than a new CFRP (carbon fiber reinforced plastic) airplane. For Airbus, neo is also a low risk way to push the envelope.

We believe one has to watch the single aisle market closest because this is where the two big OEMs have the highest demand, and the most capital at risk. These programs are the money-makers and bellwethers for the industry, and the OEMs will protect their franchises with every tool available. The current advantage of the big two is economies of scale -- as amortizing development cost over 42 aircraft per month is easier than over the 10 or 15 units per month that Bombardier or Embraer plan to produce.

Even with substantial scale economies, Airbus and Boeing will need to relentlessly cost-cut to keep aircraft prices in line with inflation. Watch for growing robotics deployment at Boeing and Airbus (which has deployed a lot in its Hamburg A350 factory already). The key challenge will be their ability to develop creative ways to work around looming engineering and skilled labor shortages. And looming in the distance is China, armed with massive funding and endless patience. The need for continuous improvement is just that – continuous. Until the next disruptive technology arrives, execution and cost-effectiveness will be the driver of profitability at the OEMs.

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No. 72, June 11, 2013 Unlocking New Profits

The two big airframe OEMs are working on expanding their service offerings beyond basic warranties. This will allow both firms to move into new lines of business that are almost certainly more profitable than selling airplanes. Airbus has a solution called "Customer Services"; Boeing's version is called "Commercial Aviation Services".

The common thread behind both OEMs initiating this line of business is not just creating a new profit center. Competition between the two is more intense than ever. Every opportunity to get closer to the customer is paramount. After all, the products these firms sell have a realistic lifespan of twenty years or more, far beyond the original warranty period. The OEMs have seen the growth in MRO work around the world and realize there is a lot of money to be made.

The engine OEMs recognized this some time ago, and moved to capture more than half of the MRO market through power by the hour programs. Rolls Royce has taken this to the next level, mandating an MRO contract with each engine sold for the Airbus A350. Of course, this does not set well with airlines that have established engine shops, and a pending deal with Air France has been delayed for some time until that issue can be resolved. But the trend is clear -- OEMs are now moving to capture an ever-increasing share of the aftermarket.

With thousands of parts per airplane, they can't do it alone, and must also be able to rely on their supplier base for repairs, exchange programs, and high quality services. But within the 200-400 rotable components that make up 80% of maintenance cost, it is quite feasible.

In our view, the obligation to stay close to the customer is important to the OEMs in protecting market share. Airlines are prone to business disruption by more factors than just about any other business. Imagine an airline's reaction to an airplane that has broken down – an event that should never happen because all maintenance is strictly regulated, at least it is supposed to be. Even with constant upkeep, machines will occasionally break, especially machines that are sensitive and worked hard. No manner of regulation can ensure every airplane is "up" 100% of the time. Both OEMs like to talk about dispatch reliability because this is a critical yardstick. It is the number that demonstrates all the parts and pieces coming together to deliver a flight. Typically the number airlines want, and currently achieve, for today's aircraft, are over 99%.

Airbus and Boeing want to ensure their products are delivering the highest possible quality of dispatch reliability. The premier way to do this is enter the business of post-warranty services and support. Interestingly, this does not mean they can charge high fees. In an interview last week with Airbus' Didier Lux, EVP Airbus Customer Services, he explained that there is significant competition from third parties. Pricing is tight. But he pointed out that Airbus is determined to support its global customers. Air travel is very reputation sensitive and no OEM (or airline) wants any negative image of their brand or products.

Getting into this sector was not a matter of simply starting a new department. Boeing, the earlier mover into this business, acquired Aviall in 2006. Airbus followed with market entry in 2007 and acquired Satair in 2011. Just like everything else in the business, the two big OEMs tend to combat each other's competitive moves.

Today, many airlines have cut back on engineering departments and outsource the majority of their MRO, particularly LCCs. Those carriers are the initial targets of the OEM, who will attempt to take share from smaller third party MRO shops.

The Airbus solution consists of the following areas: e-Solutions; Upgrades; Fly-by-Hour; Consulting Services; Logistics and MRO. Their group consists of 3,000 people overseeing 7,500 aircraft. Part of this team consists of 290 support reps in 150 cities – ideally as close to key customers as possible. Downtime is among an airline's biggest enemies.

The Boeing solution (called Boeing Edge) consists of Material Services, Fleet Services, Flight Services, Information Services, Integrated Services and Customer Support. Once again there is a close parallel between the two OEMs. Boeing offers a unique online portal for customers to access the latest data on their aircraft called MyBoeingFleet. Boeing also has teams ready to go (AOG Teams) with 24/7 dispatch ability to solve a problem within 24 hours. But 24 hours is an eternity in the airline world. However, when you get something like a push back tug impacting an airplane, not every airline has the internal resources to solve the problem.

The Electronic Issue

One of the arrows in the OEM's quiver is the rise in e-Enablement (e^2). This term describes the ever more digitally complex and connected airplane. The operation of e2 aircraft (currently Boeing 787 and 747-8, A380, A350 and Bombardier CSeries) is typically done in a secure environment, eliminating the need to send personnel to an aircraft carrying physical data storage devices (e.g. paper, CDs, USB sticks). It is one of the new big areas of promise from the OEMs.

The Star Alliance defines e^2 as "the integration of aircraft IT networks with ground systems (e.g. Flight Operations, Aircraft Airworthiness & Maintenance and Cabin Operations) and IT infrastructure to enable new airline business processes and/or safety controls". The new airplanes all feature some form of e^2. These new airplanes are fitted with a myriad of sensors delivering staggering amounts of data on performance. For example, the 787 downloads 18Gb of performance and maintenance data when it completes a flight.

E^2 is an excellent opportunity for the OEMs to secure their customers. E^2 standards from Airbus and Boeing are not the same. This means third parties who want this business need to be knowledgeable about both systems. British Airways is about to discover that the 787 and A380 are going to add significant complexity to their fleet, rather than simplify it. The airline will have to support three fleet types with respect to information; Airbus e^2, Boeing e^2 and legacy fleet.

Airlines simply lack the required IT knowledge base and staff to handle e^2. Airlines suffer from "silo-think" and e^2 is going to prove tough to handle. The tasks required to support e^2 demands people who understand flight operations, IT and maintenance. How many people does any airline have with all these skills? We are sure every airline is short on these people.

The creation of these new areas of business at the OEMs comes at the perfect time to ensure they grab and hold the long term relationships with customer because of e^2. The MRO facility that will likely be able to provide the OEMs with earliest competition is Lufthansa Technik. Lufthansa is known for buying aircraft in a manner unlike any other airline. They fly almost every type of commercial airplane. One reason, we believe, this happens is because it enables its in-house MRO to have excellent capabilities to

service any aircraft in service. Lufthansa's Technik is top tier and undertakes its work at the equivalent level of the OEMs which is why it gets so much outside airline work. Delta Air Lines also has a world class MRO facility that would likely be following Technik in the e2 business. Another top tier MRO is SIA Engineering. But there won't be many others any time soon and none have the breadth of Technik's range of aircraft.

While the OEMs will be able to initially attract better than normal profits from their new customer support services as e2 enters the global airline fleets, it won't be long before Lufthansa Technik and others enter the business and bring prices down. But the MRO game is rapidly changing with technology, and the OEMs are positioning themselves to grab market share from third parties with the next generation of airplanes.

No. 73, June 30, 2013 ELECTRONIC TAXI SYSTEMS – HIDDEN TECHNICAL CHALLENGES

EGTS is the acronym for the e-taxi solution from Honeywell and SAFRAN, which was demonstrated this week at the Paris Air Show. A description of their product can be found here. The photo below shows how this solution looks on the main wheels of an A320.

This system is in competition with another e-taxi solution, WheelTug which relies on power to the nose wheel. (Full disclosure, WheelTug is a former AirInsight client)

The difference in architectures between the two systems resulted from different engineering solutions to the complex tradeoffs involved in developing an e-taxi system. The difference is pulling using the nose wheel versus pushing using the main gear, and results in differences of speed, efficiency, turning radius, and other factors.

EGTS team are industry Goliaths compared to WheelTug – however WheelTug, which demonstrated its competing nose-wheel system more than a year earlier, already has commitments from 11 airlines for nearly 600 aircraft for its nose-gear system, and several additional customers pending announcements. EGTS now has an agreement with Air France for tests.

Two of the major trade-offs in powering the main wheel of an airplane haven't been publicly discussed by the EGTS team – additional heat generation, and the time required for heat dissipation.

Heat

Brakes generate massive amounts of heat. (On the A320 brake temperatures greater than 300 degrees Celsius trigger a hot brake ECAM [Electronic Centralized Aircraft Monitor] warning). Brakes must cool below a certain temperature before the airplane can begin a takeoff roll, because the aircraft would not

be able to stop should a takeoff be aborted for a safely issues. Today, carbon brakes generate significant heat that must be dissipated to ensure that in a Rejected Takeoff (RTO) that the plane can be stopped, and that hydraulic fluid fires won't occur.

- Airbus offers as a standard part of the package hub fans to cool the brakes. Without the fans, airlines might delay a takeoff when the brakes are still too hot. The existence of fans proves that these wheels get very hot.
- Cool air gets sucked in through the gaps between the brake disks and blown out through the protective screen on the hub. There are holes in the flange of the wheel to permit the air pass through. (A good discussion on brake fans can be found here)
- Now what happens if you put hardware, sealed with its own oil, which blocks the path of the cooling air? Look at the EGTS hardware; it covers the axle-side of the wheel.
- In-flight heat is another concern. Note aircraft brakes do not even cool down all the way in flight – at least, not by themselves.

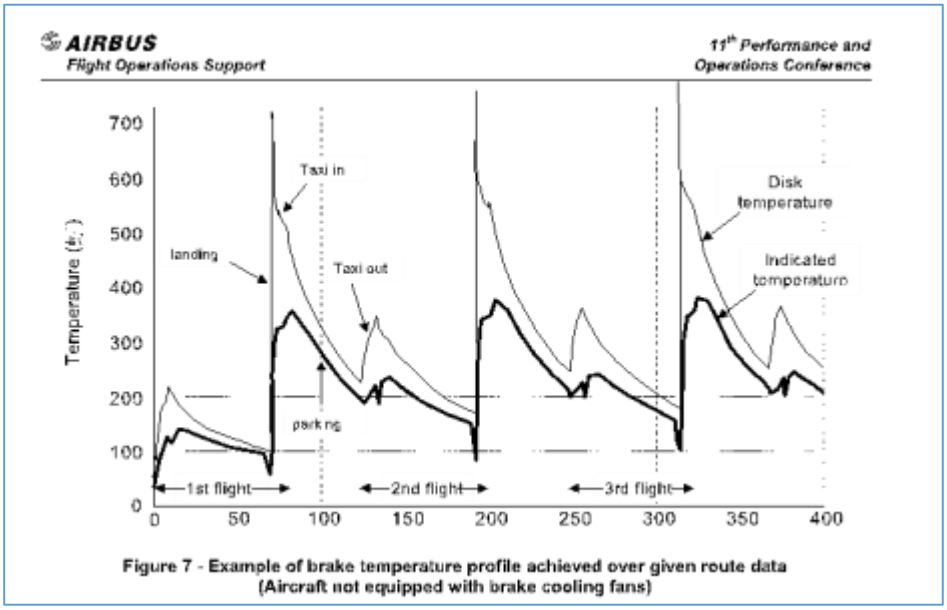


Figure 7 - Example of brake temperature profile achieved over given route data (Aircraft not equipped with brake cooling fans)

- The EGTS will is a heat source in its own right. EGTS uses 50kw electric motors which will generate heat as the airplane taxis. All that heat is located inside the wheel. Brake hydraulic fluid has to stay below its flash point or there is a fire risk. Awareness of this issue is demonstrated on the prototype EGTS in which the hydraulic lines run on the outside.
- The question is will this solution provide adequate brake cooling, or exacerbate the problem by blocking airflow and introducing the heat from electric motors adjacent to the brakes?

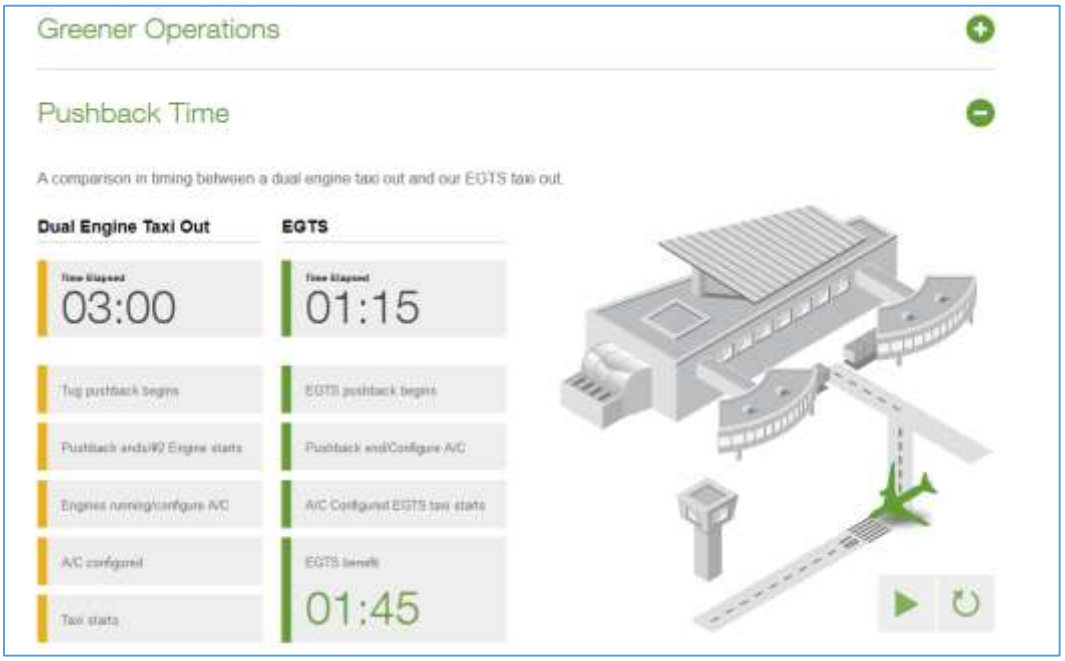
Time

- For airlines, time is money, and shorter turn times generate improved profitability. If EGTS adds cooling time to a turn, it may give back the savings it achieves in lower fuel burn through slower turns.
- The EGTS may not, itself, generate that much heat. But any additional heat introduced to the wheel and brake area, without additional cooling, could be problematic.
- Airlines want to get rid of wheel heat as fast as they can. Why? Because they want to save time.

- Airlines sell schedule if nothing else. That has resulted in Airbus making its aircraft more efficient by adding hub fans for faster cooling of brakes. EGTS located in the airflow must lower the effectiveness of these fans.
- What is the cost for an airline? It is a rule of thumb that an "airline minute" is worth between $100-150.
- Brake cooling could be a limiting factor for EGTS-enabled aircraft, as they could potentially spend more time waiting for brakes to cool than those without the EGTS system. Therefore aircraft with this system cannot be turned faster than an aircraft without the system.
- The question is whether the e-taxi system will result in a rise again in temperatures as the aircraft taxis out for its next flight. As we haven't seen the final details, it is difficult to tell. But it is certain that adding electric motors adjacent to brakes both generates more heat in a confined space, and disrupts the path for cooling airflow.

The Configuration Advantage

Clearly putting e-taxi on the main wheels impacts flight operations in a way that using the nose wheel does not because nose wheels have no brakes. Unless the EGTS' heat is dissipated very quickly an airline could see its flight turn times impacted. How much does EGTS claim to save an airline per turn? The chart says about ninety seconds. In airline minutes that means about $300.



Given that airlines are risk averse and the time saved is rather low compared to the possibility of waiting for brakes to cool (especially in hot weather) it would appear the EGTS solution savings are not that compelling. The savings return and the flight operations delay risk, in our view, do not have enough delta to assure a highly profitable installation. Imagine selling this solution to an airline and advising the airline to slow its operations for minimum cooling? Particularly an LCC with twenty minute turn times.

Conversely, the nose-wheel solution from WheelTug adds no heat to braking systems, and enables the current cooling airflow to operate normally. As a result, there will be no adverse impact on brake cooling times.

While many of the trade-offs between the differing e-taxi configurations are quite clear, such as push versus pull, total weight added and implications for weight and balance, others, such as brake cooling, are not quite as obvious, but could have significant ramifications on operational effectiveness. We're not certain that EGTS, while acceptable for a ground demonstration at the airshow, is yet ready for prime time in a fast-turn LCC environment.

No. 74, June 24, 2013 PARIS AIR SHOW - IMPLICATIONS AND TRENDS

The 2013 Paris Air Show has now concluded, and we can reflect on what the activities at the show will mean in the marketplace and the implications for the industry. While the last two shows, Paris 2011 and Farnborough 2012, were dominated by the narrow-body neo and MAX, respectively, Paris 2013 is the year of the wide body.

The Year of the Wide Body

The Airbus A350XWB flew at the show, only a week after its first flight, providing a signal that the program appears to be on track with its current schedule. Orders from United for the -1000 model and the anticipated order from Air France-KLM (held up by a dispute with Rolls Royce, which wanted power by the hour maintenance for all engines on the program) moved the program backlog forward. Things look on-track for successful EIS next year.

Boeing launched the 787-10, as expected, and gained several orders, including Singapore just before the show and United and two leasing companies during the show. The largest version of the Dreamliner will incorporate the significant learning that has gone on during the rough introduction of the 787-8, and should provide Boeing a cost-effective platform with a similar seating capacity as the A350-900.

Airbus was buoyed with a leasing company order for 20 A380s, a program which has been seen slowing momentum as newer aircraft offer similar seat-mile economics with much lower risk. Unlike the halcyon days of the 747, when the tri-engine competitors couldn't quite match seat-mile economics, today's new model twins will be just as cost-effective on a per seat basis. As a result, we now see the A380 (and 747-8) as niche aircraft, rather than mainstream aircraft, that will focus on constrained airports that require high capacity aircraft.

Boeing dropped additional hints about the 777-X, but is waiting to officially launch the program. Perhaps a launch order from Emirates could result in an announcement at Dubai in November, or Farnborough next July.

A Significant Regional Launch

Embraer successfully launched its E2 series of EJets, which had become economically obsolete only 7 years after entry into service. While a re-engining of a program that young is quite unusual, competition from the Mitsubishi Regional Jet in the 70-90 seat range and the Bombardier CSeries in the 100-135 seat range forced Embraer to either revise its aircraft or see sales continue to erode. The largest E-195 model includes a 12 seat stretch to increase capacity and better compete with the Bombardier CS300.

Their major launch order in the regional sector is with Utah-Based SkyWest for 100+100 of the smallest 75 seat airplanes, subject to an out clause in the event SkyWest does not secure a Capacity Purchase Agreement with a major player. Embraer also secured an order from ILFC for 50+50 of the larger E-190/195 models in the 100-130 seat size, a vote of confidence from the leasing community.

With a large installed base, we would expect the re-engined E2 series to be popular with existing customer for reasons of fleet commonality.

Pratt and Whitney Gaining Momentum with the GTF Engine

The PurePower geared turbofan engine from Pratt & Whitney gained further momentum with the Embraer launch and has now been selected for five programs, the CSeries, Airbus neo, Mitsubishi MRJ and Irkut MS-21 in addition to the E2.

The order book at the show indicated clear momentum for the GTF, particularly on the Airbus neo, where it is gaining market share and appears to be now clearly winning the battle with CFM. Prior to the show, PW had a slight lead on neo with a 599-589 lead over CFM. At the show, PW gained slightly over 2/3rd of orders, and post show has a 37%-31% market share lead, with 32% remaining to be announced. On the largest Airbus model, the A321, the market share is about 75%-25% for the GTF, as the LEAP appears to be more limited in higher thrust applications.

We believe the growth potential for the GTF is higher than for the LEAP, and expect a performance gap to emerge over the next five years as PW prepares its first technology insertion program. PW expects that it will be able to offer a 1% improvement each year over the next decade in fuel economy, and that it will be able to retrofit half of those improvements into existing engines as those improvements are developed. The growth potential for the engine appears to be a major differentiator in the airline decision process and economic modeling favoring the GTF over LEAP at several airlines we have spoken with.

Electronic Taxi Systems Come of Age

SAFRAN/Honeywell demonstrated their engine-off electronic taxi system at Paris, using only the APU to push back and taxi the aircraft with electric motors on the main landing gear. This is more than a year after WheelTug demonstrated its own system using a nose wheel electric motor in a competing configuration.

The benefits are significant, in terms of fuel savings, as well as time savings during a turnaround by eliminating the tugs and enabling the pilot to taxi out himself. Using a “twist” maneuver and enabling use of two jetways or stairs at front and rear, turn times can actually be significantly reduced, increasing aircraft productivity and airline profitability.

While SAFRAN/Honeywell announced no new customers (they announced an MOU with Air France), WheelTug has received commitments from 11 airlines for nearly 600 aircraft. We expect to see these program gain significant momentum in 2013, and a David vs. Goliath battle in this market.

QUIET SHOWS

The show was relatively quiet for Bombardier and Rolls Royce, neither of which made a big splash at the show, but continue to drive forward. Bombardier revealed a previously unannounced customer for its CSeries but no new orders, but expects first flight later this month and the ability to verify the economics projected for the aircraft. Rolls Royce, which competes well in the wide-body market and is the sole power plant for A350 and an option on 787-10, is well positioned, but maintained their understated British reserve at the show.

The new international competitors, Irkut and COMAC, were very quiet at the show. We understand that Irkut is moving ahead with their program but likely to have a schedule slip, and that COMAC still lacks the integration skills needed to coordinate the design elements outsourced to Tier 1 suppliers, and that a substantial, 787-like schedule slip is looming.

IMPLICATIONS

We've come away from the show with a clear indication that innovation wins. The new technology wide-bodies continue to sell well, and with A350 flying and 787-10 now launched, the success of aircraft designed with advanced materials is quite clear.

On the narrow-body side, the new MRJ and CSeries models will compete against the re-engined small neo, MAX and E2 series, that won't offer the same level of technological innovation. When we see completely new designs competing against re-engining programs, the new designs win economically. It will be interesting to see how well the 777-X will be able to compete against the all new A350 when it hits the market next year.

While the MRJ and CSeries haven't yet taken off in terms of orders, there is a degree of "show me" that remains in economic performance that can't really be determined until the aircraft fly, which in the case of the CSeries will be later this month. We would expect that all new designs will outperform re-engined designed, and that these two new airplanes will, once proven, achieve market success.

In the engine market, the Pratt & Whitney GTF, with an innovative configuration, is gaining the lead over its more conventional competitors, and appears to be the leapfrog technology Pratt & Whitney was looking for. But with Rolls Royce exclusive on A350 and GE exclusive on 777-X, and GE/RR competing on 787, there isn't much room for a wide-body GTF at the moment.

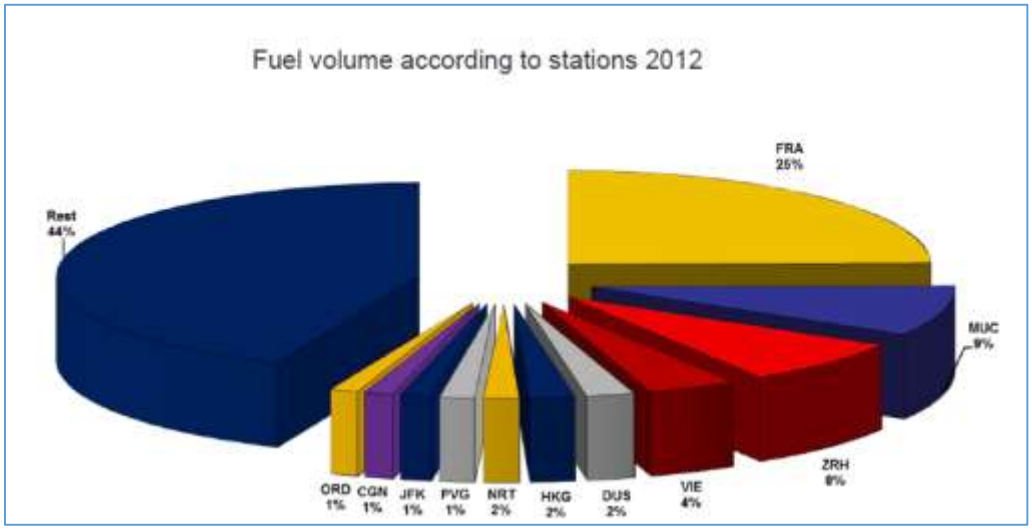
The future of the industry looks bright, and Paris 2013 was upbeat.

AirInsight | Weekly Review

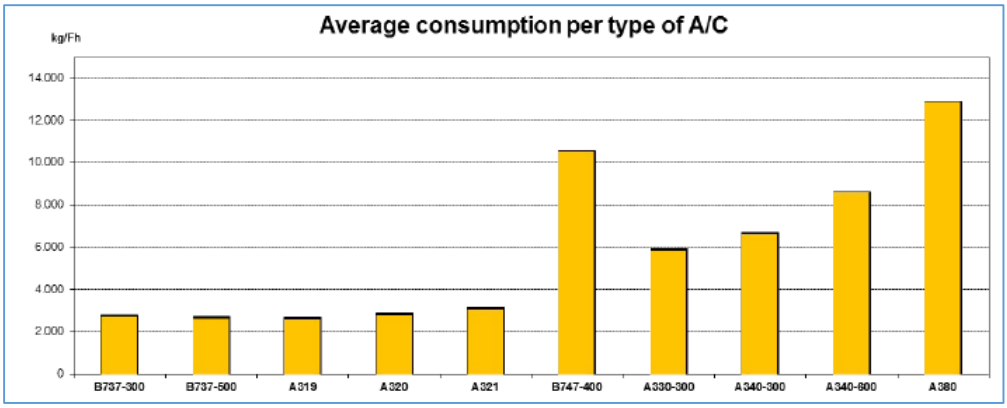
No. 75, July 2, 2013 Lufthansa's fuel cost mitigation

Recently Lufthansa conducted an "academy" in New York around the fuel problems the airline faces. Invitees were all local media, and it was a small group. The airline brought in three high level executives who made presentations of how the airline is managing fuel challenges. Lufthansa is a well-managed airline and the insight from this event offers not only a view on this airline is dealing with the fuel issues, but also serves to educate on how the industry might be dealing with fuel related challenges.

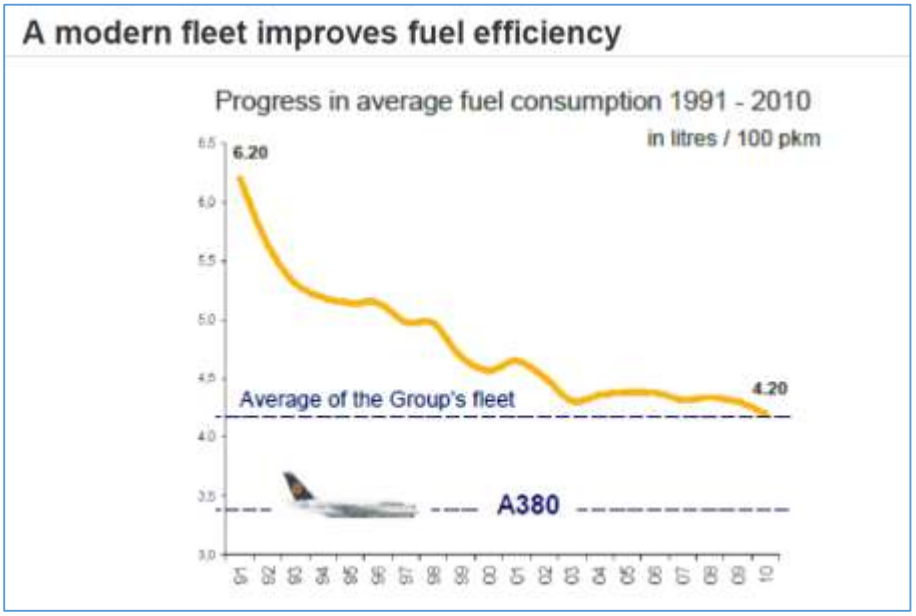
The first presentation was on fuel management and we have a few slides to share from that event. The complexity of this function at the airline is best illustrated with data: 540 airports served globally, using 150 suppliers and consuming 10 million tons of fuel annually to fuel eight airlines in the group. To give perspective, Lufthansa uses as much fuel per year as Finland. How's that for a statistic? For the passenger side of the airline, fuel costs are 28% of total costs. Because Lufthansa is the quintessential network carrier, this number is actually pretty low. For an LCC it would be nearer 40%. To get an idea of the logistics take a look at this chart. As you can see 44% of the airline's fuel is processed at sites that are under 1% of the total.



Consumption by the airline by aircraft type was shared with the group and is shown in the next chart. The 747-8 is not reported because the data refers to average consumption in years before 2012. The take away here is that 10% of the fleet consumes 70% of the fuel. The long haul fleet consumption is eye popping.



However, the airline has done an exceptional job improving its fuel consumption as the next chart illustrates. This chart supports the major aircraft orders airlines are signing in an effort to drive down their fuel costs. Newer airplanes burn a lot less fuel and pollute less (noise and air). Lufthansa averages 58 miles per gallon, which exceeds most hybrid cars for fuel efficiency.



The next presentation was on fuel efficiency, which is a great segway from the previous chart. The tone for this presentation was "Rising fuel costs can only be absorbed by fostering efficiency". Lufthansa has 400 projects in the works trying to identify fuel efficiencies. One example that caught our eye is called "Connex Info". Using in-house software (Lido) the airline makes aircraft speed decisions based on how many passengers might miss a connection. This way a delayed flight is either accelerated or not. The airline has also developed a neat EFB-based calculator to enable pilots to perform real-time flight path optimization. This brings in a key item airlines are all working with – connectivity. To ensure optimal decisions invariably means providing the decision makers with current data. Lufthansa has "FlyNet" on its long haul fleet which allows crews to get the data updates they need. The airline was a pioneer in this field and is now harvesting benefits from this decision.

Aircraft suffer from rapid technology aging. Regulators cannot approve new technology fast enough and OEMs cannot update technology at the speed with which it becomes available. The iPad as EFB is the

latest example. The FMS on the A320 was designed in 1978 and was delivered in 1979. (Remember the Commodore PET from the same era?) Airbus still installs this computer today. Is there any wonder that pilots jumped on the iPad bandwagon? Airlines are forced to discover solutions outside the constraints of aircraft technologies.

The final presentation was on biofuels, a subject of great interest to us. Lufthansa explained that Jet A1 has a carbon chain length of C9 to C13, this makes it nearly the same as diesel. The need to reduce carbon dioxide emissions is a big issue for IATA and Lufthansa intends to play its part. The airline feels that biofuels is a solution that may work. It is compatible with aircraft engines and the industry's fuel supply infrastructure. Blending up to 50% is already an allowable fuel option. Biofuels have proven to be cleaner than fossil fuels. But there are challenges – availability and price. Lufthansa provided this useful chart.

Aviation biofuels – a comparison with Jet A-1

Property	Jet A-1	BtL-FT	HEFA
Standard	ASTM D1655	ASTM D7566 Annex 1 ASTM D1655	ASTM D7566 Annex 2 ASTM D1655
Licensed	1960	2009	2011
Freezing point	- 47° C	- 47° C – - 69° C	> - 47° C
Density	0.78 – 0.82	0.72 – 0.75	0.72 – 0.75
Energy content	100%	104%	104%
Blending with Jet A-1	-	≤ 50%	≤ 50%

There are clearly advantages for the airlines to find ways around the supply and pricing issues. But who will take the lead? The supply base is looking for a large customer who will contract for sufficient volume to justify investment. With that supply created, prices should start to decline – or so everyone hopes. The most likely leadership role here will be the US government by way of the US Air Force. The military has already started trials, but $59 per gallon is expensive. Moreover there are already signs of in-fighting. However, the airline industry should proceed with its tests. Because even initial trials by the US government is starting to attract the kind of interest that will drive up supplies which could reduce the long term pricing.

Some economists are predicting a long-term decline in fuel prices, as the US becomes energy independent through shale oil, and overall demand is reduced as automobiles become much more fuel-efficient after the next replacement cycle. Even if prices fall, fuel has become such a significant element of aircraft operations that mitigation efforts are essential to success. And should prices rise, these initiatives could make the difference between survival and failure.

Different airlines have different strategies, perhaps best contrasted by Delta Air Lines, which has chosen to continue to operate older types, and minimizing new fleet capital costs. But even Delta has purchased a refinery to eliminate the refining spread from their cost structure. Fuel is a critical element, and the aviation industry has led the way in fuel cost reduction in recent years. With the next generation of wide

bodies entering the market, as well as the neo, MAX, CSeries and E2 in the narrow-body markets, we expect that trend to continue as the industry leads the way in fuel cost reduction.

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No. 76, July 9, 2013 WHAT IS REALLY AN "ORDER"?

As we reach the halfway point of the year, Airbus is reporting a record backlog of nearly 7 years' of production, with Boeing closing in on similar record levels. But how firm are these firm orders? And what about options, purchase rights, and contracts with contingencies? Let's try to straighten out some definitions:

Firm Order: A signed contract between a customer and an airframe manufacturer for delivery of an aircraft at an agreed price, at an agreed delivery time. Typically, firm orders require some down payment, and progress payments leading up to aircraft delivery.

But there are variations on a "firm" order.

The "Specify Later" order: Many leasing companies, for example, will order the smallest member in a series, retaining the option to switch upward to a larger model closer to delivery. So that order for an A319neo or -7MAX could really be for an A321neo or -9MAX later on. The reason is clear - progress payments are smaller for the smaller model, which typically carries a lower price - and the OEMs are happy to place orders with leasing companies and will accept that lower revenue to secure the order -- as after all - the leasing company doesn't require a lot of "concessions" in the deal, whether in the form or spare parts or training.

The "Firm Order with Contingencies": The recent 100 aircraft order for Embraer 175E2 jets from Skywest included 40 firm order, and 60 orders subject to a successful capacity purchase agreement with a major airline, which are not quite as firm. While they are likely to convert to firm orders, there is an "out clause" for the buyer - so should they be counted as absolutely firm, or closer to an option? But this order also had 100 options, in case they need more aircraft. Should we call this order 100 firm +100 options, or 40 firm +160 options?

The "Modified Firm Order": Firm orders can also be modified - as we recently saw, one carrier change an order for wide body aircraft into narrow body aircraft as their strategy and competitive position changed. The change, of course, continued to benefit both parties, but caused a blip in the firm order totals in each column - one going down and the other going up. It does make keeping track more fun.

"Speculative Orders": Speculation also rears its head periodically in the industry. Back in 1989-1990, carriers were rushing after delivery positions, some speculating on them to sell to others, before the bubble burst with the inevitable industry downturn. Whether the Gulf War, SARS, 9-11, or economic recessions, there always seems to be an event that will burst any bubble. Today that speculation is in massive growth orders for some airlines.

Lion Air in Indonesia is an example - with more aircraft on order from Boeing and Airbus than the entire fleet of all Indonesian airlines combined. Either Lion Air will be a stock that I will regret not having purchased, or some of those orders will never be delivered. Only time will tell if all of these orders will be delivered, or merely a portion of them. Combine Lion Air with Air Asia and Tiger, and even with the highest growth rates on the planet, it will be difficult to take all of the aircraft on order.

Options

Traditionally, an option is the right to purchase additional aircraft at the same price and terms negotiated in the original contract, likely with an inflation escalation built in. That has the benefit of assuring the airline that aircraft will be available should it successfully continue to grow, and ensures the manufacturer that those aircraft won't be purchased from a competitor. And with most aircraft orders, we see firm plus options from the major players. Options may have a time frame associated with them, in terms of potential delivery positions.

But the game appears to be changing, and some OEMs no longer report options in their numbers, which is a shame because it helps analysts gauge the popularity of a particular program.

Purchase Rights

More recently, we've seen a new element introduced - Purchase Rights - which are apparently less firm than an option, but grant the purchaser the right to purchase additional aircraft should they be needed. Recently, we've seen some 10+10+10 contracts, with orders, options, and purchase rights.

As far as we can tell, a purchase right is an option that the OEM added to the deal to enable the airline, should it decide it likes the aircraft, to acquire more at the same price - just like an option, but perhaps without the commitment of potential delivery time frames. As a result, with purchase rights, the carrier needs to move them up the food chain in order to secure deliveries.

The Bottom Line

It's beginning to get harder to tell what's real and what isn't in today's market. Is a contingent order worth more than a purchase right? Can we trust a massive order from an emerging carrier as really going to be delivered? Unfortunately, we'll need to make the best of a situation that appears to be growing more confusing.

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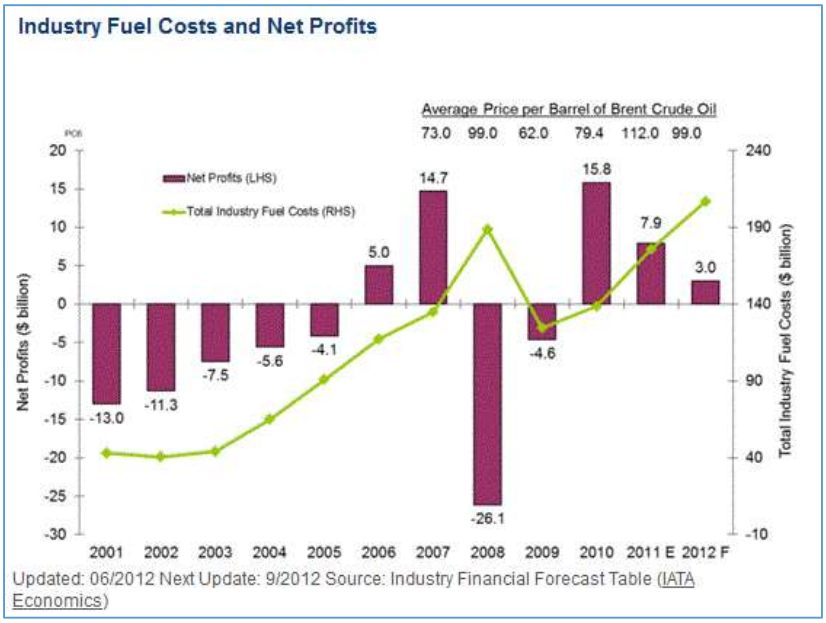
No. 77, July 16, 2013 As Oil Prices Slide Again

We know prices are rising now, but we think this is a temporary condition due to unrest in Middle East. If speculators step in, prices can spike even further. But in the long term we think the trend will be in the opposite direction.

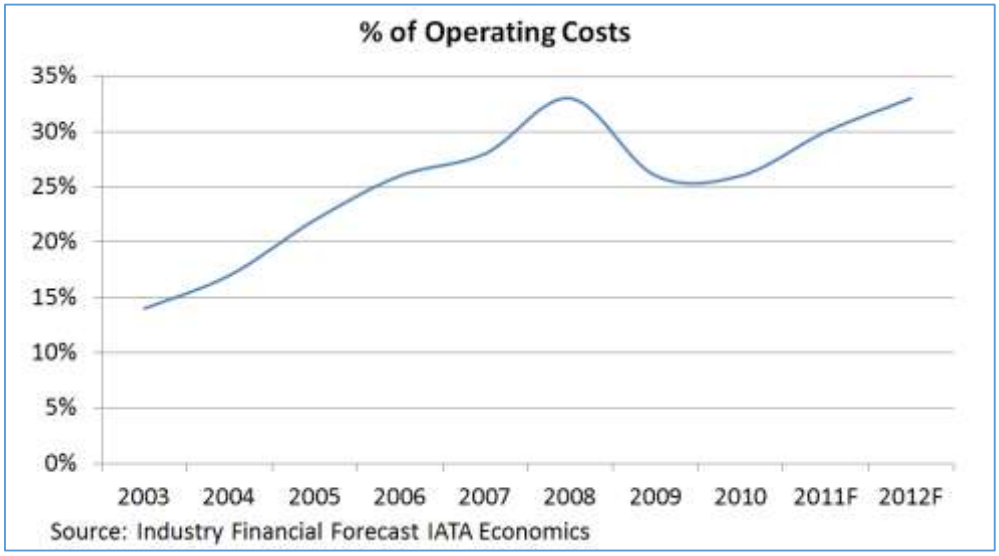
This is chart typical of one sees when doing any research on oil prices and aviation. It's always a line running sharply to the right hand top corner. Just the kind of curve to make every airline manager (and analyst) cringe. How does one square this chart with the ever reducing real cost of air travel? How can airlines ever become profitable? Yet many airlines are profitable and, of late, more so than in many years.

IATA's data demonstrates how quickly airline profits bounce back when fuel prices fall. In 2008 the world had a short reprieve from oil price shocks. But it did not last long.

Source: Bureau of Transportation Statistics F41 Schedule P12A as of 7/9/2013



In fact when one looks at the impact of fuel costs on total airline costs, we get the same picture, as illustrated here by IATA data.



It is really quite depressing isn't it? Yet traffic keeps growing and, despite losses, airlines keep flying. Even the OEMs are seeing signs of continued confidence by way to massive backlogs in orders. The general hypothesis is that these orders are for the newest most fuel efficient airplanes money can buy. In the EU, taxes on fuel certainly encourage airlines to go for the lowest fuel burn possible. IATA points out in their Economics Briefing No 10, "Since 1970 air travel demand, measured by revenue Passenger Kilometers flown (rpks) has risen 10-fold, compared to a 3-4-fold expansion of the world economy. Air cargo demand, both reflecting and facilitating the globalization of business supply chains and economies generally, rose 14-fold." Yet IATA found that the typical passenger only generated $2.56 in net profits for the industry. This razor thin margin simply cannot withstand shocks – and the cost of fuel has been impacted by a series of shocks. Airlines are, simply put, too risky for many investors. The margin of profit is insufficient to offset

the risk of an industry that regularly is impacted by exogenous factors, from oil, to politics and health issues.

To this point this newsletter reads like a brief on reasons not to be involved in the aviation industry. However, there is some very good news on the horizon and it is quite likely to be transformative for air travel. The good news can be summed up in two words "Shale Oil".

Changing the Supply-Demand Balance

The Supply Side

Leonardo Maugeri at Harvard University provides an excellent analysis of the US shale oil boom. The numbers involved are eye popping: "Continental Resources now estimates that Bakken may hold 900 billion barrels OOP, a two-fold increase in the 2012 assessment. That would make Bakken's endowment alone larger than Saudi Arabia." Bakken is one of three major oil shale areas in the US. In addition to finding so much "new" oil, drilling technology has also improved. Using a steerable rotary drill bit means that well that took two weeks to complete now take ten days or less. In addition to improved technology, production productivity has improved as well – average production per well has doubled between 2007 and 2012. Texas oil production is now larger than some OPEC members. .

With all this extra oil production, traditional sources like OPEC can be expected to react. It did not take long for this to happen. But OPEC is not a monolithic body – some members simply don't have the flexibility to handle a sharply lower US demand. US crude production was up 20% to 7.37 million barrels a day in the week ended May 3, making it the highest level since February 1992, according to data from the U.S. Energy Department. If US production keeps growing at its current rate, there are estimates the country will have no need for foreign oil by the decade's end. Mr. Maugeri calculates that at $85 a barrel most shale oil wells repay capital costs within a year. He estimates that if oil prices fall steadily to $65 in five years, shale oil production will treble in the US because of increasing productivity per well and the easing of transport bottlenecks. By 2017, Mr. Maugeri thinks, the US will be producing nearly 11 million barrels a day which is equal to its previous production peak in 1970. Crucially, US oil imports peaked at 60% in 2005 and will probably below 40%. An amazing impact.

However the reason we have so much interest in shale oil is the current high oil price. Shale producers, just like OPEC, do not want to see prices fall below $100 per barrel. So it should be clear that all producers are goal congruent with respect to pricing. However it will be tough to stop the drillers now because they are getting better at their work, and US wells are likely to see profitability at even lower prices. OPEC will be stressed because of the disrupted Middle East. Whereas Saudi Arabia has throttled back production to keep prices high, they may not be so inclined going forward. To prevent any "Arab Spring" in that country, the royal family can be expected to continue to throw huge amounts of money at its restive population. As the link points out, the House of Saud has been doing this for a long time. If the choice was between selling its oil to garner cash to buy domestic calm or protect OPEC, we are betting on pacifying Saudi citizens before anything else.

The Demand Side

At the same time, the demand side of the Supply-Demand balance is also trending towards a model that requires less oil. Automobiles, the largest users of oil, will have mandated CAFE increases in 2016 and 2025 that will significantly cut fuel demand. Those standards are documented in a presentation by an MIT Professor and show that on-road mileage will increase from 22 mpg in 2012 to 26 mpg in 2016 (an

18% improvement) with an additional increase to 35 mpg, (a further 34.6% improvement) in 2025. From 2012 to 2025, automobiles will reduce average consumption by 63.6%. That's a meaningful reduction.

Aviation itself is seeing significant improvements in fuel economy, as the 727s and DC-9s have been phased out, and early model 737s and A320s will soon be replaced by A320neos and 737MAX models that are 15% more fuel efficient than current model aircraft, and are 20-30% more efficient than older generation aircraft they will likely replace. The net result is that demand, even with moderate economic growth, will fall significantly as new technologies enable higher efficiency.

What Will Happen to Prices?

As economic history has shown, lower demand leads to lower prices, and increased supply also leads to lower prices. Logic suggests we are headed for a much lower oil price. This is the view of Mr. John Llewellyn in a report for Puma Oil. In Mr. Llewellyn's report he details two schools of thought:

- The 'peak-oil' school which anticipates the price of oil in real terms will rise over time, perhaps to $200 per barrel
- The 'technology-driven' school which anticipates the price of oil in real terms will fall over time, perhaps to significantly below $100 per barrel

Mr. Llewellyn's report concludes: "We judge that a sub-$100 per barrel price (Brent, in real terms) will eventuate by 2020 as a result of a number of economic and policy-driven factors.

Economic factor - A high oil price of around $100-120/barrel has driven, and will continue to drive, technological innovation, both in finding new reserves, and more efficient extraction. This contrasts sharply with the 1990s, where a price between $20-30/barrel effectively destroyed the incentive for development of new technologies. There is also much potential to switch to abundant low-cost substitutes, such as natural gas: global reserves held by the majors have risen by more than a third since the early 1990s.

Policy measures - To the extent that a carbon price is introduced more widely, this will raise the oil price in the short-term, reducing elastic demand. But in the medium-term it will also induce substitutes i.e. low-carbon alternatives, further lowering the demand for oil. To the extent that subsidies for fossil-fuels – which are important in a number of developing countries, including India – are removed or reduced, this will tend to reduce demand, and lower the oil price."

In summary, we expect to see oil prices start to decline as production in the US impacts markets. This should be a major boost to transportation, especially the airline industry. Among the US airlines, Delta's decision to bet on keeping older aircraft in service looks like it could become a winning strategy. Its capital has been preserved by not ordering new aircraft to the same extent as its competitors. However the impact on OEMs and engine makers could be harsh. If oil prices do fall, as expected, back to $65-$70 per barrel levels, there is likely to be sharp reduction in the new orders and huge backlogs for re-engined narrow-body aircraft.

The question today is whether the OPEC cartel can be broken, or whether market forces take over and enable the supply-demand balance to reach an appropriate equilibrium. We're betting on the latter.

No. 78, July 23, 2013 Passenger experience becomes part of product strategy

Passenger experience—that which travelers have on board aircraft—has become a major part of Boeing's product strategy for improving its current airplanes and for the 737 MAX and 777X.

In briefings ahead of the Paris Air Show (PAS), three executives made a point of emphasizing the increasing importance of passenger experience as Boeing moves forward with future airplane programs.

Airlines have increasingly relied on ancillary revenue to produce profits. This isn't just the likes of RyanAir, Spirit Air or Allegiant Air. Legacy carriers are turning to fees to produce profits that tickets can't.

US Airways, for example, at its April 2013 media day indicated it expects around $600m in revenue to come from fees. This basically will account for its entire profit in 2013.

Boeing designed the 787 interior with passenger experience in mind. The basic design migrated to the 737NG in the form of the Boeing Sky Interior and to the 747-8I. The space-age look is a step ahead of the interiors of the 20th Century, but Boeing said in its PAS briefings that by the time the 777X enters service (c. 2020), the 787 interior will already be obsolete. So Boeing is already working to further enhance the interior look and feel.

But passenger experience doesn't end there. Boeing didn't go into detail, but officials said they are focusing on how they can enable customers (i.e., airlines) to maximize ancillary revenues. This is an all-encompassing approach: in-flight entertainment systems, seating options and who-knows-what-else that Boeing can come up with.

Boeing is not alone in this, of course.

Airbus suggested in May 2012 that its A320s could be reconfigured to have 20-inch seats on the aisles to be sold for a premium. Unfortunately, this comes at the expense of the middle and window seats, where width is reduced from 18 inches to 17. So two-thirds of the passengers would have a worse passenger experience for any airline taking up this option. Still, it's an innovative idea, and Airbus gets credit for offering it. We're not aware of anyone taking up the option, however.

Bombardier suggested its 19-inch middle seat on the new CSeries (an inch wider than the already larger-than-normal window-aisle seats) could command a premium for the extra room. We think this a stretch, but setting aside the pricing suggestion, BBD at least recognized that the passenger experience in the middle seat generally sucks and did something about it.

Airbus seems to be going the other direction in passenger experience for the A380. Faced with the prospect of the proposed 777-9X offering similar seat-mile costs as the larger A380, which is more risky to fill given its capacity, Airbus suggests going from 10 to 11 abreast in coach class. This lowers CASM—and it also lowers the passenger experience standard Airbus has spent years promoting for the super-jumbo.

Boeing is trying to make a silk purse out of sow's ear with the 777X. It plans to re-sculpt the interior to allow for four more inches of room, enabling about quarter or half inch to seat width. We're not sure that 17.25 or 17.5 inches from 17 inches will make a material difference.

As Boeing (and presumably Airbus) ponder the replacements for their single-aisle aircraft, will the OEMs simply widen the fuselages to allow extra seat room or will these become twin-aisle aircraft to further enhance PaxEx?

Airlines and the seat-suppliers have been moving toward slim-line seats in coach. Purportedly these allow the same legroom at 31 inch pitch as standard seats allow at 32 (or even tighter). This may be so. We've been on several flights with these seats and leg room seems to hold up. But the seats also feel like they have less recline and it's like sitting on a wooden park bench. Those coach seats where the bottom moves along with a shallow recline also leave us wanting. Finally, even for an average height of six feet, these seats don't provide neck or head support to nap, or worse, in an accident. Whiplash is a distinct possibility.

Passenger experience continues to be a schizoid experience.

No. 79, July 30, 2013 WILL AIRBUS AND BOEING END THE PRICE WAR?

The narrow-body market has been flooded with orders, with both Airbus and Boeing holding record backlogs, resulting in only a few delivery positions available through 2020. But in achieving these record high backlogs, the companies have been heavily discounting aircraft, with price reductions greater than 50% off list prices commonplace for large orders. Airbus jumped out to an early lead, launching neo in an attempt to block market entry by CSeries and gain an advantage over 737NG. Boeing, mired in 787 problems, was unable to launch an all new aircraft, and was forced to quickly react with MAX, which was announced during the heat of battle for the American Airlines order, which was split between the manufacturers.

Paris 2011 was the year of the neo, and Farnborough 2012 the year of the MAX, as each gained significant footing in the market. Since then, it has been a battle of discounting, with Airbus taking a higher market share in the re-engined market. But why discount heavily in what is essentially a duopoly environment? Part of the reason has been to preclude future competition, and the strategy appears to be working well.

Three years ago, the prospective glut of competition from Embraer, Bombardier, COMAC and Irkut appeared to spell a significant future market share reduction for Airbus and Boeing in the narrow-body field. Thanks to the aggressive discounting and locking up record backlogs, that threat appears to now be fading somewhat. The programs from COMAC and Irkut appear to be facing significant delays, with only domestic customers. Bombardier's potential traction with the CSeries has been delayed enough that a potential stretch version that could become a direct competitor at the heart of the market has been delayed. While Bombardier and Embraer will likely take the former A319 and 737-700 market segments, as they did with the similarly less efficient A318 and 737-600 previously, Airbus and Boeing will focus on the more profitable A320/321neo and -8/9 MAX models which provide them higher unit revenues.

We expect Embraer to continue to be successful with its EJet program, and Bombardier to succeed with their CSeries against the A319neo and 737-7MAX. While we do expect China and Russia to eventually succeed with their aircraft, we no longer expect significant exports for either program, which will focus on domestic markets. Even so, the 10 aircraft per month from Bombardier and potentially 10 from Embraer, along with 5 each from COMAC and Irkut will, by 2020, begin to change market dynamics. Their impact on the supply/demand balance will likely result in an oversupply bubble in the narrow-body market.

As of 28 July, Airbus has generated 2,348 firm orders and 846 options for the neo family, while Boeing has generated 1,491 firm orders and 834 options for the MAX family. The market share for the re-engined aircraft is 61.2% for Airbus and 38.8% for Boeing on a firm order basis, and this market share has been holding fairly steady over the last few months. We expect this trend to continue, as from our independent calculations, the aircraft are very close economically, with a very slight edge, and future growth potential, to the PW GTF equipped neo.

In recent days, we've heard some interesting statements from Airbus and Boeing regarding the marketplace, focused on the narrow-body space. Airbus indicates that it is not interested in maintaining a market share of more than 60%, despite their belief that they could obtain a two-thirds share in the

marketplace. Boeing still indicates that it would like to achieve 50% of the market as its goal. Adding these together, one still gets 110%, which isn't possible. With the Airbus and Boeing success at killing the market for potential competitors, who were very quiet at Paris, will the price war ease off, or will both continue to cut prices to gain share?

We believe discounting will ease, for several reasons. First is the heavy backlog and relative scarcity of delivery positions. While we believe some positions may be speculative, the current order books are filling up to capacity, eliminating the need to further discount in the near term. Second, the immediate competitive threat from CSeries has not materialized to the degree feared, and the Chinese and Russians appear stalled. As a result, with the competitive threats eliminated to a great degree, duopoly pricing can return. Third, both companies have significant development projects underway in both the narrow-body programs as well as the A350, 787-10, and 777-X wide bodies, and need positive cash flow.

The Bottom Line

Don't expect massive discounting of narrow-body aircraft to continue, as Airbus and Boeing are again well positioned competitively, no longer as worried as they once were about potential new competitors, and will soon focus on their more profitable models and cash flow.

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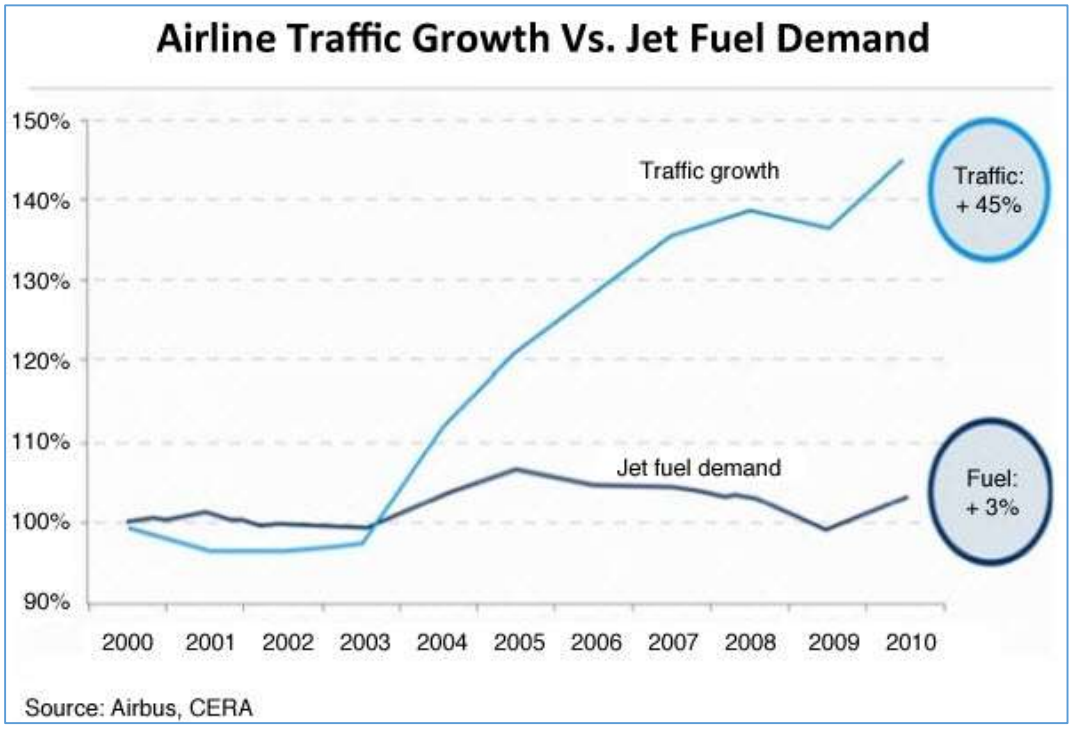
No. 80, August 6, 2013 Seeking Even the Smallest Margins

Airlines are constantly seeking ways to reduce operating costs. The principal target focused on today is fuel costs. The following chart illustrates how efficient airlines have become over the last decade. But as impressive as this chart is, one can see the fuel demand curve has spiked up after a steady decline – a sign of weakening progress in gaining fuel efficiency. The airline industry needs its next step change in technologies to keep the fuel demand curve on a gentle decline. What technologies are on the horizon that will generate the gains in efficiency that the industry needs? Two items we have been watching, winglets and electronic taxi, are particularly interesting because they be applied both to current as well as future aircraft.



Winglets

The introduction of the first winglets on the Boeing 737 created quite a buzz. Dr. Louis Gratzer, Chief Aerodynamicist at Aviation Partners Boeing (APB) was the creator of this technology. Its impact was without doubt impressive – it's rare to see a 737 without winglets in the developed world these days. APB claims that some airlines have seen fuel burn drop off by as much as 6%. On the 767-300ER airlines can expect to save 600,000 gallons per year - roughly $1.8m. For an airline, such savings add up quickly. But business jet operators have seen even better numbers.

While winglets have proven themselves, the technology has continued to improve. Boeing developed its own advanced winglet for MAX. See a video here. Boeing claims the new winglet, combined with new technology engines, delivers 13% better fuel burn over the NG. While most of that is from the engine, the new winglets are an important element of the overall package. Performance improvements of that

magnitude get the attention of airlines. Even in the world of exaggerated claims by OEMs, a 5% improvement in overall operating costs is quite significant.

Airbus has also entered the winglet era with its "sharklets". Airbus' legal challenges with Aviation Partners are headed for arbitration in London next year. Airlines ordering the single aisle Airbus aircraft are selecting these new winglets for the same reason 737 customers requested them – fuel savings. Airbus now builds all its A320 family wings with sufficient strength to handle "sharklets", whether they are ordered or not to enable future retrofit. Airbus claims a 3.5% improved fuel burn, and has hinted that the numbers may even better than that for some routes.

Aviation Partners has moved ahead again with a radical design, called Split Scimitar. At first glance it looks similar to the new MAX winglet, but it is quite different. Aviation Partners claims "would net a cruise performance gain of over 30-40% above the original Blended Winglet configuration". The promises of such improvements have brought a number of airlines forward; United is the launch customer and TUI a recent additional to their order book for retrofits. United expects the new Split Scimitar winglet to result in approximately a two percent fuel savings for their existing 737 fleet once retrofit.

e-Taxi

A relatively new area attracting attention is e-Taxi. This attention came more into focus during the recent Paris Air Show, as pioneer WheelTug was joined by Honeywell/SAFRAN in having demonstrated the concept on a real aircraft. E-Taxi represents potentially significant savings for airlines in a number of ways, some of which are beyond simply fuel and result from quicker turn times and better operational efficiencies.

For single aisle aircraft, the primary focus of e-Taxi efforts, the savings can be surprisingly high. While fuel savings are an important element, they are not the only source for savings. A typical aircraft doing five daily turns spends some 15 minutes of taxing per cycle. E-Taxi allows for much lower fuel burn – four gallons per hour compared to 18 gallons per hour using one main engine or a 78% lower fuel burn during taxi. But the real benefits are not immediately visible.

Using electronic taxi reduces FOD damage to engines, which typically occurs during taxi, and improves engine maintenance costs. The real benefit is reducing turn times, because towbars, tugs, and other equipment can be eliminated, and personnel shifted to utilize a second door on the aircraft. That significant reduction in ground time is money in the bank for an airline, which would typically fly an additional daily flight utilizing the same asset. A 1/6th reduction in capital cost is significant for a narrow-body fleet.

Look at an airline like United with 330 single aisle aircraft plus 100 MAX on order. Were United to deploy e-Taxi on its 330 single aisle aircraft, the combination of savings from reduced fuel burns, reduced turn times, lower engine maintenance, and improved asset utilization would be as significant as the 4 to 4.5% reduction in cash operating cost between the 737-8 and today's 737-800NGW.

The beauty of these enhancements is that they can be retrofit, and even older aircraft can benefit from implementing them. Given the long delays for many airlines in taking delivery of the next generation of aircraft, deploying winglets and e-Taxi could have a significant impact on lower operating costs for aircraft in fleets today. In fact, for many airlines these two items could represent an excellent way to hedge against the long lead times because of existing backlogs that stretch to 2020 for some models.

The airline industry is a cyclical business and it has often been said that airlines order when times are good for delivery during the next slump. A potentially intriguing strategy for an airline might be to not add to the backlog for new aircraft, but instead upgrade its existing fleet with advanced winglets and e-taxi, and wait for the next downturn. At that point, they could then step up and pick up next generation airplanes at lower pricing when some orders inevitably are cancelled, or order new aircraft with much shorter lead times that today's record backlogs. The economics are compelling.

No. 81, August 13, 2013 The Emerging Airport Infrastructure Gap

Industry forecasts for commercial aircraft show considerable growth over the next two decades, with upwards of 25,000 aircraft to be delivered in most forecasts, the majority of them to accommodate growth. In an unconstrained world, the Asian market, including India and China, will continue to grow at a double digit pace. But when we look at the capacity side of the issue, finding enough airports for these aircraft appears to portend a problem.

China currently has 180 commercial airports, with 82 new airports currently under construction. India has 84 air carrier airports, 62 domestic and 22 international. Brazil has 132 commercial airports in operation, and the United States has 503. Given the vast population differences, comparing these countries on a per-capita basis illustrates the significant difference in aviation infrastructure.

Country	Commercial Airports	Population (millions)	Commercial Airports per Million Population
USA	503	313.9	1.60
Brazil	132	196.7	0.67
China	180	1,344.0	0.13
India	84	1,241.0	0.07

Much of the growth in the aviation forecasts provided by Airbus, Boeing, Bombardier and Embraer all show substantial growth in the Asian markets. While both China and India are upgrading their airport infrastructure through massive projects, it will take some time before they are able to reach the capacity of more developed countries, particularly for domestic routes.

While the major hubs in China and India are comparable in size, or in the case of Beijing, even larger than counterparts in the US in terms of passenger throughput, the major cities do not yet present capacity issues, but will soon do so at current growth rates. 53 of the 180 commercial airports in China have carried more than 1 million passengers over the past year. But the access to the more remote provinces in the country currently without service remains difficult. Some large cities, such as An Yang, considered small by Chinese standards, has a population 7 million people, roughly the population of New York City. Yet there is no commercial air service and the city is difficult to access.

As Chinese hubs become more constrained because of additional feeder airports, will there be adequate capacity to sustain growth in narrow-body aircraft, or will slot and gate constraints force less frequent domestic services utilizing short-range wide bodies? If we extend the current growth curves, Beijing and Shanghai will both require 2 or 3 major airports within the next two decades. Airbus and Boeing aren't creating "lite" versions of the A330, A350 and 787 without reason, as they can also see the writing on the wall. It is also notable that there haven't been many neo or MAX orders from China. Perhaps capacity constraints are influencing demand.

In India, Delhi and Mumbai are already quite overcrowded, with circling delays of 1 hour common during peak hours, creating inefficiencies for the domestic network. But as these major cities continue to expand, it is ever more difficult to find a parcel of land suitable for a new airport without displacing people, or moving it far from the city to a less convenient location. Traveling from Mumbai airport into downtown

can often take over an hour to travel a few miles on the crowded roadways. While a new airport has been planned at Nuvi Mumbai for the last decade, it seems permanently stuck in limbo given Indian politics. We don't see much relief in the near future for India.

An alternative, at least in China, is high-speed rail. With the largest high speed rail network in the world, there is pricing pressure on domestic airlines, as rail service is cheaper, and while not quite as fast, often more convenient from a door-to-door perspective. As a result, the yield pressures may make it difficult for China's domestic airlines to compete without cutting fares, which in turn may spur demand, and can in turn exacerbate capacity issues. Balancing the transportation system in emerging countries will not be an easy task.

The Bottom Line

If we gaze into our crystal ball to receive an image of the future, we foresee increasing congestion, a lack of slots and a need for increased capacity at major hubs to serve feeder traffic, and a lack of reliever airports near large cities that could handle domestic operations. New York has JFK, LaGuardia, and Newark. London has Heathrow, Gatwick, Stansted and Luton, and is looking at expansion options. Yet Beijing, Shanghai, Delhi and Mumbai each have one major airport, yet larger city populations.

Long term, it simply doesn't add up, and the growth curves will inevitably come up against constraints. Look for 787s and A350s replacing 737s and A320s in the domestic markets 10-15 years from now, with reduced frequencies and larger aircraft.

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No. 82, August 20, 2013 American Airlines/US Airways – now what?

The US DOJ, various state attorneys general and the District of Columbia have filed challenging the American Airlines (AA)–US Airways (US) merger. This news was not what was expected by any industry followers. The previous merger between Delta and Northwest went through without a hitch, followed by United and Continental and then Southwest and AirTran, all of which were approved. How is this merger any different?

It can't be competing routes. Delta and Northwest had 12 overlapping non-stop routes, United-Continental 11, and Southwest-AirTran 18 routes. USAirways and American overlap on 12 – so that certainly can't be the reason. It appears that the Department of Justice has decided, after three mega-mergers, that a fourth will be anti-competitive and changes the nature of the industry.

Up to now the US has been leading the airline industry in turning around its profitability. This has been enabled by two key issues; consolidation and capacity discipline. Capacity discipline has led to much higher load factors and, even with high fuel costs, helped airlines improve their efficiencies.

The following chart illustrates the recent performance of this industry on two factors, yield and load factor. Running an airline is a risky, perishable commodity, business, with cash flows easily interrupted by exogenous factors. This industry has seen players routinely bankrupt, and needs either regulation or consolidation to endure. Its history as a destroyer of capital means that the fewer survivors need to operate in a more rational way. Ergo, consolidation and capacity discipline.

If the AA/US merger is not approved, we will almost certainly see these two airlines focus on attracting traffic to the same extent as Delta, United and Southwest. The airline business is volume driven, and the players each want the biggest slice of the pie. Profitability comes from getting as many paying customers

through the system as possible. Domestically, without a merger, neither AA nor US can effectively compete with DL-NW and UA-CO on a national scale for the lucrative business travel market.

Therefore one can understand the chagrin within the management teams at these two airlines. They are not going to accept the DoJ's antitrust position without a fight. American said it would "vigorously defend" the merger and the US Airways CEO said "we will fight them." Bill Baer, the assistant attorney general in charge of the DoJ's antitrust division, argued the merger lessens competition and results in higher fares and less service. One has to ask, where was this view with the previous mergers? It was plain as day that once one merger took place the others had to follow. Surely the DOJ has access to people who under the economics of oligopoly. The DOJ position is hard to defend.

As the chart illustrates, US airline consolidation has provided financial stability. The most recent years show yields and load factors improving. Yes fares are higher but the economy has not been strong – yet people are flying more every year. And a more stable airline sector is going to create jobs, something the US economy dearly needs.

The concern with rising fares needs to be seen in context. The US airline club, Airlines for America (A4A), provides a useful historic view. To keep it simple we selected the average fare in constant 2000 dollars. As A4A describes it, "From 1979 to 2012, the U.S. CPI rose from 72.6 to 229.594 or 216 percent. That means that in constant Year 2000 dollars (in "real" terms), the average round-trip domestic fare fell from $441.69 in 1979 to $266.82 in 2012. Including reservation change fees and bag fees, the average round-trip domestic journey price fell from $442.88 in 1979 to $283.97 in 2012".

When looking at the trade off in terms of public policy it appears to us that the airline industry deserves the break. It has had to suffer tremendous capital destruction – both in financial terms and human terms. Taking a job with an airline is not the attractive option it might be been long ago. The US airline industry has been hampered with taxes unlike any other industry as well – politicians see air travel as a well that never empties. Much as airlines are an unending source of jokes, the reality is that this industry has been hammered for decades.

Public policy is not being served by denying the AA/US merger. Fares would need rise by over 200% to get back to 1980 levels. That is hardly a big fear. But there are thousands of people who could use a job.

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No. 83, August 27, 2013 DELAYS AND CROWDED CABINS

We're coming into the hurricane and stormy summer seasons for North America, which can shut a hub airport and cause flight cancellations that could have airport terminals looking like makeshift hotels. A major reason airports will fill up with passengers is that they cannot be re-accommodated because of the success of airline yield management systems and their effectiveness in filling cabins.

Looking back over the past 50 years, load factors were much lower, averaging about 65% until yield management systems began to dramatically reduce the number of perishable seats that went unsold. While there is still a Tuesday in each week, and the chance that flights won't be quite full, finding an empty seat next to you on a flight is a rarity these days.

That lack of empty seats leads to cascading delays. Let's compare the number of flights it would take to accommodate all of the delayed passengers assuming a historic 65% load factor versus today's 82% load factor. The following table shows how passengers from a single cancelled flight would be fully accommodated by the 3rd flight following a single flight cancellation. With a 65% load factor, 98 passengers would require re-accommodation, and could be readily accommodated in 2 additional flights. With 4 flights per day in most markets, unless the last flight of the day is cancelled, overnights and hotel stays would be minimized.

Flight	Total Seats	Empty Seats @ 65% load factor	Needing Seats	Total Accommodated	Flights to Fully Accommodate
1	CANCELLED		98		
2	150	52	98	52	1
3	150	52	46	98	2

Now assume an 82% load factor, what the US industry has recently been averaging, and difficulties with delays become more apparent. The 123 displaced passengers would not by fully accommodated until the 5th flight after cancellation, which in many markets means an overnight stay.

Flight	Total Seats	Empty Seats @ 82% load factor	Needing Seats	Total Accommodated	Flights to Fully Accommodate
1	CANCELLED		123		
2	150	27	123	27	1
3	150	27	96	54	2
4	150	27	69	81	3
5	150	27	42	108	4
6	150	27	15	123	5

It now takes more than double the number of flights to fully re-accommodate all of the passengers for a single flight delay. But what happens when bad weather hits, and three consecutive flights are cancelled? The following table presents a picture of how long the recovery might have taken in the old days - about 6 flights - perhaps a one day delay.

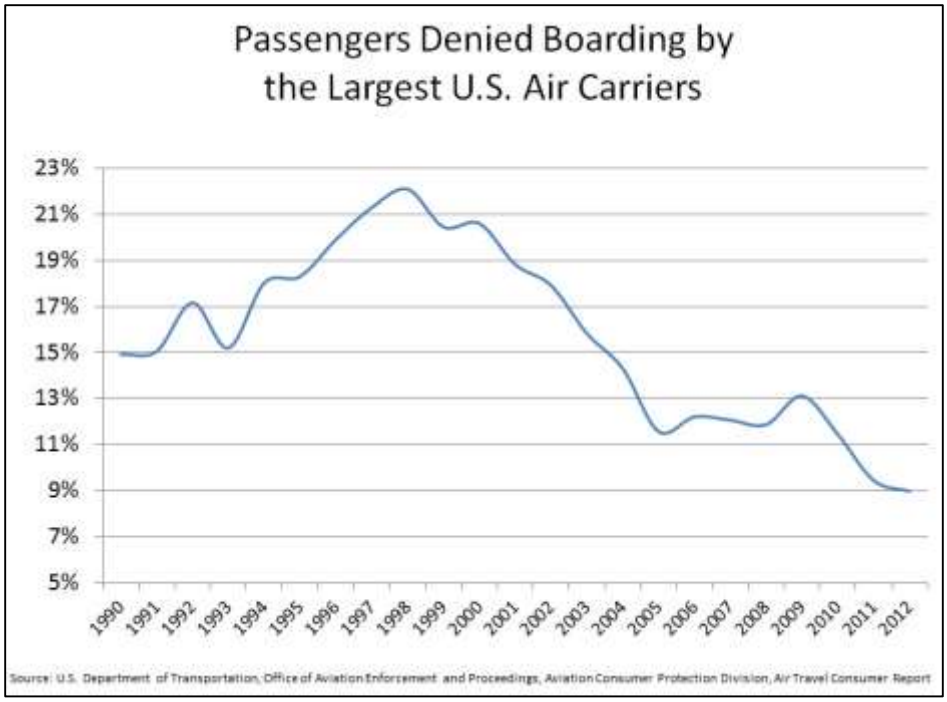
Flight	Total Seats	Empty Seats @ 65% load factor	Needing Seats	Total Accommodated	Flights to Fully Accommodate
1	CANCELLED		98		
2	CANCELLED		196		
3	CANCELLED		294		
4	150	52	294	52	1
5	150	52	242	104	2
6	150	52	190	156	3
7	150	52	138	208	4
8	150	52	90	260	5
9	150	52	38	294	6

But with today's higher load factors, three cancelled flights can lead to lengthy re-accommodation delays, particularly for those on the third cancelled flight.

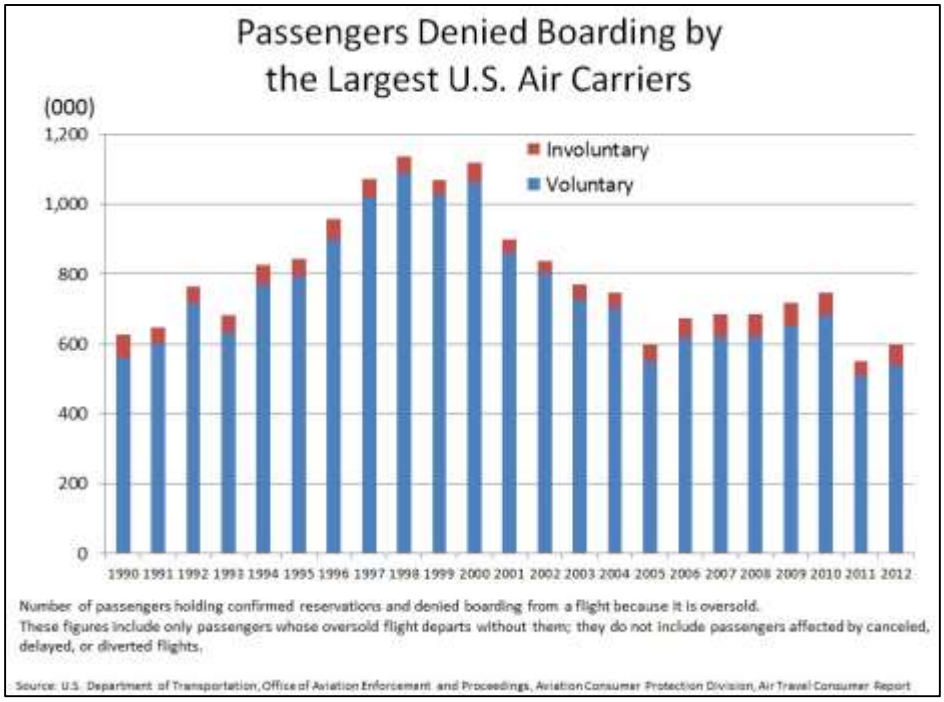
Flight	Total Seats	Empty Seats @ 82% load factor	Needing Seats	Total Accommodated	Flights to Fully Accommodate
1	CANCELLED		123		
2	CANCELLED		246		
3	CANCELLED		369		
4	150	27	342	27	1
5	150	27	315	54	2
6	150	27	288	81	3
7	150	27	261	108	4
8	150	27	234	135	5
9	150	27	207	162	6
10	150	27	180	189	7
11	150	27	153	216	8
12	150	27	126	243	9
13	150	27	99	270	10
14	150	27	72	297	11
15	150	27	45	324	12
16	150	27	18	369	13

In a market with four flights per day, the last passenger to be accommodated would have a three day delay in getting home. And, of course, major storms often cancel more than three flights, exacerbating the problem. The question for airlines is how they establish priorities for re-booking, and how to get to the head of the line. There are two answers, money and frequent flyer status.

How big is the problem today? A reasonable guide to the issue is denied boardings, which is tracked by the US DoT and shown in the next chart.



It would seem that airlines are effectively managing denied boardings even with much higher load factors. However, the volume of people impacted by denied boardings is significant, as the following chart will illustrate. Typically around a minimum of 600,000 people go through this each year in the USA. Airlines have effectively kept the involuntary numbers low. Travelers in the USA are familiar with the refrain "We are in an overbooked situation and are offering $xxx in compensation if you take a later flight".



First Class passengers and full fare passengers are the first to be accommodated, as they provide the airlines revenue lifeblood and paying the most, they should be entitled to some benefits. Next in line will be the most loyal customers of the airline - the diamond, platinum, gold, and silver tier frequent flyers, with different priorities. A diamond level million miler, even on a discounted ticket, would likely obtain a higher priority than a non-elite level traveler at a higher fare, as that loyalty is appreciated by the airline. But the process is one of the state secrets at an airline - how re-accommodation priorities are established.

Our advice for passengers:

1. Watch the weather, and try to avoid a major storm.

2. If you must fly during a storm, purchase a full fare refundable ticket. Yes, it will cost more, but it provides you more flexibility when it "hits the fan."

3. Fly on the carrier with whom you have the most loyalty and the highest status, as you will obtain priority treatment in the event of a cancellation.

4. Be patient, but look for alternatives from nearby airports, which may have flight availability, even if well out of your way. Florida to New York via Chicago today is better than waiting for a non-stop tomorrow.

Our advice to airlines:

When a storm hits, accommodate passengers by openly endorsing tickets. This means the airport's full available capacity can be used to get everyone out. It may cost some revenue, but in an age of social media, you do not want images of mayhem online and your brand highlighted. Your pressurized airport staff will appreciate this act of kindness, too. Watch your brand image because because videos and images stay online forever. Swallow the revenue hit and minimize the long tail pain.

Advice for OEMs:

Airlines are focused on capacity control, and prefer not to increase frequencies or add additional aircraft in many markets. But airlines also find their capacity frequently tapped out when average load factors are over 80%. There are two answers to that problem, one short-term and the other longer-term. The short-term solution is more seats on each aircraft, which the new generation of thin-line seats is permitting, a la Southwest and Lufthansa. The longer-term solution is larger aircraft serving growing markets. With the airlines in better financial shape than they have been in a long time, the narrow-body fleet replacement cycle has accelerated. And with new, more efficient smaller aircraft emerging, the existing 737-700s or A319s are being replaced either with larger 737-8MAX or A320neo, or could be by more efficient CSeries and E2 models. For Boeing and Airbus, the strategy is to push larger models in the current replacement cycle. For many markets, the E-Jets and CSeries provide an excellent alternative to older RJs as well as 737-700s and A319s at the high end of the segment.

No. 84, September 3, 2013 MIKE PLATT – UNPLUGGED

This is a transcript of our Unplugged interview with Mike Platt, CEO of LCI Aviation. You can listen to the interview here: http://wp.me/p1qk0u-1AH

Addison Schonland ("AS") and Michael Platt ("MP")

Today is August the 30th 2013, This is Addison Schonland, and today I am speaking with Mike Platt who is CEO of LCI Aviation. Mike, Thanks so much for taking the call, and perhaps we can start off, if you could tell our audience a little bit about your company.

MP: Sure, Thanks Addison. LCI is an Aircraft leasing company this has been around for about eight years. It's part of a conglomerate of companies, a family owned conglomerate that has its roots in the shipping industry. It's a Greek family owned company, with multi-generations in the shipping industry. About eight-ten years ago, the company sold a number of ships, took some profits off the table, and looked at other investment opportunities. They diversified into a number of businesses, including aircraft leasing. At that time it was only fixed wing aircraft leasing. We now have a hospitality company and own a number of hotels under our own brand, and manage other brands as well. We have a renewable energy company, we have a real-estate investment company, a development company, and a number of other things we do as well. Obviously the shipping company continues to be a large part of the Libra Group.

So that's where we started. When they started the aircraft leasing company, which is the company I am the CEO of, they originally started by purchasing aircraft from other lessors. The first one they purchased from was IFLC, and at the time I was handling aircraft sales at ILFC and developed a good relationship with the Libra Group. Eight years later, I joined them as a CEO. So, that's the brief history of the company. About two years ago we entered into the helicopter leasing business, and we'll talk about that a little later.

Our company is a niche player in the aircraft leasing business. We do things a little bit differently than others. Coming from our shipping roots, we certainly understand things like cyclicality and volatility, which are much more extreme in the shipping business. So that's in our roots, and that's in our DNA. We tend to be in the market using that understanding. We know that it's very important to buy the right products at the right time, and also to sell those products at the right time.

We have a small but very, very highly skilled fantastic team of people, both at LCI and at the Libra Group. And we do use the resources of the Libra Group from time to time. We have a very relationship driven business, both with our customers, our suppliers and our banks. We have very, very deep banking relationships which cut across the group, so some of the banks that finance ships also finance aircraft, may also finance real estate projects, or other things that we do. So there is a very deep relationship there.

With our customers we try to differentiate ourselves by doing more than just being either a source of aircraft or a source lease financing. Probably the best example of that is with our largest customer

Singapore Airlines, where we have 8 A330-300s currently on lease. We spent a great deal of time with them, and we've done all sorts of fleet planning and forecasting exercises with them. We've tried to help them in many ways and I feel that they value that relationship and that friendship. They value an outsider's perspective. That kind of thing is important to us. We are not huge, so we have a limited number of customers at any given time, and those relationships are extremely important.

I'd say going down the list of other things that distinguish us, we are a very creative company. We'll do things that others wouldn't do, or couldn't do, for a number of reasons. We are unencumbered by a number of certain accounting concepts. We report to only one shareholder, one family. We don't have shareholder issues, and we don't have to manage earnings every year. We don't have to do things that others might have to do, and that gives us the ability to listen to our customers and provide them with some kinds of creative structures and products that they may not find elsewhere.

AS: How about the industry leasing model? The airline industry seems to be using more externally financed and leased airplanes, as opposed to the good old days; you may recall Northwest used to be famous for buying all their own airplanes. How do you see that evolving?

MP: I think we are now getting close to getting close 50% of all aircraft being leased. Between the large order books that mega-lessors have, and the sale and lease backs that you see, it's a huge percentage. I've been in this business for about 25 years and when I started it was in the low teens, maybe even below that, and it's grown every year. I think If you look at some of the problems that leasing companies have with older aircraft, where the value of those aircraft (the market value) are well below their book value, airlines are seeing that it's better for somebody else to take that risk. I think airlines also aren't the most efficient users of the tax benefits of aircraft ownership, so they may not be as good at financing aircraft as leasing companies can be.

I think leasing is going to continue to grow, I think that you'll see a combination of things. You'll see operating leasing, more tax driven leasing over time that seems to move around the globe wherever tax benefits exist at any given time. You're even seeing leasing on things like A380's with Doric. So the entire spectrum of aircraft from turbo-props to A380's is now available under an operating lease model. So I see that growing, but I also see some opportunities for consolidation the aircraft leasing market. There are so many participants now, and it's also cyclical. It comes and goes. You see large sums of money coming in from Asia, from Japan from China. You see interest in people getting bigger, who have access to large piles of money. So I think we will see some consolation.

AS: You mentioned early on about helicopters. Leasing helicopters probably touches with a whole different set of customers than the airline business. Can you walk us through the synergies between these two, or will these always be separate business units?

MP: They will always be separate businesses, but there are synergies in managing those separate businesses. For instance, we've been in the aircraft leasing business for a long time, some of our people have been doing it for 40 years. The concepts of how to lease aircraft, how to market the value of leasing, how to deal with the accounting issues, the tax issues, the importation issues, return conditions, insurance issues, for all that stuff there are great similarities. It's pretty efficient to have our back office team, if you will, do both. And that's what we're doing now. But we are running them as two separate entities, two

separate legal entities, two separate accounting entities that are audited independently, but currently we're using the same management team. We are, however, adding some more dedicated helicopter expertise, and we've added an industry-leading advisory board that is very active on the helicopter side. So while we can run them both with the same management team, we are bringing in some real helicopter expertise.

As far as the other kinds of synergy go, it is a completely different market. With fixed wing, you lease to airlines and the end users of those are really passengers. In helicopters, or at least a large part of the helicopter market that we're in, we're leasing to helicopter operators, and their customers are large oil and gas companies. So the oil and gas companies determine they have a need, that they have a platform to get workers to. So they put out a tender for helicopters and a bunch of helicopter companies will bid on those tenders. So it's very, very different.

You have to understand the oil and gas market, who the different operators are, and how the tender process works, so it's very different. In most cases helicopter operators will not lease equipment until they've won a tender, so you have to follow the tender process very, very carefully. It's a mistake to think that the people that are out there marketing fixed-wing will be marketing helicopters and seeing some of the same operators because it is a different knowledge base. We are converting some of our fixed-wing marketing people into being helicopter marketing people, and they will be able to do both. But it is very, very different.

I should say that we find some synergies within our Libra Group. For instance our shipping company owns platform supply vessels and anchor handlers that service the same oil company clients that our helicopter will ultimately service. We have an energy company, a renewable energy company, that has wind farms and now you're seeing off-shore wind farms that are serviced by helicopters. So there are some synergies within the Libra Group in addition to the banking synergies that we find pretty helpful.

AS: That seems to be an interesting aspect for vertical integration, right there, in the helicopter area?

MP: Yes, and I think right now we're using it for a market knowledge base, we're using it for some introductions, and we're using it really for our understanding for where markets are going. There is definitely some, although I don't know if I'll say its real vertical integration yet, but there is definitely some value in being in multiple places in the same market.

AS: My last question for you, I can understand that you would be reluctant into going into too much detail about fleet decisions, but your company was one of the early buyers of the CSeries. I am very interested to find out about how you went about the process of selecting this airplane, and I'd like to know if you have any background that you can share with us on that decision.

MP: Sure. First I should say I've been with LCI now about two years, so this CSeries contract was done before I joined LCI. That being said, it's a very interesting project. We like to do things that not everyone else is doing. We don't want to compete with the GECASs and the ILFCs of the world. We need to find our niches. The CSeries is going to be a fantastic airplane. It's a great airplane, and has great engines. At the time we did the deal, not everyone was convinced on the engines, for instance. But now if you look at the Pratt Whitney geared turbo-fan engine, it's on 5 different platforms including the new A320 family. So I don't think there is any doubt that it's a fantastic engine.

Its an airplane that offers about 20% fuel savings over the competitors, and it's replacing a bunch of shrinks. So if you look at what it will replace, planes like 737-700's and A319's which are inefficient because they are shrunken versions of larger aircraft, which necessary makes them heavier and less efficient. And I think if you look at the market and look at where lease rates are today on 700s and 319s, airlines have figured out that it's really hard to make money with those airplanes.

So this is the first time that I can think of, and maybe the first time in history, that a smaller aircraft will have better seat mile cost, lower seat mile costs, than a larger aircraft. Convincing airlines of that is a job that Bombardier needs to do, and we've been out there talking to airlines and I think people are starting to get it, starting to understand the economics of the airplane. Nevertheless because -700s and 319s are really cheap, and you pick them up on lease for a very low cost, it's difficult to break into that market, so Bombardier has got its challenges. Over the long term we think that the 700 and 319 market, even the last off the line classic airplanes that are being offered, will get absorbed, the markets will firm up a little bit and we'll see places for these aircraft.

All the airlines that we talked to about the CSeries think it's a fantastic airplane, and they're just trying to justify the economics of adding a fleet type, or having two different fleet types operating, and the cost of integrating a new fleet type with new maintenance and pilots, etc. Those are the issues, not the aircraft itself. We still have high hopes that this is going to be a successful program. The airplanes is about to fly, any day, any week. They've done the low speed taxi test, I believe this week they will do a high speed taxi test, if not this week then next.

AS: And they've just got their certification from Transport Canada.

MP: Right, so they've got that. That was due this week, and whether it is next week, or the week after when it flies. I can't really tell you, but I do think that once it flies, the conversations with some of these airlines will start to get a little more serious. Then as delivery positions start to get taken up and people realize they just can't sit on the sidelines and wait if they want this aircraft, we'll see commercial activity pick up. That's our view of it.

So again, why do we do it? We did it because we believe a smaller aircraft with good seat mile economics and low trip cost would make sense to replace a bunch of shrunk, older technology airplanes. We saw that Boeing and Airbus really aren't that interested in the smaller aircraft space. If you look at how many 700's and 319's they sell and the way they price them I think that's evident. And we see a market, so we're still hopeful that it's going to be a good product for a long time.

AS: You just set me up with one last little item then. It's interesting you talk about airlines confronting the issue of having another sub-fleet type. Do you that think switching cost, which is what I've heard Airbus and Boeing talking about with the CSeries, is really a big factor here, or not?

MP: Yeah, I think it's a big factor. If you're a small airline and operate a couple of 737-500s and you're deciding that those are leased aircraft, and if you own the and you're going to sell them, whatever you're going to do and switch them to 4-5 CSeries, that's not a big deal, Bombardier will support that. But if you're an airline that's operating a fleet of A319's, A320's, and A321's and the 319's are not that efficient but, you're contemplating bringing in the CSeries on the smaller side, so you'd operate both the Airbus narrow-bodied fleet and the CSeries, it has to make sense. You have to have enough of them to make sense to warrant bringing in another aircraft type. You have to be replacing probably more than just one

aircraft type in your fleet, and there are examples of people that are operating multiple aircraft types on the smaller side that is inefficient. There are plenty of examples where it makes a lot of sense, but there are plenty of examples where it's difficult. It's an expensive proposition, and it's hard to beat an existing family. So this aircraft won't go everywhere that perhaps it would be the most efficient choice, because of those integration costs. But we still think there are enough good opportunities where it will go.

AS: Mike, thanks so much for sharing your thoughts.

MP: It's been a pleasure, thank you.

No. 85, September 3, 2013 WHEN EGO TOPS RATIONALITY - MALLYA AND KINGFISHER

Photo Credit Bangalore Aviation/Devesh Agarwal

Just when you thought Kingfisher Airlines was dead, and a thing of the past, CEO Vijay Mallya is attempting to resurrect it again, speaking with investor groups about re-starting the airline. But creditors for the carrier aren't buying it, so India's not so flattering imitation of Sir Richard Branson is seeking funding from other sources, including a lawsuit against International Aero Engines for allegedly faulty V2500 engines.

Headlines in India focus on Vijay Mallya blaming everyone but himself for Kingfisher's failures and he is current seeking new investors to re-finance his folly. In the meantime, debts have piled up to astronomical levels, unlikely to ever be repaid. Kingfisher's auditors question whether the company should be considered a going concern, the creditor banks have not approved the re-start business plan, and lessor ILFC has still been unable to pull its three remaining aircraft (of six) out of India, despite taking possession, due to bureaucratic snafus. The situation at Kingfisher remains the same, a total mess.

However, the annual report, signed by Mallya, which was distributed to shareholders prior to the Annual General Meeting planned for 24 September, indicated that "in view of the difficult operating environment as well as the engine problems, your company's airline operations and finances were severely affected." That statement isn't going over very well in India.

The report details an outline of a "revival plan" to restart the carrier's operations. The plan calls for a modest restart with 5 Airbus and 2 ATR aircraft, with hopes of growing to 10 Airbus and 11 ATR aircraft within 3-4 months of restart. UB Group (Mr. Mallya's beer business) has offered Rs650 crore (approx. $US97M) for this phase, with the remaining capital to come from new investors.

But these plans appear to be "pie in the sky," as the airline, per its most recent annual report, has a negative net worth of nearly Rs 13,000 crore ($US1.95B), a bank debt of RS 6,900 crore ($US1.03B) and creditors wary of supporting the revival plan, something that even Mallya noted in the annual report. He stated that "your company diligently continues its efforts to bring in a fresh infusion of funds...despite the persistent negative media statements being made by the lenders, as well as the hostile recovery action

initiated by the lenders proving to be a major concern for these investors." The report also stated that only one investor was in discussions as of 14 August.

In the meantime, KFA and Mallya are facing charges from the tax authorities over disputed payroll tax payments. The company is being pilloried in the press for its payment of Rs 4 Crore (about $US600,000) to its CEO, while many employees have been let go and payments to severed employees remain to unpaid. Clearly, Mallya has gone from the media darling of several years ago to the opposite today; a child-like failure unable to realize his own shortcomings or take responsibility for his own actions.

Kingfisher's auditors have warned that the airline is not a "going concern," and the creditors are concerned that valuations of two key properties, Kingfisher House in Mumbai and KF Villa in Goa, are currently valued at about 60% of the initial estimates. Even that amount may not be recoverable, given liens by tax authorities and employee payments due. Kingfisher loans have been reclassified as "doubtful 3" which is the worst category of non-performing assets.

Of particular concern is ILFC's difficult in repatriating aircraft from India, even after repossession of the aircraft, which are now under their control. Six months is a long time for bureaucratic issues to repatriate an aircraft, and India's airlines all run the risk of higher lease rates as a result of the increased risk from the incompetence of the government bureaucracies and Ministries involved. If India is to maintain a viable airline system, it needs international lessors to understand that recovery of aircraft after a default is an international legal right, and not interfere with lessors being able to move their assets post judgment. India has not become a high risk country for aircraft leasing, negatively impacting the competitive position of the country's international airlines, who must compete with carriers with lower lease rates.

The Bottom Line: Kingfisher is dead, and no investor in their right mind should invest in what is clearly a funeral pyre waiting to be lit.

No. 86, September 17, 2013 The Moribund Very Large Aircraft Market

The market for Very Large Aircraft ("VLA") is very small niche. We believe this market, for aircraft with more than 400 seats, will continue to be stagnant for four-engine aircraft, and will begin to grow again once the 407- seat Boeing 777-9 enters into production.

The incumbent aircraft in this sector, A380 and 747-8, are struggling to gain customers, and have shrinking backlogs as deliveries continue. The outlook for these aircraft has dimmed, and we believe sales will fall well short of manufacturer projections.

The classic argument in favor of VLA aircraft (>400 seats) is that in congested markets, a VLA makes most sense when one has limited slots. Heathrow is the poster child for this argument, as are others such as Haneda in Tokyo. But this argument has not been holding true, as growth in wide-body twins remains much stronger than for the new jumbos.

Heathrow believes the number of A380s using the airport will triple to 30 by 2020 as BA takes delivery of its A380s. But 12 out of 1,288 average daily movements isn't high penetration today. The airport is congested, already at approximately 98% of its capacity, and as a leading global hub they should be a major VLA user. With such a small user base today, adding one or two A380 or 747-8 customers can provide impressive growth percentages in operations without requiring a large number of aircraft.

In a recent interview Doric Aircraft Leasing CEO Mark Lapidus discussed the recent deal to acquire 20 A380s: "400-plus seat routes are growing very fast…Whether you listen to Boeing, whose global market forecast predicts 910 very large aircraft by 2032, or Airbus, with 1,710 VLAs, the A380 is going to be a success, and with only 30 produced in a good year, in short supply." Mr. Lapidus goes on to say "The point-to-point versus hub debate is the wrong issue," he says. "The real question is which routes are the 400-plus seat routes. There are more than 220 such routes today and they will grow to more than 400 by the end of this decade – that is in just seven years." The question is whether you serve a 400-seat route with one 400-seat frequency, or two 200 seat frequencies?

If 30 A380s produced per year is a good year, then 600 produced over 20 years is a MAXimum and well short of Airbus forecasts. Boeing has only sold 40 747-8Is. If you subtract the Emirates order volume from the A380 totals, it has not been very successful, and unlikely to change its stripes seven years after entry into service.

Airbus remains bullish on their A380 program and shared this view: "The market drivers for the A380 remain unchanged, and will be exacerbated as we enter a period of sustained growth following five years of recession. In 20 years there will be 92 mega-cities. These cities are not just where hubs are located, but rapidly expanding centres of business, industry and population that literally billions of people want to fly between." But the market drivers for A380 haven't driven very many sales, and the outlook for further A380 orders this year is limited.

Boeing is more sanguine about the prospects of the VLA segment and shared this view: "The large airplane market segment is indeed slow right now – and this has been felt in demand for both the 747 and A380."

Our view is that new technology twins, offering comparable seat-mile economics and lower aircraft mile costs, enable the airlines to be more profitable on most routes. Airlines don't want to fly empty seats, and most airlines today would rather "right-size" aircraft to a market than take a risk with empty seats. Every year has a weak winter season and every week has a Tuesday with lower traffic.

By "right-sizing" aircraft, airlines ensure profitable load factors on a more consistent basis using smaller aircraft, even if they occasionally need to turn away passengers. This risk mitigation, combined with seat-mile costs for smaller aircraft being competitive with the jumbos, has resulted in a preference for non-VLA aircraft.

Airbus, the manufacturer of the biggest VLA in terms of capacity, points out that traffic doubles every fifteen years. But not all that traffic growth will be fed through hubs. We are already seeing effective use of 787s to move traffic across the Pacific between smaller markets without direct service. Route dispersion, flying non-stop to smaller destinations rather than hubs, has been a trend for many years, and the 787 and A350 are ideal for those markets.

Moreover, while VLA sales slowed due to the current economic climate and high fuel prices, the market for long-range twin-engine aircraft has been robust. Airbus and Boeing have both seen strong sales for their long-range twins. Aircraft order decisions are driven by economics, and airlines appear reluctant to take the risk on VLA aircraft unless they are assured of filling them in very high traffic markets. Competition for premium class business travel is emerging from London City airport to New York using even smaller aircraft to "pick-off" high yield traffic.

Airline earnings on long-haul flights depend on premium traffic, and configure similarly sized premium class cabins across various aircraft configuration. Lufthansa is an interesting example with its 747-8s, running only 372 seats, technically not a VLA over 400 seats by definition, to MAXimize its business class seating configuration for high yield markets. But most airlines are optimizing their aircraft choices to fit the majority, rather than a few, markets, and are reluctant to add the expense of a new fleet type to offer additional capacity in just a few markets.

The following table shows net orders for wide-body aircraft from 2000-present. It is notable that VLAs are a small percentage of what the market has ordered, despite the congestion projections for key airports.

Aircraft Type	Net Orders 2000-present	Percent of Total
Boeing 787	936	23.5%
Boeing 777	1,002	25.2%
Airbus A330	877	22.0%
Airbus A350	682	17.1%
Total non-VLA Wide Bodies	***3,497***	***87.9%***
Airbus A380	262	6.6%
Boeing 747	220	5.5%
Total VLA	***482***	***12.1%***

Boeing says that congestion has little to do with the demand for large aircraft, contradicting Airbus' view. In Boeing's view airlines choose aircraft based on economics and mission performance. Focus on economics has led to some up-sizing of aircraft, as seen with 50-seat RJs being replaced by larger RJs. But at the high capacity end of the market, we've seen carriers downsizing from 747-400s, replacing them

with smaller 777s. While carriers like British Airways are buying only a few A380, they are acquiring a large number of A350s and 787s. United is not replacing its 747s with VLAs, nor is Delta. The current trend is that airlines that formerly operated Boeing 747s are unlikely to replace those with four-engine VLAs on a one for one basis.

In our view, the VLA market is likely to remain stagnant for some time. There will be exceptions – Emirates, for example, and its deployment of A380s to secondary markets. Airlines that have ordered VLAs to date are going to focus on thick routes where economies of scale work in concert with slot congestion.

We don't project more than 30 A380s built per year and even fewer 747-8 passenger sales. With equivalent or better seat-mile economics coming from new large twins, including A350-1000 and 777-9, the old rule of thumb that the largest aircraft have the lowest seat-mile costs might no longer hold true. This is true in the narrow-body range with the Bombardier CSeries against larger A319 and 737-700, and will be true for the next generation of wide-body twins, A350 and 777-X, against today's four engine VLAs. The day of the four-engine airliner is waning, and we might not see a new four engine aircraft after the A380 and 747 cease production. Today's offerings in the VLA range are becoming less economically attractive when compared with the next generation of twins.

If Airbus is to meet its sales goals for the A380, it may require either a stretch or re-engining (or both) to regain the lead it once held in seat-mile economics. The incremental improvements since entry into service have been positive, but will not be enough to overcome the comparable seat-mile and lower aircraft mile economics of A350, 787, and 777-X.

We believe that the VLA market, which is smaller than industry analysts projected when A380 and 747-8 were introduced, and will continue to shrink, as route dispersion and the "right-sizing" of aircraft to routes continues to drive airline fleet decision-making. Of course, there will be routes well suited to the A380 and 747-8, but many of these have already been developed, and congestion has not yet reached the point to force increases in gauge at most airports. As a result, we believe A380 and 747-8 will both find tough sledding in the market, as they compete for a narrow market niche that appears to be shrinking.

Our Insight: The four-engine airliner segment is moribund, if not dead. Long live the new king - the wide-body twin. Perhaps the forecasts for growth in the VLA market will be met by the 777-9, which at just over 400 seats will meet the technical, if not the spirit, of the definition of a VLA. We believe this model will outsell A380 and 747-8I combined by perhaps an 8-1 margin over the next two decades.

No. 87, September 24, 2013 Last Week's First Flights - What they Mean

Last week featured two back-to-back first flights - on Monday the CSeries in Mirabel, Quebec, and on Tuesday the 787-9 in Everett, Washington. Each is a significant step forward for the respective manufacturers, and each will have a significant, and positive, impact on the marketplace.

The CSeries

For Bombardier, the CSeries has now moved beyond a paper airplane into reality, and at least one of the performance characteristics that Bombardier promised, an exceptionally quiet aircraft, was demonstrated. If the rest of the aircraft performs as well as noise levels, Bombardier has an excellent aircraft.

Judging by the number of potential customers we saw at the event, there are a number of active campaigns in process that could help meet the stated objective of 300 firm orders and 20 customers before entry into service next year. They are at 177 and 15 today. Most of the existing CSeries customers also have options and purchase rights for the aircraft, and judging by the happy reaction at first flight, it would not be a surprise to see some of those options exercised during the next year.

It will probably take 2-3 months for Bombardier to confirm fuel burn and projected maintenance cost numbers in their test flight program. Fuel burn numbers from Pratt & Whitney test flights are already known, and now it is the combination of airframe, aerodynamics, and engines that determine how accurate the projections, based on computational fluid dynamics models, match reality. Given today's computing technology, things are looking good for Bombardier to meet their projected "game changing" economics.

The key questions facing the CSeries are whether potential customers are ready to add an additional fleet type, and whether Bombardier can afford to compete with the deep pockets of Boeing and Airbus, which have been massively discounting their narrow-bodies (to about 50% of list prices in some recent campaigns). If Bombardier's economic performance advantages prove correct, they will be able to close the gap significantly, as Airbus and Boeing would be forced to continue massively discounting their 737-7 MAX and A319neo to match the CS300's economics.

The question of adding a fleet type centers on fixed costs - additional provisioning, more training and transition costs. Our computations show the net differential to be equivalent to about 1-1.5% of operating costs, so a new airplane with a 7-10% cost advantage should still prove profitable, even after transition costs. The key may be having both 100 and 130-150 seat aircraft in the same family, providing a more cost-effective aircraft for smaller markets, which often have higher yields, especially if they have been served by high cost regional jets. It will be interesting to watch the CSeries order book as the aircraft approaches entry into service, and how current customers plan to deploy the aircraft in their route systems.

The Boeing 787-9

The Boeing 787-9 is a quite different airplane to the 787-8; nearly 30% of the parts are different on the newer airplane. Typically a derivative would have 90-95% parts commonality, so a significantly higher than normal degree of refinements have been made. Clearly, Boeing has learned a number of lessons, unfortunately the hard way, with the introduction of the 787-8, and has capitalized on that experience with a strong continuing improvement program for the 787-9 and forthcoming 787-10.

With 250 rather than 210 seats in typical configuration, the 787-9 will offer even better seat-mile economics than its predecessor, fly 350 nautical miles farther (8,000nm), and is aimed squarely at the A330-200 and A350-800. Orders for the 787 started early in the program, but then tailed off as the program experienced difficulties, and are beginning to slowly up-tick again, as shown in the following chart:

After the early rush to secure delivery positions, orders for the 787 have fallen to a more typical pattern. Boeing's current backlog shows 415 -8, 388 -9, and 50 -10 models yet to be delivered. But if we examine orders from 2010 onward, the 787-9 has been the bestselling model, with 86 orders, versus 50 for the -10 and 46 for the -8. We believe the -9, and potentially the -10, will eventually overtake the -8 as the bestselling models in the program.

The significance of first flight of the second 787 model for Boeing is that it occurred without any issues, and went smoothly for a program that has been plagued by delays, battery fires, electrical panel problems, and brake issues since the 787-8 was introduced. Smooth is good for Boeing, which is on target to reach its production goal of 10 aircraft per month between its Everett, Washington and Charleston, South Carolina facilities.

With numerous changes from the 787-8, we believe the 787-9 will be a much better airplane with improved reliability. Because the -9 will have higher margins than the -8, this event also bodes well for Boeing's future financial performance.

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No. 88, October 1, 2013 Additive Manufacturing

Additive Manufacturing is a term we are going to hear more about in aerospace as this decade unfolds. The concept of "additive manufacturing" is another term for what others call 3D printing. Why "additive"? Because typical manufacturing is a "subtractive" process. For example, the complex geometries of jet engine components are manufactured using subtractive machining methods: filing, turning, milling and grinding away material from a block of metal. Collectively, subtractive machining techniques cut away raw material into the desired shape. By contrast, additively manufactured parts are "grown," which results in little to no material waste. If you have ever visited a manufacturing plant you understand how important this is, both physically and economically. For a good primer on the additive process, take a look at this story from The Economist.

What are the other advantageous of additive manufacturing? Typically, additive parts weigh a lot less than conventionally manufactured parts. This is one of the key reasons aerospace is paying such close attention to this process. Additive manufacturing allows engineers to create better parts in just about every respect than their milled counterparts, and are becoming economically competitive in cost as manufacturing technologies evolve. Take a look at this link to information from EADS. The company estimates that the weight of an optimized wing spar could be reduced by as much as 80% using this technology. That's extremely significant.

Rolls-Royce is spearheading a European Union project called MERLIN that plans to save material by using 3D printing in the manufacture of aircraft engines. Using subtractive manufacturing methods, the production of a one ton aircraft engine can consume over six tons of metal during manufacturing. Using additive manufacturing techniques, it is hoped to produce engines with close to 100% materials utilization.

In 2011 at the University of Virginia an engineering class built a one-quarter-scale working replica of a Rolls-Royce AE3007 turbofan jet engine. The parts were printed in plastic, so the engine is powered by compressed air rather than jet fuel. Forty three parts of the engine were printed in layers measuring 0.010 of an inch at a time. The class spent more than 150 hours assembling the engine. With conventional manufacturing this process would have taken years and cost a quarter-million dollars, according to project lead Professor David Sheffler. Students made the engine in just four months for under $2,000; about $1,500 for the plastic and another $300 for the bearings, nuts, and bolts.

Pratt & Whitney is also deploying this technology. "Additive manufacturing has huge advantages from a cost standpoint," says Pratt & Whitney's President David Hess. "It also eliminates the time needed to develop tooling." P&W has flight tested components made from additive manufacturing on the PW1500G that powers Bombardier's CSeries. They are much simpler to make than conventional solutions.

P&W has been a leader in additive manufacturing for the past 25 years and has advanced its experience in both additive manufacturing and rapid prototype techniques. P&W has used this technology to make more than 100,000 parts to date including concept models, casting patterns, tooling, test rig hardware and direct metal parts used in engines. More than 2,000 additive manufactured metal prototypes have been made to support developmental engine programs. For example, the GTF family will be the first P&W introduction of production hardware using powder-bed additive manufacturing. P&W will incorporate more than 25 additively made parts into the PW1500G engine for the Bombardier CSeries at entry into service.

The additive process provided P&W up to 15 months lead time savings in developing prototypes compared to conventional manufacturing processes. Additive manufacturing also enables new innovative designs that can't readily be made using conventional processes, and have a bonus of up to 50% weight reduction.

GE is another company in the thick of the additive manufacturing process. GE Aviation is focused on a specific additive technology called direct metal laser melting (DMLM), which precisely melts fine layers of metal powders layer by layer from the bottom up until the build is complete. Once complete in the machine, a series of post-steps are performed including thermal processing, often times post-machining and finally inspection. GE views DMLM and other additive metal processes as a disruptive manufacturing technology.

GE's process works like this: A machine operator loads the computer aided manufacturing (CAM) data or model into the computer connected to the DMLM machine. The manufacturing process begins by melting, or welding, a first layer of 20 micron powder onto a steel platform. The platform then lowers by 20 microns. A fresh layer of powder is swept over the previously formed layer, and the next layer is welded on top of the previously built layer. A powerful fiber laser is precisely controlled at the X and Y coordinates, allowing for exceptional tolerances to be held and extremely small sizes to be built. Many small to medium size parts and inserts can be constructed in hours and days, as opposed to days and weeks using traditional processes.

Once started, the machine builds unattended 24 hours per day. Parts and inserts coming out of the machine typically go through a series of post-steps, including support removal. These parts tend to be lighter than traditional forged parts because they can be designed specifically for the additive process. In most cases, this allows for substantially less material to be used for the part, without sacrificing strength and functionality.

GE Aviation is already committed to providing components within the combustion system of the LEAP jet engine. Additive manufacturing is a significant technology GE wants to keep in-house. It is comparable to

other capabilities GE is keeping in-house, such as the production of carbon fiber composite and ceramic matrix composite components. In the longer term (post-2020), GE believes there is great potential that blades, blisks, tubing, external mounting hardware and stators will also be additively manufactured.

So just when you thought that 3D printing was a lab experiment that could make plastic toys, look again. Additive manufacturing is changing the nature of materials used on aircraft. The rate of change in manufacturing speed is also growing, as computer controls and machines become more sophisticated, so parts that took hours to make ten years ago can now be completed in minutes. The next generation of additive manufacturing technology is already enabling strong, lightweight parts that will enhance fuel efficiency and differentiate the next generation of aircraft engines, including the GTF and LEAP for narrow-body programs, and Trent XWB and GE9X for wide bodies. The market for additive manufacturing is here, and while multi-axis milling machines won't go away for a few years, they will have new competition on the shop floor creating optimally engineered components "printed" by lasers.

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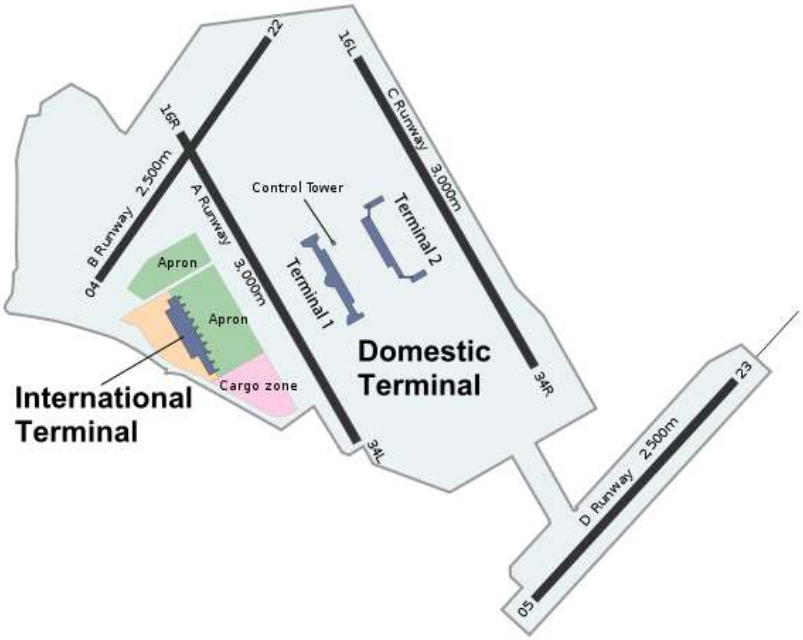
No. 89, October 8, 2013 HANEDA AND THE SUPER-TWINS

This week, the Japanese government issued additional take-off and landing slots for international flights from Haneda, Tokyo's downtown airport (picture below). That airport, which is primarily used for domestic service, has recently added an additional runway, opening 20 new slots for international service. This week, the Japanese government awarded the first 16 of the 20, with 4 slots for destinations in the US yet to be decided.



All Nippon Airways (ANA) secured 11 of the 16 slots, with the remaining 5 going to Japan Air Lines (JAL). This is a substantial victory for ANA and its Star Alliance partners, as this airport is closer and easier to access than Narita, Tokyo's main airport, for international traveler. ANA has been arguing that the $3.5 billion state bailout of JAL had put it at a competitive disadvantage, and it appears that their arguments have been heard. ANA lobbied for these slots by arguing that JAL's $3.5 billion state bailout wiped out most of its debt and left it with tax credits, giving JAL pricing leverage over ANA.

The previous government regime was more "friendly" to JAL. Of course, JAL is appealing this allocation. "We have asked regulators to explain whether they gave consideration to the convenience of travelers and the impact on airline alliances in making their decision," JAL President Yoshiharu Ueki said at a press conference last Friday. JAL recorded operating profit of JPY¥22 billion in the three months to June 30, while ANA recorded a loss of JPY¥5.6 billion.

Doesn't it seem strange that in one of the most congested cities for air traffic, often cited as an example of a city that will require VLAs, neither ANA nor JAL (the two largest carriers in the country) own a VLA? Each has retired their 747-400s, and the largest aircraft operated by either is the 777-300ER. Both are early customers of and operate the most 787-8s.

Narita and Haneda are crowded airports, and with traffic continuing to grow, for many years slot constraints have fueled speculation that Japanese carriers would order new VLAs, especially since Japan was the largest market for the Boeing 747. This hasn't happened as of yet, and neither ANA nor JAL appears to want to take the risk of new very large four-engine aircraft, as evidenced by JAL's order for the A350-1000.

Having experienced the prior downturn in the Japanese economy, they understand how a large number of empty seats will translate into massive losses. As a result, they are being cautious, recognizing that they can remain profitable even while turning people away. As a result, we expect the next generation of large "Super Twins", the Boeing 777-9 and the A350-1000, to be candidates as the mainstays for Japan's major airline long-haul operations.

When VLAs first arrived, the rule of thumb was the larger the aircraft, the lower the seat-mile costs. That might hold true anymore, as the 787-10, A350-1000, and 777-9 will all have equal to or better seat mile costs than the 747-8I and A380-800, the current state of art VLAs. With equivalent seat-mile costs, airlines can match capacity to routes without having to worry about filling excess capacity through discounted fares.

Of course, to every trend there is an exception. Domestically, Japanese LCCs are changing competitive dynamics, and Skymark Airlines, which began as a LCC, is moving upscale, changing its strategy from that of a low cost carrier to one offering premium business service at competitive rates. Skymark currently operates Boeing 737s domestically (it retired its 767s), has ordered 7 Airbus A330s and 4 Airbus A380s, and plans to operate them with premium service once they begin to arrive in 2014.

Skymark applied for rights for its A380s between Narita and New York JFK and London Heathrow, configuring the aircraft with business class and premium economy. Their A380s will have only 394 seats (below the 400 for a typical VLA seat count), with 114 business class at 60 inch pitch and 280 premium economy "green seats" that have 38 inch pitch and are 22 inches wide. Their A330s, for domestic use, will have 271 "green seats" in a single class configuration. So there will be more competition, and additional seats, on a couple of key long-haul routes.

Of course, there are few markets that can support an airline without good connecting traffic at both ends. Skymark has a good domestic network within Japan, but lacks connecting traffic at Heathrow and JFK. In this regard JAL, which belongs to Oneworld, and ANA, which is a member of Star Alliance, have a significant advantage. Will Skymark be able to fill an A380 in both directions with traffic primarily generated from Japan? The jury is out, but their 394-seat configuration will be among the lowest seating capacities for A380. Or perhaps Skymark could join Sky Team.

Super-Twins

The next generation of VLAs will likely be "Super-Twins", as materials and engine technologies continue to evolve. Historically, engine technology has driven aircraft development, and will continue to do so. As engines have evolved to enable additional range and capacity, airframe OEMs have taken advantage of those improvements to extend range and capabilities of aircraft. Over the years, we've seen aircraft that were designed for long-range operations superseded by enhanced models - from the 747SP to 777-200ER to A340-500 - and find that their markets quickly disappear as larger capacity aircraft offer better economics. We expect the same for A350-800 and 777-8 over the next decade, as engine improvements

that enable larger, and equally productive, variants will render these models economically obsolete. This week's A350 order from JAL is, in our view, symptomatic.

Using the 400-seat definition, the 777-9 will be the first twin-engine VLA, and the precursor for new models to follow. We expect that Airbus will need to fill the gap between the 350 seat A350-1000 and 525 seat A380-800. A larger A350 model, with 400-425 seats, would make sense for Airbus to bridge the 175 seat gap between its models. Boeing could also incorporate one more stretch for the 777X, and introduce a 450 seat 777-10 that would make sense for a number of markets. This aircraft would replace the 747-8I, which is economically obsolete and was dead on arrival in the market.

Stretching the currently planned twins into Super-Twins with more than 400 seats will likely be the next step in the wide-body market. Aircraft of this size, with range for 90-95% of airline missions, would likely sell well as a 747 replacement and A380 alternative for smaller markets, and would be the logical next steps for Airbus and Boeing. The market needs efficient replacements for four engine VLAs that are no longer economically competitive, and Super-Twins are the answer.

No. 90, October 15, 2013 QantasLink's Fleet Choices

Recently Qantas held a briefing in Seattle regarding its future fleet plans, and indicated that there are big changes coming. Qantas plans to standardize its domestic services using Airbus A330s and retire its Boeing 767 fleet. Some of those A330s will come from new orders, others from the carrier's low cost subsidiary Jetstar, which is transitioning to the Boeing 787.

Their next decision will be for QantasLink, as it seeks to replace 14 Boeing 717s. QantasLink added 5 leased 717s to its fleet in late 2013, augmenting the original aircraft that arrived in 2001 when it took over Impulse Airlines. Qantas has apparently been pleased with the 717. But the airplane is out of production and a replacement must be found and ordered. Qantas has a wider selection in this aircraft range than in any other market segment, with 5 competitors including Bombardier, Embraer and Sukhoi in addition to Boeing and Airbus. We understand that the airline is considering the A319neo, 737-7MAX, CS100 and E-195. The following table lays out some key characteristics for each aircraft.

COMPARATIVE AIRCRAFT CHARACTERISTICS					
	717	A319neo	E-195	737-7	CS100
Range	1,430	4,200	1,800	3,800	2,950
Seating	117	131	108	129	110
MTOW	114,000	166,400	107,563	159,500	129,000
Cabin Width (ft)	10.3	12.1	9	11.6	10.8
Cruise Speed	0.76	0.78	0.78	0.79	0.78
List Price USD	NA	$92.00	$40.00	$85.10	$62.00

Despite the 717 being outclassed by the newer airplanes, it remains young and is not likely headed for the desert. Newer technologies aircraft can be expensive and, as we have seen at Delta, who took over the AirTran 717 fleet at low prices, aircraft can remain competitive if their operating costs are offset with low capital costs. But this can only happen when assets are priced to the point of economic indifference.

The operating economics of new technology aircraft in this sector are becoming compelling, particularly as aircraft built specifically for this market contend with the larger and less efficient shrink models from Boeing and Airbus. The following chart compares our estimates of economics for the key models in this sector, including the A319neo, Boeing 737-7MAX, and E2-195 re-engined models from Embraer and the all-new CSeries from Bombardier. While we lack firm data for the E2 models from Embraer, we have estimated weights and performance in our modeling based on our best judgment using the limited information currently available to us. Despite the 717 being outclassed by the newer airplanes, it remains young and is not likely headed for the desert. Newer technologies aircraft can be expensive and, as we have seen at Delta, who took over the AirTran 717 fleet at low prices, aircraft can remain competitive if their operating costs are offset with low capital costs. But this can only happen when assets are priced to the point of economic indifference.

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TOTAL CASH OPERATING COSTS 600nm mission — Projected costs based on AirInsight Models and Estimates

	Number of Seats	Cost per Mission: Fuel	Maintenance	Crew	Landing	Total Cost for Mission	Cost per Aircraft Mile	Cost per Seat Mile
A319ceo	131	$ 3,990.00	$ 1,295.00	$ 1,006.25	$ 665.20	$ 6,956.45	$ 11.59	$ 0.0885
A319neo	131	$ 3,570.00	$ 1,242.50	$ 1,006.25	$ 669.20	$ 6,487.95	$ 10.81	$ 0.0825
737-700W	129	$ 3,885.00	$ 1,295.00	$ 1,006.25	$ 626.71	$ 6,812.96	$ 11.35	$ 0.0880
737-7Max	129	$ 3,517.50	$ 1,330.00	$ 1,006.25	$ 636.21	$ 6,489.96	$ 10.82	$ 0.0838
CS100	110	$ 3,010.00	$ 857.50	$ 910.00	$ 532.00	$ 5,309.50	$ 8.85	$ 0.0804
CS300	130	$ 3,272.50	$ 901.25	$ 1,006.25	$ 581.50	$ 5,761.50	$ 9.60	$ 0.0739
EMB195	108	$ 3,605.00	$ 1,006.25	$ 1,006.25	$ 499.83	$ 6,117.33	$ 10.20	$ 0.0944
SSJ100	98	$ 3,290.00	$ 1,041.25	$ 831.25	$ 455.20	$ 5,617.70	$ 9.36	$ 0.0955
E2-195	122	$ 3,202.50	$ 997.50	$ 1,006.25	$ 587.50	$ 5,793.75	$ 9.66	$ 0.0791

From an operating cost perspective, it is clear that the CSeries has an advantage over both the existing and re-engined models in the marketplace, as shown in the comparison chart below that shows both aircraft-mile and seat-mile cost.

Even with 15% reductions in fuel costs, fuel is only about 1/3rd of operating costs for short-haul operations, and depending on other factors such as maintenance, we would expect a re-engined aircraft to hover around a 5% baseline. Our economic projections indicate that re-engining the existing 737-700 and A319ceo results in net improvements in the range of 4.7% for the Boeing 737-7MAX and 6.7% for the Airbus A319neo with Pratt & Whitney engines. This results in Airbus taking a slight advantage from Boeing, reversing the slight advantage Boeing held with the 737NG over the A319ceo. The E2 series from Embraer

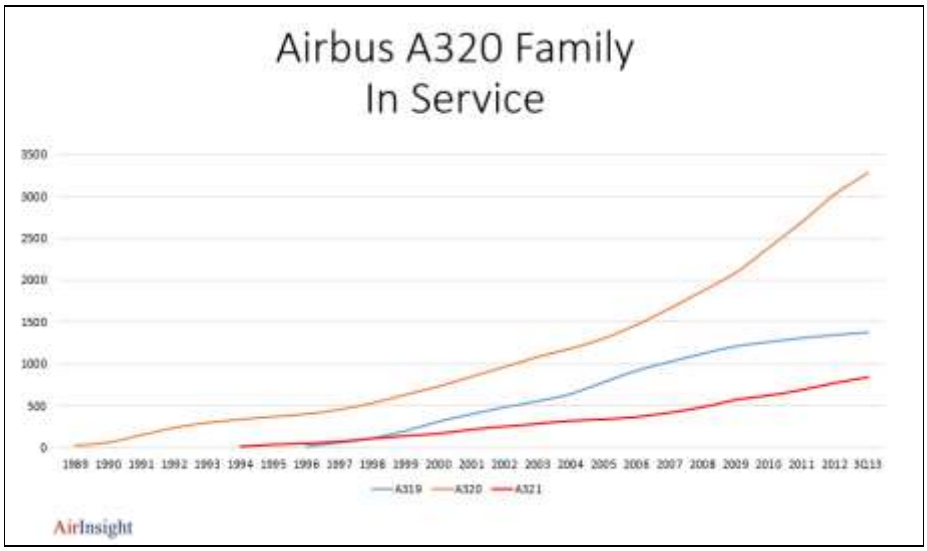
benefits from a stretch, and we project a 5.6% improvement in aircraft-mile costs, but with three more rows of seats, a significant 19.3% improvement in seat-mile costs.

But even with similar engine technologies, these aircraft fall short of the economic performance of the CSeries, which was optimized for these new technology engines and incorporates other new technologies in its lightweight and efficient design.

The issue then comes down to pricing, and playing the game of pricing to the point of economic indifference. Airbus and Boeing can easily discount their aircraft by 50% or more in price wars to win key customers, while Bombardier and Embraer may be more limited in their capacity to discount. But with lower list prices for the latter two manufacturers, we expect a healthy competition between the four players as Qantas pursues its fleet expansion. The logical choice from a technology and operating economics standpoint is the CSeries, but Airbus in particular has been vocal about pricing to win campaigns to keep Bombardier from gaining traction. This will be another interesting battle to watch as the competitive dynamics of the four major players are in play for a well-respected customer.

No. 91, October 22, 2013 Airbus A319/320/321

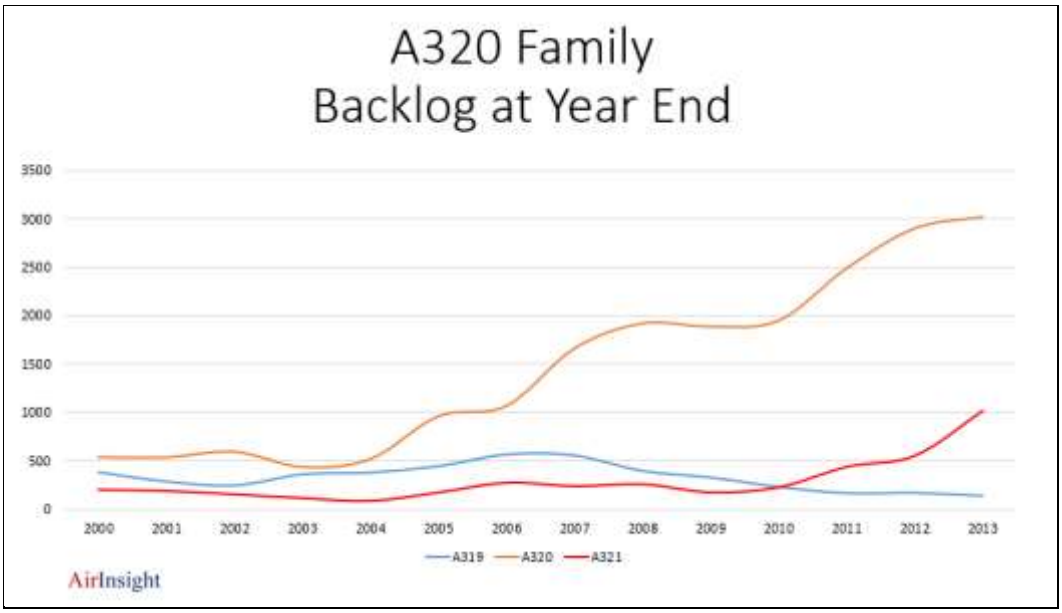
This family of aircraft has become the mainstay of Airbus and the industry. The chart below illustrates Airbus deliveries from the outset of the A320 program.



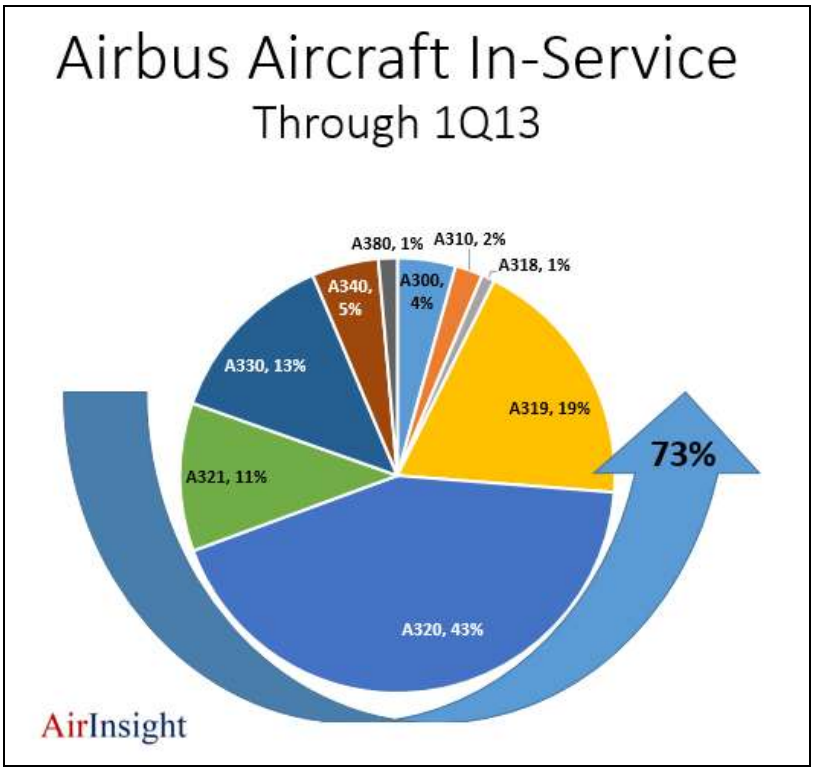
The A320 family has been a blockbuster for Airbus. Airlines and leasing firms have ordered 9,931 single aisle aircraft from Airbus, and through the 3Q13, 5,755 (58%) have been delivered. The backlog of 4,176 aircraft will take nearly 100 months - over 8 years - to deliver at a production rate of 42 per month.

The chart above indicates that among the family variants, the A319 may have peaked, while the A321 is just now coming into its own with a steady rise in demand. We believe several factors are contributing to the trend towards larger aircraft, including the need for better seat-mile costs, as well as because the A319 is seeing competition from more efficient models from Bombardier and Embraer of similar size. The need for a 757 replacement may also be an element in the growing interest in the A321, especially the neo version.

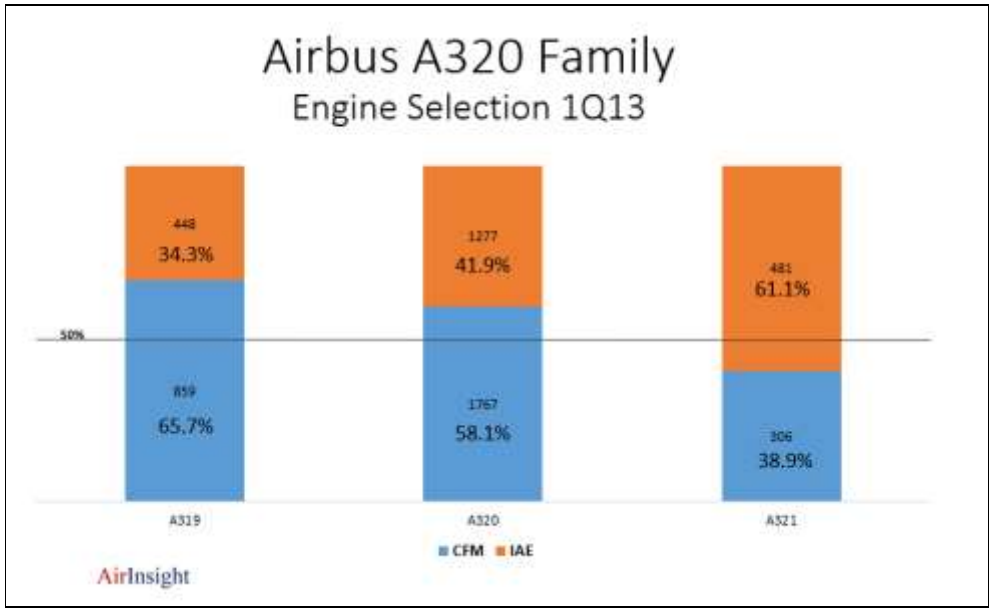
The following chart shows the backlog for the A319 over the last 13 years. It is notable that the A319 program has a negative five orders this year to date, indicating that, even with the neo model, it may have fallen out of favor with airlines. Airlines have generally been buying larger family members.



Narrow-body aircraft are the cash cow for the big two airframe manufacturers, and the following chart illustrates that nearly three-quarters of all Airbus aircraft in service are part of the A320 family. Airbus' focus on protecting this franchise is quite rational. 74% of Airbus in service aircraft are narrow body, which compares with Boeing's similar ratio of 73.5%. (In the chart we show 73% for Airbus because we excluded the A318.)

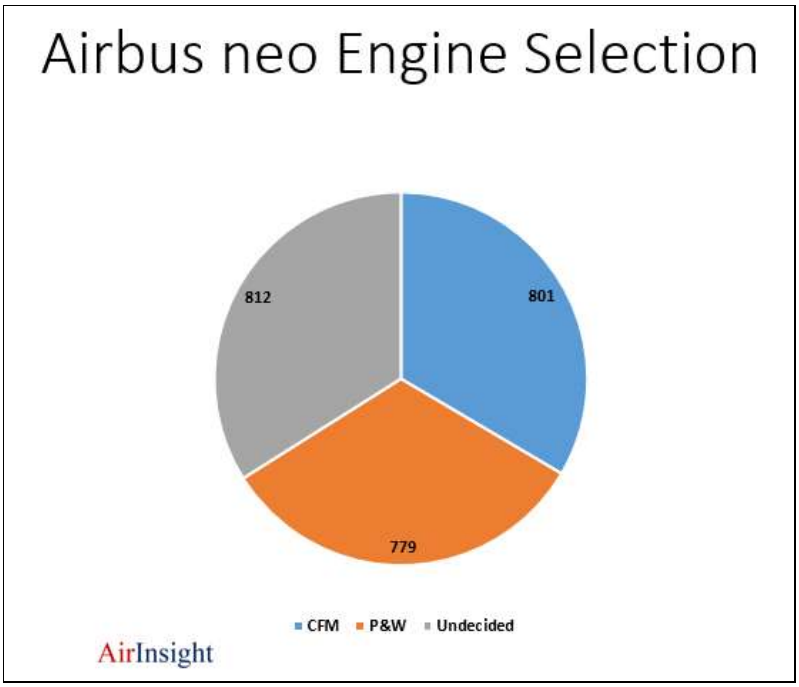


There are two engines available on the A320ceo family. The order pattern suggests that the smaller the aircraft, the more likely it will have a CFM engine, and conversely, the larger the aircraft, the more likely it will have an IAE engine. Overall CFM/IAE have a 57%/43% share of the program.



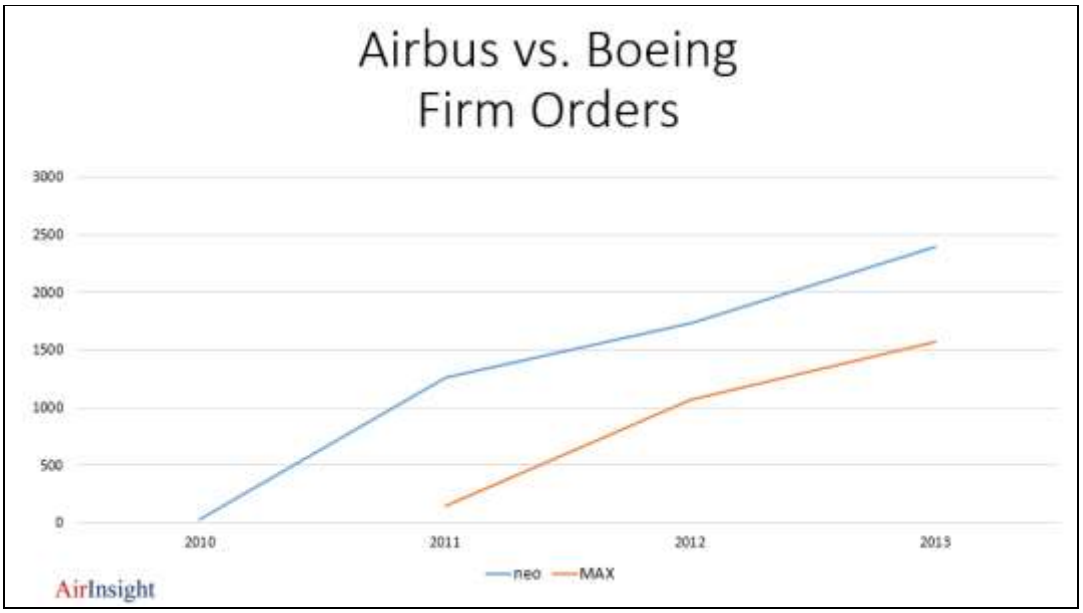
For the neo, the Pratt & Whitney PW1000G competes with CFM LEAP. (Pratt & Whitney supplied engines for 15 of the 70 A318s sold). Whereas CFM holds a distinct advantage over IAE on the in-service Airbus narrow body fleet, the engine race for neo orders is much more competitive. Yesterday came the much anticipated order from ViveAerobus for 52 A320s (40 A320neo and 12 A320ceo) to replace 737-300s, with the engine order will be announced later. If the airline selects the Pratt engine the switch means both aircraft and engine go to new vendors.

Of the 2,392 neo orders to date, the engine race is about even as the chart illustrates. We expect the race to remain about even as the undecided group announces their engine preferences.



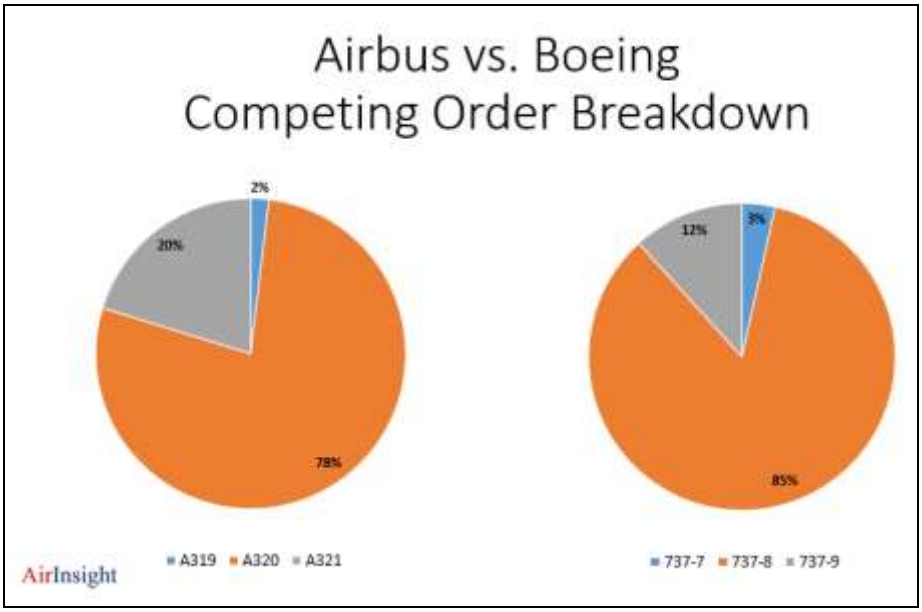
It is quite possible that because the neo has two entirely new engines, this has kept a third of the orders in the undecided bracket, waiting for confirmation of fuel burn and economic data. The other major competitive program, the Boeing 787, by contrast has a clear leader, with GE at 43%, and Rolls-Royce at 25% and undecided at 32%.

The A320neo program currently holds a competitive advantage over the Boeing 737MAX program, as Airbus started a year earlier. While Airbus clearly benefited from its early start, the order patterns are remarkably similar, indicating that the strong competition between Airbus and Boeing will continue.



Although Boeing has made a strong response, it still trails Airbus in orders by 33%, although we expect this gap will likely narrow significantly over the next few years. The competitive order breakdown among

models, however, is quite interesting. With a seating advantage of 12 seats in standard configuration, the 8MAX is Boeing's best-selling model at 85%, with only 12% of orders for the -9MAX. By contrast, A321 takes 20% of neo orders, with 78% for the base A320 model.



A319	MAX-7	A320	MAX-8	A321	MAX-9
45	55	1863	1328	484	184
1.9%	3.5%	77.9%	84.7%	20.2%	11.7%

We believe the smaller segment is going to see less interest, as Bombardier and Embraer offer more efficient models in that segment. We expect to see many of the current smaller segment orders, particularly those from leasing companies, to be converted to the middle segment. In the larger segment, while neither model is a true replacement for the 757, the market perception is that the A321neo is the more capable of the new models, and a better 757 replacement than the -9MAX.

No. 92, October 29, 2013 The Super Twin Battle: A350-1000 versus 777-9X

With the forthcoming launch of the 777-9 at the Dubai Air Show next month, the battle between the A350-1000 and 777-9 will be officially on, with two very different aircraft competing for the same market. While there is discussion of another stretch to the A350 program to provide comparable capacity to the larger 777-9, we can compare today's aircraft and examine their relative economics based on manufacturer projections and Piano models based on preliminary specifications.

The A350-1000

The A350-1000 is the largest of 3 models in the A350 family, with 350 seats in a typical three class configuration, with an 8,400 nautical mile range. The A350 features carbon fiber composite structure and wings, and at 53% composites will have slightly more of the aircraft made of this material than the Boeing 787-9, which is 50% composites. It features new technology Trent XWB engines from Rolls Royce with state-of-the art fuel efficiency, advanced aerodynamics, and state of the art systems.

The 777-9X

The 777-9 is a stretched version of the current 777-300ER with a new engine and new wing, along with other enhancements, to create an updated version of the 777, which delivered its 1,000th example earlier this year. The 777-9X will feature an aluminum alloy fuselage with a carbon fiber composite wing, and new technology GE9X engines that are derived from the GE90 and GEnx families. The wingspan for the 777-9 will be longer than any Boeing aircraft, and will include folding wingtips to enable the aircraft to utilize current gate positions at airports, as otherwise the new model would require gates typically used for A380 operations (which are currently quite limited at congested airports.)

Comparing the Aircraft

The following table compares the two aircraft on several key statistics, based on preliminary data prior to the 777-9X launch:

The A350 cabin width is larger than the 787 and smaller than the 777X. The result is that a typical configuration in economy would be 9 abreast at 17 inch seat width for the 787, 9 abreast at 18 inch seat width for the A350, and 10 abreast using 17 inch seat width for the 777. While the 777 is currently offered in 9 and 10 abreast seating, recent orders have trended to 10 abreast seating as airline seek to MAXimize seat-mile costs.

	Airbus A350-1000	Boeing 777-9X
Seats: 3-class	350	407
MTOW	679,000	759,000 lbs
Engine and Thrust	Trent XWB 97,000 lbs.	GE9X 99,500 lbs
Length	242 ft.	250 ft. 11 in.
Wing Span	213 ft.	234 ft.
Cabin Width	19.6 ft.	20.3 ft.
Range	8,400nm	8,200nm

COMPARATIVE ECONOMICS

Both manufacturers are claiming class leading economics for their airplanes, but in reality, they are very, very close. The 777-9 holds a 16% advantage in capacity, which directly impacts seat-mile costs, but the A350-1000 will have lower trip costs than its larger competitor. Our estimates for a 6,000NM trip, based on preliminary specifications from airframe manufacturers, our own economic modeling, and data gleaned from airlines, are as follows:

Estimated Operating Cost Comparison	6,000 nm mission		
	B777-300ER	**A350-1000**	**B777-9X**
Fuel Cost	$107,250	$85,313	$98,638
Maintenance Cost	$16,900	$13,200	$14,872
Crew Cost	$20,800	$20,800	$22,085
Navigation and Landing Fees	$11,500	$10,900	$11,400
Total Operating Cost	$156,450	$130,213	$146,995
Total Cost per Aircraft Mile	$26.08	$21.70	$24.50
Number of Seats- 3 Class	350	350	407
Total Cost per Seat Mile	0.0745	0.0620	0.0602

With very comparable seat-mile costs, the A350-1000 and 777-9X will be competitive, and it will come down to how many seats an airline believes it can fill. For those that can fill 400 seats, the 777-9 looks like a good alternative, for those that prefer a lower risk, the 350 seat A350-1000 is the right airplane.

The key question, as the OEMs continue to one up each other, is whether an A350-1100 stretch will be built. The A350-1100 would be an all new technology aircraft competing with a highly modified but derivative model, and should have both lower aircraft mile costs and lower seat mile costs than the 777-9. A stretched A350 would also help to bridge the large gap in size between A350-1000 and A380-800.

We believe the A350-1100 will become a competitive necessity for Airbus. With the A350-1000 due for EIS in 2017, and the 777-9X due in late 2019 or 2020, there is still time for Airbus to bring out an additional model in time to check the size advantage for Boeing. As airlines are looking to larger twins to replace 747-400 with aircraft of similar capacity, the time is right for these “super-twins” in the marketplace.

AirInsight | Weekly Review

No. 93, November 5, 2013 The E-190 and JetBlue

There are 84 E-190s flown by US airlines. Embraer has delivered 482, and the US fleet accounts for 17% of the total. The following table shows the fleets for E-190 operators in the United States.

Operator	Fleet
JETBLUE AIRWAYS	54
US AIRWAYS	21
REPUBLIC AIRLINES	8
FRONTIER AIRLINES	1
Grand Total	84

Source: Jet Information Services, Inc.

This week JetBlue deferred deliveries on 24 E-190s, pushing deliveries to 2020. The E-190 currently accounts for 31% of the airline's fleet and JetBlue was the launch customer for this model. Both Embraer and JetBlue put a good spin on the news. JetBlue's fleet changes are "natural fleet management based on market opportunities and the company's business plan," Embraer said in an e-mailed statement. "It's important to emphasize that there has been no order cancellation but a restructuring of deliveries over time."

The timing of the restructured deliveries is also interesting, in that it will afford JetBlue the opportunity to acquire E2 versions of the aircraft, with the Pratt & Whitney GTF engines, which it also has on order for its A321neos. The key question for Embraer is whether JetBlue will have enough growth in new markets to add to their fleet, or begin an early replacement process for the existing E190s with E2-190s when those deliveries occur.

JetBlue shared this comment: "*We have found that the right size fleet of E190s for our network needs is around 60 for the time being. We use the 100-seat E190 primarily in Boston and San Juan, for the short, thin routes or those routes that require high frequency (Boston-Washington DC, for example). Overall, our network is shifting to higher density routes (NYC departures to Florida, Caribbean, West Coast) so our investments in fleet will reflect that growth. A factor in this includes the slot-controlled airports we call home - JFK and the rest of the New York airports. We have to use our slot assets very wisely, and adding 40 more seats (A321 core = 190 seats vs. A320 at 150 seats) gives us more lift off the same slot*".

How has the airline's experience with the E-190 been?

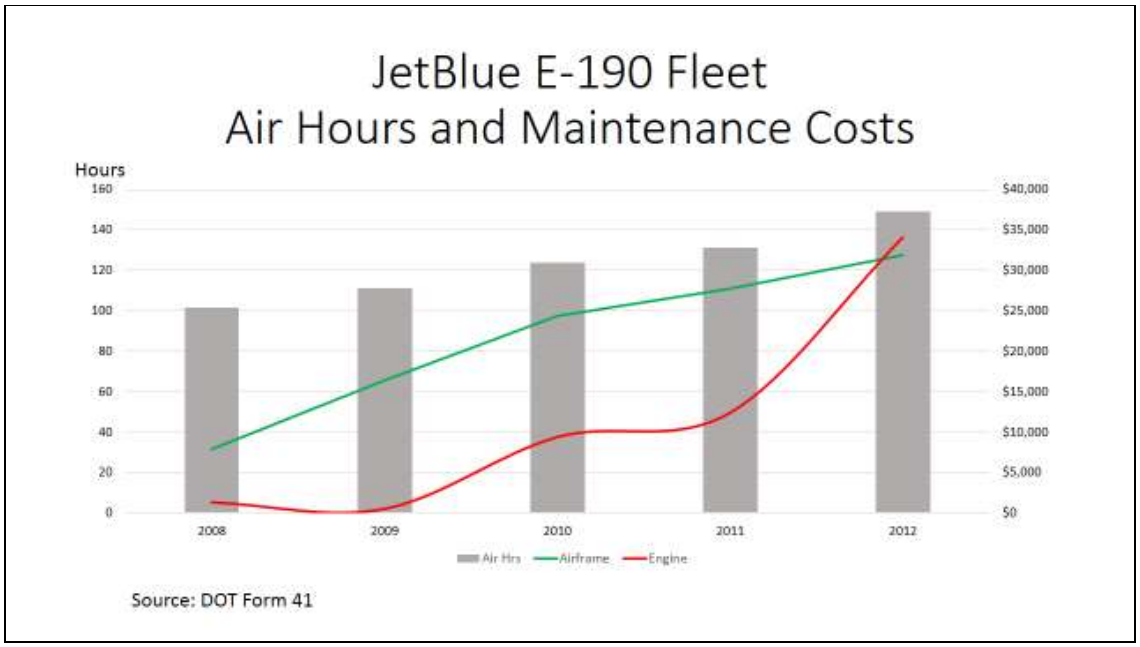
Between 2008 and 2H13, JetBlue reported 110 SDRs (Service Difficulty Reports) to the FAA. In total the FAA had 1,684 SDRs reported during that period for the E-190. The table lays out the various types of SDR codes used by the airline and the US-based fleet as a whole.

It is clear that JetBlue has a different and perhaps better SDR profile than the rest of the fleet. Moreover, even though JetBlue accounts for 64% of the fleet, it only accounts for about 7% of the SDRs. Based on that data, logically one would deduce that the airline is pleased with the aircraft, as it certainly does not appear to have been a burden in terms of operations.

JetBlue SDRs		Fleet SDRs	
Flight Controls	11%	Fuselage	25%
Landing Gear	9%	Doors	14%
Navigation	6%	Flight Controls	10%
A/C	5%	A/C	9%
Comms	5%	Equipment	8%
Instruments	5%	Lights	8%
Doors	5%	Other	26%
Fire Protection	5%		
Fuel & Control	5%		
Other	45%		

Source: FAA

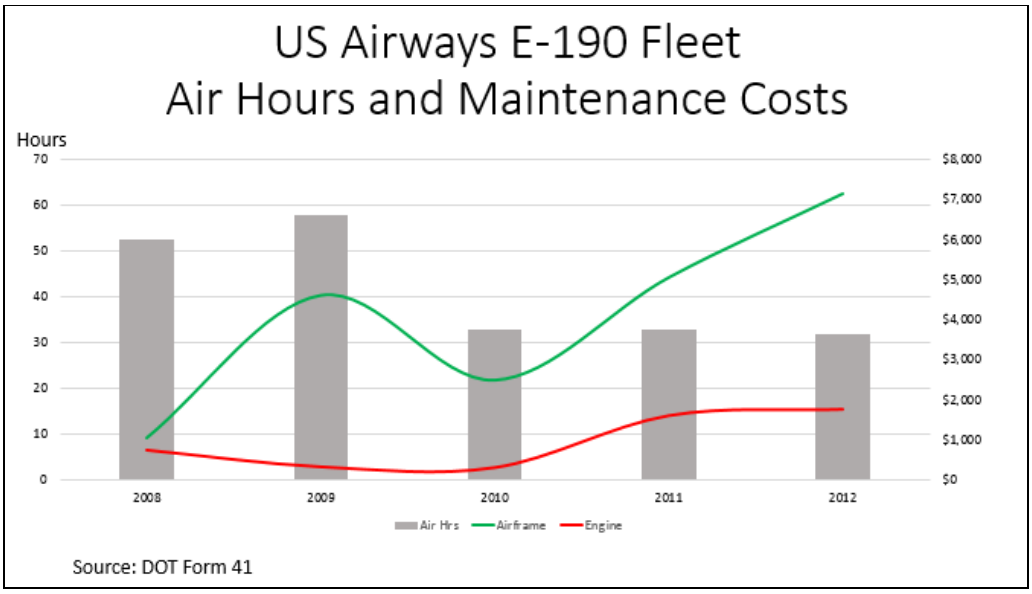
Yet in April JetBlue's CEO was reported to be unhappy with the fleet's maintenance costs, particularly with the CF-34 engines. The following chart shows maintenance cost for the Jet Blue E-190 airframes and engines, based on FAA compared with air hours. The source of Mr Barger's unhappiness is now clearer.



The table below illustrates the E190 fleet growth at JetBlue. As the fleet has grown, JetBlue has been able to deliver more flights and air hours. But the rise in maintenance costs has been eye-popping. Even Embraer concurred that the initial fleet had problems. "Back in 2006-07 we were still struggling on the [E-Jet] production ramp-up, dispatch reliability of the aircraft, and we were late on deliveries," Embraer CEO Frederico Fleury Curado told Aviation Week in 2010. The first 20 of the E190 models appear to have much higher maintenance costs than later deliveries, according to JetBlue.

Delivery Year	Fleet
2005	7
2006	23
2007	30
2008	34
2009	40
2010	44
2011	49
2012	53

Are the problems faced by JetBlue unique? The following chart reflects the same data for US Airways, another E-190 operator based in the United States.



The chart shows very similar airframe cost growth to that of JetBlue, but not as large a rise in engine maintenance costs. US Airways has 21 E-190s, and it appears the airline is drawing down its air hours on this fleet. Back in 2009, the airline was already starting to reconsider its E-190 fleet plans. US Airways started with 25 E-190s, sold ten to Republic and, earlier this year, bought five back. The merger of US Air with America West and the consequent merging of pilot lists made operating the E-190 tough. With mainline pilots flying the aircraft its costs were higher than if operated by a regional partner like Republic.

US Airways shared this with us:

- "*The drop in block hours in the 2009/2010 period is largely tied to 10 aircraft that were sold to Republic Airlines during this time-frame.*
- "*The increase in airframe maintenance costs was not unexpected and was driven by the fact that these aircraft began to cycle through heavy maintenance checks in 2011 with the entire fleet completing these checks in April 2013.*
- "*As for the engines, we also saw the first engine shop visits for the E190 during this time.*"

"With that said, the E190 has been a good aircraft for US Airways filling a niche on both short to medium haul routes where the aircraft's capacity of 99 seats is well matched to demand. The aircraft is currently used on PHL-BOS and PHL-SAT as examples."

Should the push back of JetBlue deliveries be a concern regarding the E190?
The answer is maybe. Of course, there are concerns whenever a major order is deferred. The current model has been quite successful, with more than 1,000 deliveries since its introduction seven years ago. But current backlog, despite 131 orders this year, is down to 246, and with orders already coming in for the E2 model (150 at the Paris Air Show), the delivery rate per month is not likely to be anywhere near the previous peak until the E2 enters service. The deferral at JetBlue will likely result in E2 rather than current models being delivered.

JetBlue's deferral to 2020 is also interesting, as JetBlue has indicated that it was not ready to launch a new aircraft type. While the E2 will be a derivative rather than an all new airplane, it is notable that JetBlue chose to defer until two years after EIS, a point at which any "early glitches" should have been worked out with other customers.

No. 94, November 12, 2013

Airbus & MRO

Companies are often forced to rethink their strategies based on externalities, and we've seen a couple of examples of this in the aviation markets this week, at Airbus and SkyWest.

Airbus this week quietly announced that it was dismantling its MRO network, which it had initially begun some years ago to ensure that some of the best MROs in the world had the capabilities to maintain Airbus aircraft. Their network had 17 members, who have all now been notified that the network was being disbanded.

The operation was not commercial in nature, as Airbus never made any commitments to give work to the network members, but instead it was a process to exchange data and establish benchmarks for maintenance performance. The members of the network, a who's who of maintenance providers, included Lufthansa Technik, HAECO, SR Technics, ST Aerospace. Of course, since they all compete with each other, those "secret" techniques for MRO were unlikely to be shared.

The reality of the situation is that there is little an OEM can do today in MRO unless they want to compete with those keeping their aircraft flying, which may not be an optimal productive strategy. Boeing has struggled with its Gold Care program, attracting few customers, and despite the OEMs' unique role in the marketplace, MRO work is changing.

One of the key elements of that change is that component MRO has begun to be clawed back by OEM suppliers, who can offer by-the-hour maintenance contracts at attractive rates. For many suppliers, it is less expensive to exchange a failed unit for a new one than to overhaul it, as overhauls may be more labor intensive and include extensive troubleshooting. Margins for spare parts remain quite lucrative, and the OEMs are in the best position to provide MRO services, as they have ready access to both replacement units and spare parts.

Airbus, unlike Boeing, has not focused on the aftermarket as a profit center, but instead focuses on helping Airbus operators achieve low cost solutions that keep them as customers. By dismantling their network, they have opened the door to alternate approaches, including by the hour contracts with OEMs, which can be offered to their customers without having to give preference to their former MRO network partners.

The reality of MRO work is that parts provided by Boeing or Airbus, such as the fuselage, and its major components, rarely break. The bulk of MRO work is in engines and components, which can in many cases be most cost-effectively handled by those who design and make them. That has been the case with engines for many years, and is now becoming more commonplace with components.

What's the next frontier? We've already seen airline alliances develop purchasing groups to bundle their purchasing power for supplies -- but what about bundling their purchasing power for component MRO? Imagine the power of a Star Alliance, oneworld, or Sky Team in issuing an RFP for an exchange program for each key component, bid on by both independents and the OEMs? Prices would fall, airlines

would be happy, and the winner of the contract would have sufficient volume to reap large economies of scale. But that would require a uniform maintenance standard among their members, whose technical departments may not agree.

While Airbus isn't there yet, it has made the first step - moving from away from supporting a small group of 17 MROs to working with all MROs on an equal basis. The question now is whether Airbus will take the next logical step, and help its customers join together to obtain the best potential economics with a high quality standard acceptable to everyone, and thereby differentiate themselves from their competitor. The jury is still out.

SkyWest Examining Alternative in Wake of Potential MRJ Delays

It seems that nearly every new aircraft program faces certification delays, from the A380 and 787 debacles to smaller delays with CSeries and A350; getting a new program out on time is a challenge for the industry. Mitsubishi, with its MRJ, is facing similar challenges, and its early customers are becoming concerned, as they will need to find alternative lift if the aircraft can't be delivered on schedule.

SkyWest has typically been clever in its contracts for new aircraft, leaving "out" clauses in case situations change. With a potential out, as they also are rumored to have with their Embraer E2 contract, SkyWest is now in a position to replace their MRJ order with a different aircraft if they cannot be delivered on time.

There are several options. With an order for E2s already in place, could Skywest attempt move them forward and consider ordering the existing model EJets, or would potentially examine an alternative such as the CRJ900 or the slightly larger CS100 from Bombardier, or the Sukhoi Superjet? Delays throw the entire game of fleet planning open, and the process could quickly restart, to a critical detriment for Mitsubishi.

Fleet planning isn't an easy process, and entails much more than an examination of the comparative economics and pricing of rival aircraft. It also entails routes and fleet optimization, aircraft configurations, passenger and cargo revenue projections, fuel, crew, maintenance, and other operating expenses, financing, depreciation and tax considerations, training, scope clauses, and other factors. The easy part is determining the comparative economics for each aircraft. The difficult part is running through hundreds of iterations to determine what the likely optimal aircraft will be.

Just when you thought your fleet plan was set, and it was safe to go back in the water, a the lurking sound of a potential delays (dum, da dum, da de dum,….) emerges and the decision process starts all over again. Superjet, Embraer, and Bombardier are undoubtedly waiting in the wings with new offers.

For Mitsubishi, an additional delay, coupled with a launch order cancellation, could damage the credibility of the entire program. We haven't seen much transparency in the program, in part due to cultural differences, but the MRJ team has "some 'splainin to do" to its customers and the industry.

Having seen the A380 and 787 debacles, airlines expect aircraft programs to be on time unless given clear guidance otherwise. Because delivery delays are problematic for carriers, missing a delivery is one of the last things an OEM can afford to do.

AirInsight | Weekly Review

No. 95, November 19, 2013 The Power Shift Towards the Gulf

The massive aircraft orders at the Dubai Air Show underscored the power shift in the airline industry to the Gulf, as the three large carriers, Emirates from Dubai, Etihad from Abu Dhabi, and Qatar Airways from Qatar, continue to expand and erode the traditional business of European and Asian carriers.

Several factors led to this power shift. First, the immense wealth and ready investment capital created after Richard Nixon took the US off of the Gold Standard for international settlements in 1971 and precipitated the first "oil embargo" that raised prices for energy and resulted in a financial bonanza for the Gulf oil producers, and second, the foresight to take advantage of a geographic position between East and West to diversify from an oil-based economy through massive investments in airlines, aircraft and connecting hubs. The results have been phenomenal, and concern about the growth of these airlines has spread from Europe and Asia, where most of their traffic has derived, to the United States, which appears to be the next target for expansion.

Earlier this week, several US unions cited the threat, and the availability of export-import financing for foreign carriers that is not available to domestic carriers as a threat to the industry, pointing to the Gulf carriers and their planned route expansions into the US. With several new routes planned for introduction by Emirates, Etihad and Qatar, and the ability to connect via Dubai, Abu Dhabi or Doha rather than Europe, airlines in the US are feeling threatened. Recently Delta Air Lines supported action to enable US carriers to obtain similar financing to that foreign carriers receive, and the movement is beginning to gain momentum with both management and unions.

Another real sign of power shift is the ability of the Gulf carriers with airframe manufacturers to ensure they build aircraft with the range and specifications they desire. The 777X is an excellent example. The aircraft range and engine size have been designed to fit the needs of Emirates, but exceed the needs of 95% of potential customers. The thrust capabilities of the 115,000 GE9X engine are geared toward the needs of an airline operating in hot conditions, and are likely more than most other customers will need. As engines are priced by thrust, both for acquisition and maintenance that is probably fine for Boeing and GE, but some airlines may request a "light" version of the 777 in the future.

Another sign of the power shift is agreements from both Boeing and Airbus with Mubadala, the Abu Dhabi-based government investment fund, which has significant investments in aviation. Each manufacturer has committed to $5 billion worth of future purchases from the region, including materials such as carbon fiber and parts for new aircraft programs. Mubadala has been seeking to play a greater role in producing composite tail sections for commercial aircraft. While we won't see Boeing outsourcing to the degree they do to Japan, we do expect to see the Gulf growing in importance as a potential location of aviation suppliers, as governments in the region continue to diversify away from oil as a primary economic driver. But for every part that comes from a new supplier in the Middle East, a part is taken away from the existing supply chain. The region is now extracting its "offset" for the large volume of orders, led by Abu Dhabi.

The growth of Gulf carriers has come, to some degree, at the expense of Qantas, Singapore Airlines and Cathay Pacific, which have not been growing at their historic rates, and experiencing competition for both premium traffic from the Gulf three, and for economy traffic from emerging low fare carriers.

The world continues to change, and in aviation, a new power center has emerged in the Gulf. Judging by the size of the orders at the Dubai Air Show, the new power center is likely to continue to have significant and increasing influence on the industry over the next decade.

No. 96, November 26, 2013 Singapore Airlines - What Happens when the premium disappears

Airlines over time build up reputations for superior service and garner passenger preference. But over time, consumer preferences change, and once they do, carriers must adapt to the more competitive environment.

Singapore Airlines has for years had the highest ratings for customer service in the industry from a variety of rating sources, and for many years was considered the preferred choice for business and leisure travelers who wanted a little extra. That customer preference resulted in the ability of the airline to earn slightly higher yields than most carriers, as it did not have to discount as high a proportion of its fares to fill its seats.

But times have changed, and Singapore Airlines is now in a position that it has to sacrifice yields in order to maintain market share against growing competition from both low fare and high service level carriers.

Part of the customer preference has been Singapore's Changi Airport, one of the best in the world. But the Gulf carriers are moving into new facilities that are also world class, and are competing on a more equal level than in the past.

We've seen this happen before in the industry. American Airlines, once known for innovation and superior service within the US, lost its preferential position, and then lost its yield advantage once it could no longer command a higher value perception than its competitors. While American rode that preference as long as it could to avoid bankruptcy, it could not hold off indefinitely and has now been acquired by USAirways.

While we don't believe anything that dire will happen to Singapore Airlines, there are a number of factors that are contributing to its falling yields. While the carrier remained profitable in the last quarter, a fourth consecutive quarter of declining yields is noteworthy.

Premium class travel is under pressure from several factors, a sluggish economy, the rising Singapore dollar against other currencies, and increased competition on its medium to long-haul routes from Emirates, Etihad and Qatar from the Gulf and Cathay Pacific and Malaysian Airlines in Southeast Asia. All now offer world class passenger service, with the "Singapore Girl" the remaining service differentiator. Cabins are now similar, meals are similar, seats are similar and entertainment systems are similar. Singapore has been the model of excellence other carriers emulated, successfully, and are now able to compete on an equal basis.

Singapore Airlines, like Cathay Pacific, still operates with 9 abreast seating in economy on its Boeing 777 aircraft, with 19 inch wide seats in economy -- wider even than the 18 inch width touted by Airbus in its recent campaign. But the economy cabin is under pressure from low cost carriers, including AirAsia and Lion Air, and Singapore Airlines has increased its investment in Tiger Air for regional low fare presence, and started Scoot, a long-haul low fare operation. With erosion from low fare carriers, both owned and competitive, Singapore has to rely more on the front cabin for profitability.

Yields in the premium cabin have also fallen, although yields at competitor Cathay Pacific have remained higher. This raises the question as to whether the historic preferential position Singapore Airlines enjoyed has been eroded by Emirates, Etihad, Qatar, who are aggressively expanding. We believe the answer is yes, and it will be difficult for Singapore Airlines to maintain preference-based higher yields in an extremely competitive environment. Bear in mind going further upmarket may not be a solution as costs of producing the seat is what ensures financial success. Singapore Airlines' cost structure is not as flexible as its competitors given the strong Singapore dollar.

When Qantas shifted its European connecting hub from Singapore to Dubai last year, the first signs of a more difficult environment for Singapore Airlines became clear. Today, with continuing disappointing results, Singapore is not delivering the type of return its owner, Temasek, the large Singapore-based private equity firm, would like to see.

Regaining premium customer preference is difficult, particularly in an environment in which pressure to cut costs is a natural reaction. But cutting costs, if it results in declining service levels for premium class passengers, can erode competitive position. Just ask American Airlines. The preference advantage once enjoyed by Singapore Airlines appears to be gone, and the Gulf carriers are now formidable competitors. This will require a new strategy that balances service levels, yield premiums, schedules and costs in the most competitive environment than Singapore Airlines has faced in the last two decades. Can Singapore Airlines turn things around? They can, but they need to remember what brought them to the top in the first place, and aggressively focus on their core strengths that they appear to be pulling away from.

No. 97, December 3, 2013 The Economic Impact of the Seat War

Airbus launched a campaign lamenting17 inch seats for long-haul flights, citing the 18 inch standard for its new A350XWB aircraft in direct contrast to the narrow seats that will be standard on Boeing's 787 with 9 abreast, and 10 abreast for 777 configurations. The ad series is clever, and aimed squarely at comparing the Airbus A350 with the Boeing 777X.

The size of the A350, an aircraft wider than the 787, but narrower than the 777, provides the capability for 9 seats abreast in economy at 18 inches, but is unable to accommodate 10 abreast seating without shrinking to a 16.5 inch seat, while the 777 readily accommodates 10 abreast at a 17 inch seat width.

How does this affect airline economics? The obvious answer is lower seat-mile costs for the more densely packed aircraft. But depending on the standard for seating that you choose, it can change which aircraft claims the honor of best economics in its class. And those bragging rights mean something to manufacturers who advertise their aircraft as the lowest cost option for airline customers. But the world is not always "apples to apples" in comparison, and when an "orange", like the 777X, with 10 abreast seating with 17 inch width gets thrown in, economic comparisons can begin to change.

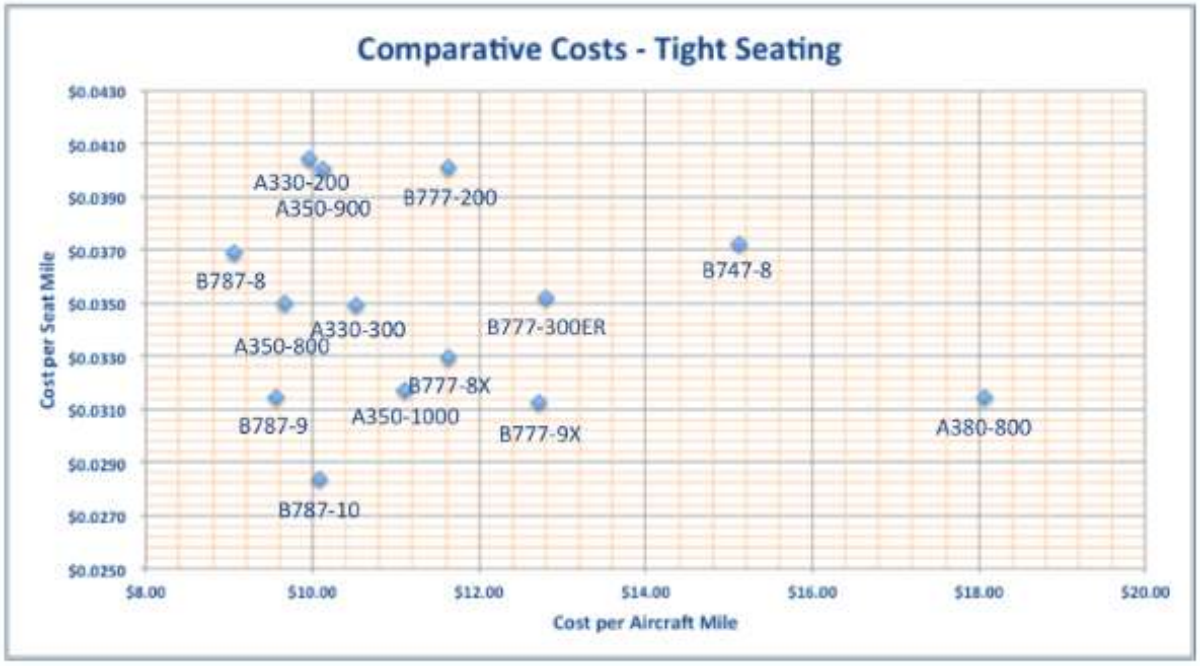
If we take a peek at the wide body market, from smallest to largest of the current models, we can compare the economics for feasible seating configurations, including tighter and more comfortable layouts to provide both "apples to apples" and "apples to oranges" comparisons:

- The Boeing 787 typically accommodates 9 abreast in economy, with seat width of 17.3-17.5 inches, depending on carrier. It can also accommodate a premium economy configuration of 8 abreast with 18.5 inch seats.
- The Airbus A350XWB also typically accommodates 9 abreast in economy, with a seat width of 18 inches. It can also accommodate a premium economy configuration of 8 abreast with 19 inch seats.
- The Boeing 777 and 777-X typically accommodates 10 abreast in economy, with a seat width of 17 inches, or a 9 abreast configuration with a seat width of 18 inches.
- The A330 typically accommodates 8 abreast in economy, with a seat width of 17 inches, or a 9 abreast configuration with a seat width of only 16.5 inches for charter and very low cost carrier operations.
- Boeing's 747-8 typically accommodates 10 abreast in economy with a seat width of 17-18 inches.
- Airbus A380 typically accommodates 10 abreast in economy with a seat width of 18 inches, and Emirates is examining an alternative 11 abreast configurations with 17 inch seats.

Of course, seat width isn't the only factor. Seat pitch, the amount of room between rows, is also important as it dictates legroom. While new thin line seat designs enable reduced pitch with similar legroom, the combination of narrow seats placed closely together can create a claustrophobic cabin in economy, especially for long-haul flights.

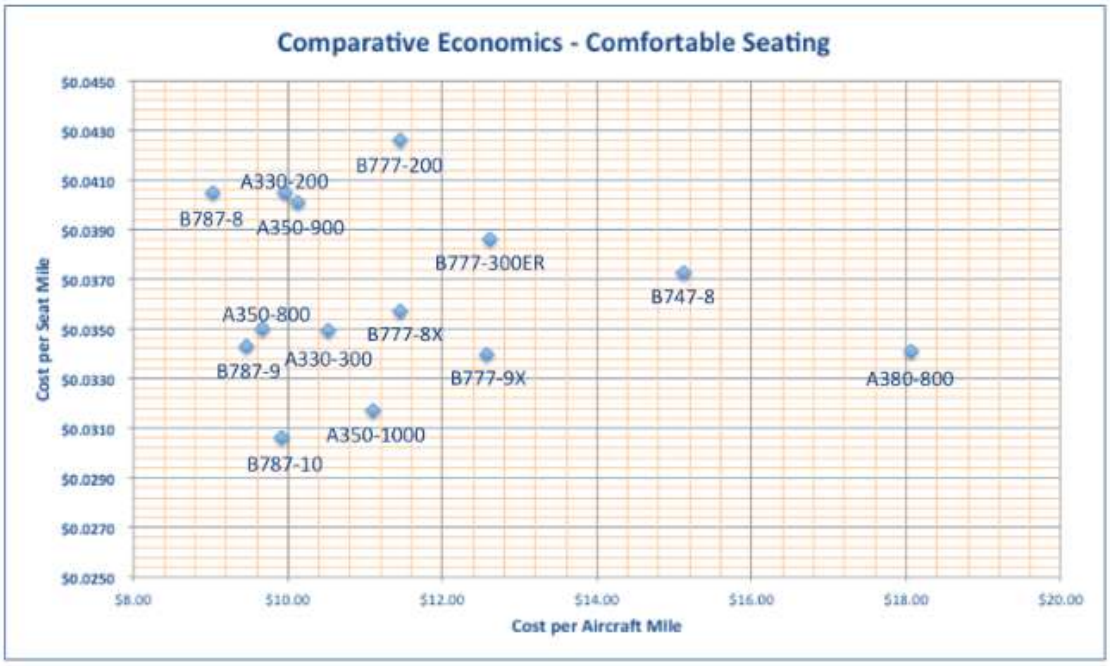
So what does it mean for economics? Let's take an apples to apples comparison for a 5,000 nautical mile mission with $3.25 fuel, and AirInsight's standard assumptions for crew costs, landing fees and other operating costs, and see the impact on operating economics.

The following chart shows aircraft mile and seat-mile costs for each aircraft in their most aggressive configuration, using the tightest seat width possible and standard economy class seat pitch of 31-32 inches - the sardine can configuration. We utilized a two class configuration for 787-8 and A350-800, and a three class configuration for all other aircraft. For tight seating, we utilized 17 inch seating, but for A350 utilized 18 inch seating, as we are not comfortable with the 16.5 inch seats that are sometimes equipped by ultra-low cost or charter carriers.



It is notable, in this configuration, that the 777-9X has slightly lower seat-mile costs than the A350-1000, and is even slightly better than the A380 on the same metric.

Now, if we move seating to an 18 inch standard, the economics begin to change a bit. This chart shows the comparative economics at the more comfortable standard Airbus is pushing. Naturally, Airbus comes out on top in this analysis in seat-mile costs when comparing the 9-abreast A350-1000 against a 9-abreast seating 777-9X.



The Bottom Line

Each of the manufacturers is a master of spin, and will publicize data that will place their aircraft in the most favorable light, using the most favorable assumptions possible. But when you cut through the hyperbole and utilize hard independently produced economic estimates, the picture can begin to change.

For these models, the economic performance is quite comparable, with differences in seat-mile costs quite small, especially when compared with the models they are replacing. We've expanded the scales in our charts to keep data points from being atop one another, and when the scales are expanded, the clustering of these aircraft is quite clear.

Airbus is correct that using an 18 inch standard, their A350-1000 would beat the larger 777X in seat-mile economics. But if the maximum capacity is used, the 777X gains a seat-mile cost advantage over the A350-1000, albeit with lower comfort levels in seat width. So both manufacturers will claim the best economics - each based on different comfort standards and apples to oranges comparisons.

The ultimate decision will be made by the airlines, and whether they believe they can provide competitive differentiation using seat width. Some carriers, such as Singapore and Cathay Pacific, utilize 9 abreast seating on their 777s, while Emirates and Air France utilize a 10 abreast configuration.

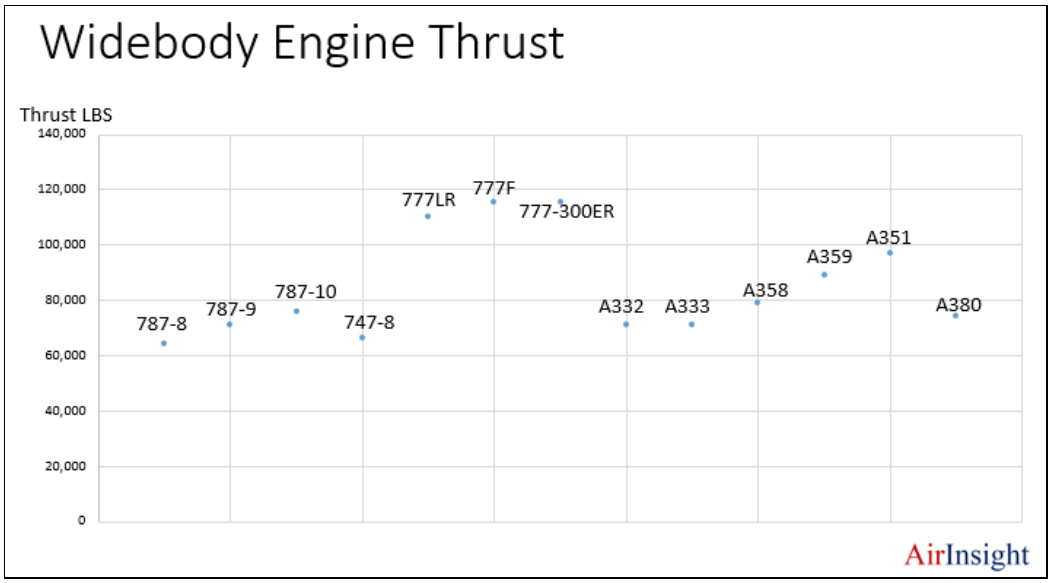
Judging by the upward trend in 10 abreast configuration for existing 777 orders, and the successful launch of 777X, it does not appear that the width of economy class seats is a major priority for airlines today, despite Airbus' wishes, and ours as passengers, that it would be.

No. 98, December 10, 2013 The Market for Wide-Body Engines

The wide body market will see the introduction of new models at a rate not seen since this sector came into fruition in the 1970s. The 787 will have two new models, the A350 three new models, and the 777X two new models all entering service or production by 2020, joining the 787-8 and 747-8 that have recently entered service. While advanced materials are an important element of these new programs, it is new engines drive this sector.

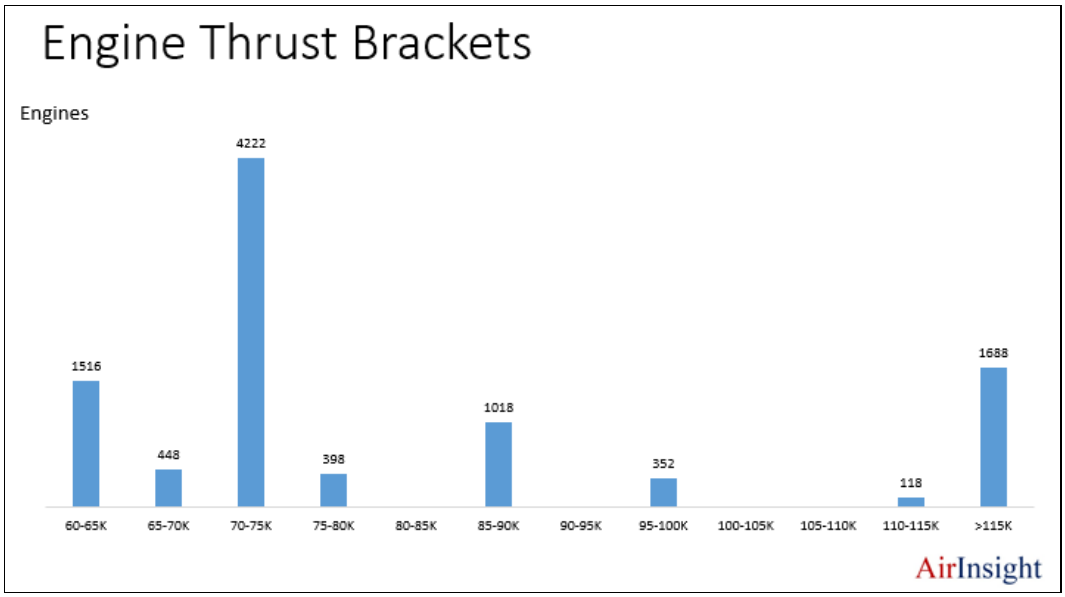
Pratt and Whitney has made a significant recovery in the narrow body market, and will be on five of the seven new narrow-body programs. But in the wide-body market, application of the GTF is less likely.

The following chart illustrates the engine programs driving these new technology programs and the thrust levels for each application:



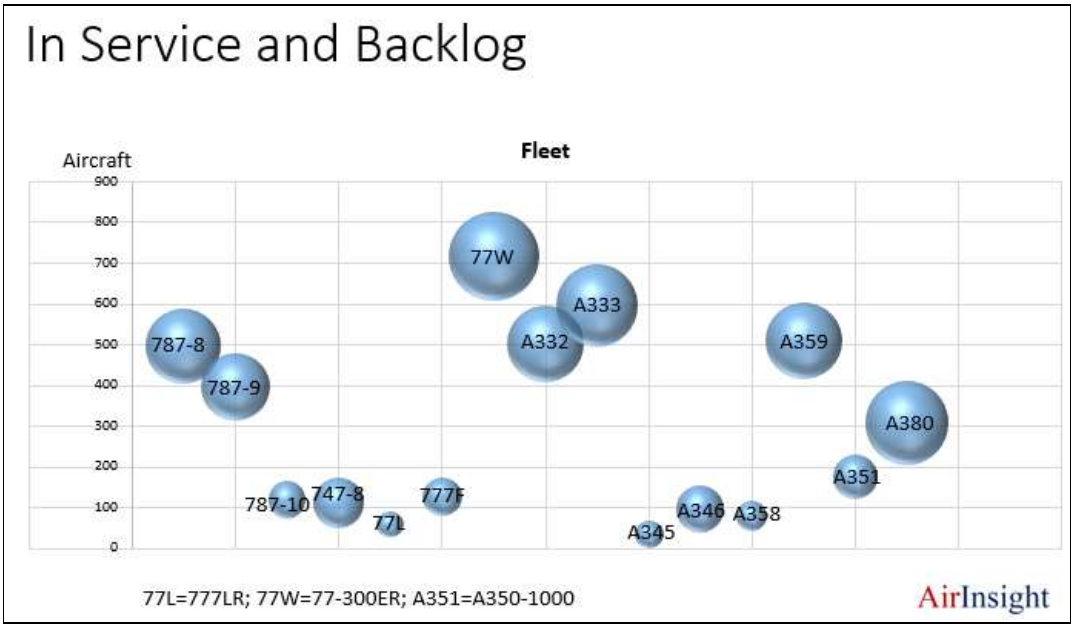
Where is the hot spot in the wide body engine market?

The following chart shows the engine market size by thrust range. As one can clearly see, the sweet spot for engines is in the 70-75K thrust range, accounting for 43% of the engine market illustrated. This bracket covers the A330, 787-9 and A380. The next biggest segment is off to the right for the 777 (110-115K+) market at 18%. The third biggest segment is that of the 787-8 at 16%.



Another way to look at the market is using a three dimension chart as shown below, where the X-axis is programs, the Y-axis is number of aircraft and the size of the balloon shows number of engines.

The 777-300ER demonstrates its market success by having 717 aircraft in service and on order, accounting for 17% of the market even though it represents 15% of the engines. Airbus' A330 represents 26% of the market and 22% of the engines. The A380 on the other hand represents 7% of the market but 13% of the engines.



That explains the market. How will competition shake out? Where should the engine manufacturers concentrate their R&D?

GE and Rolls-Royce have engines in all the right segments. Now is the time to aggressively compete and harvest the R&D investments made in new programs. But Pratt & Whitney needs more aircraft platforms to work on. Currently it is on the A330 and has a stake in the A380. Clearly Pratt is looking for an application of the GTF in the wide-body market.

However:

- 787 is already taken by GE and RR
- A350 is Rolls-Royce exclusive for -1000 and only Rolls-Royce engines are available on the other models
- 777-X is GE exclusive

So where is there opportunity for Pratt? The A380, A350-800 and -900, and A330 re-engining appear to be the only options. But is there a sufficient market to warrant the cost of an all new engine development? Because the GTF is scalable, development costs can be lower for a new wide-body engine family - but without a strong application, it will be difficult to break into the market.

The A380 market appears moribund, as airlines are moving away from four engine aircraft, including the 747-8 and A380, both under-performing market forecasts and expectations. Rolls-Royce and Airbus promise A340 operators a "four for the price of two" maintenance deal on engines to maintain the viability of the A340-500 and -600 models, which have plummeted in value recently. From our perspective, investing in a new engine for the A380 would be unlikely to provide a positive return unless the engine has other applications.

A re-engined A330, with 15% better fuel economy than the current PW4000 would be an attractive airplane, and yield costs within 4.5% of the similarly sized 787-9 in operating economics, but at a lower capital cost. This could be an intriguing option for airlines that do not require the longer range of the 787-9. But a 4.5% differential in operating economics will require a significant capital cost differential by the equivalent of the present value of the differential expense over the projected life of the aircraft. It is hard to maintain engine margins when an airframe manufacturer is forced to cut price, so from an ROI perspective, that program isn't particularly attractive.

The differential against newer technology engines for the A380 and A350 would be smaller than against the older generation PW4000, and we estimate 10% over the GP7200 and 4-5% over the Rolls-Royce Trent XWB. Replacement of the GP7200 with a new GTF could be viable, if the market for the aircraft was stronger, but adding an engine choice to only a portion of the A350 family, which is trending towards the larger -1000 model in orders, appears commercially risky.

With three major new programs already decided with respect to engine manufacturers, it appears that the Pratt GTF has too few applications available in the short-term, and may need to wait until the next generation of wide-bodies to gain a profitable application, which is unlikely to occur for another decade.

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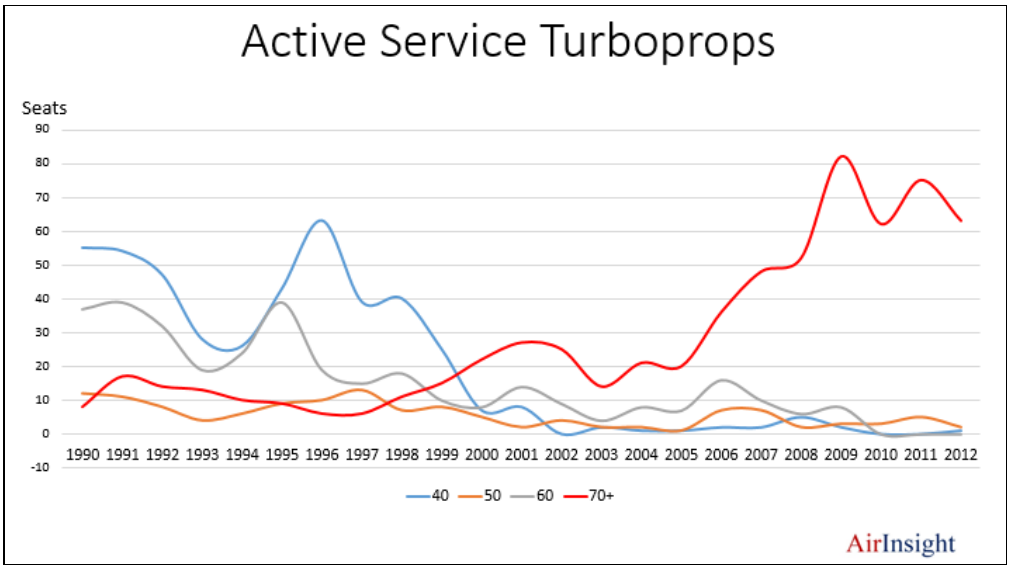
No. 99, December 17, 2013 **The Turboprop Surge**

Hidden amidst the first flights for CSeries and A350, and launches of 787-10 and 777-X, the turboprop market has quietly been gaining strength in the second half of 2013, and appears to be well positioned for success in 2014. We've seen orders and LOIs for 189 turboprops in the second half of 2013 (thru December 10th), with both ATR and Bombardier having market success.

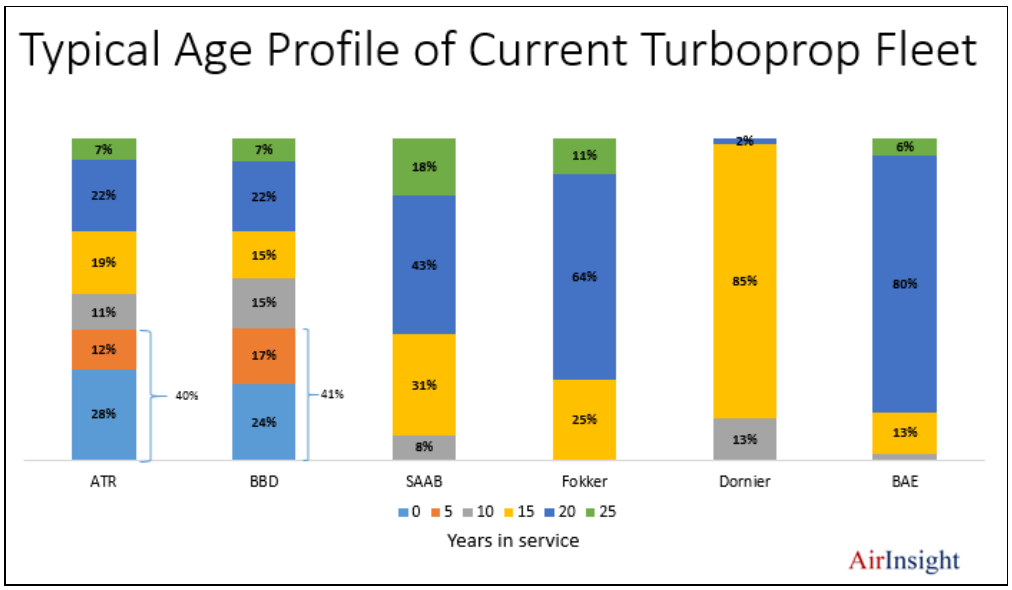
Reviewing how the turboprop market has evolved over the past decade, we can see that just like in other commercial aircraft segments, larger turboprop aircraft have grown more popular because of seat-mile operating economics. The 19, 30 and 50 seat markets have been replaced by the 70-90 seat market. The following chart illustrates the fleet of active turboprops by size over the last two decades.



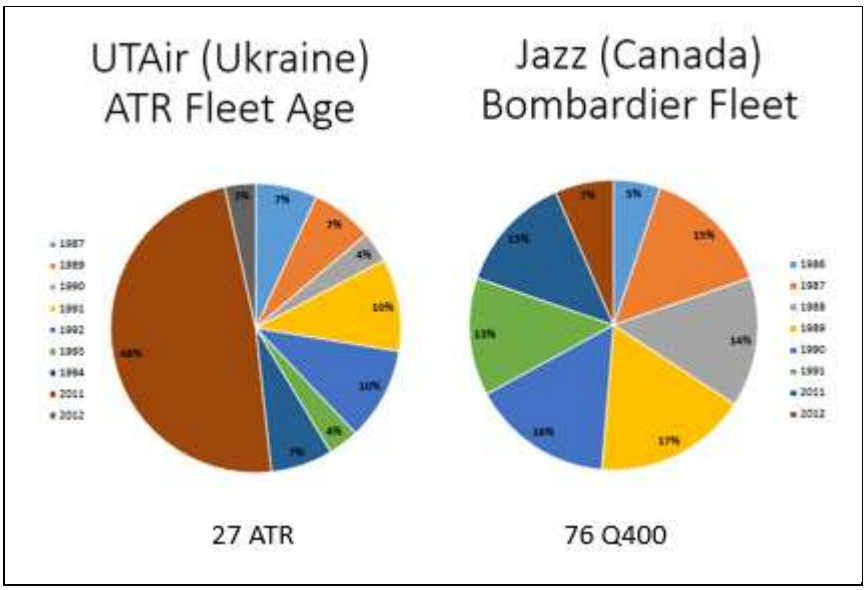
Along with this significant change, we have seen the slow demise of famous aircraft brands. Today we are seeing a turboprop duopoly; again very similar to the larger market. We can expect to see this duopoly grow a lot faster as older aircraft are retired.

For ATR and Bombardier, approximately 40% of their active fleets are less than five years old. This means as the remainder of the turboprop market undergoes updating or growth, only these two firms have the aircraft to supply the market. Moreover, airlines replacing existing ATR and Bombardier fleets are likely to remain with their OEMs because of the costs of pilot training and transition.

Even if replacement is not on a one for one basis, there are 487 older turboprops that need replacement - sooner or later. Bear in mind that turboprops fly shorter hauls and consequently perform many more cycles than most jets. This means turboprops are build tougher and we can see many of the active aircraft are over 20 years old. But they do wear out and almost certainly maintenance costs catch up with economics.



In terms of the replacement market one example from each of the two major OEMs suffices to demonstrate the need. Even though both airlines have added to their fleets regularly 18% of the UTAir fleet dates from 1990 or earlier and 67% of the Jazz fleet dates from 1990 or earlier.



Since the Paris Air Show, both ATR and Bombardier have been busy, with a notable turnaround at Bombardier after the Q400 backlog had dwindled to significantly lower levels. With the new orders, its backlog has been restored to levels that ensure production will continue at its current rate, stabilizing a program that went through a stretch with limited demand.

We expect both manufacturers to get even busier, as Pratt & Whitney Canada is expected to introduce a new engine, currently called the Next Generation Regional Turboprop to replace its current PW100 series. That engine will include a new compressor, a scaled-version of PW's Talon burner, and an 8 bladed propeller to provide a 20% improvement in fuel burn. That magnitude of an improvement is enough of a difference for customers to mandate adoption of the new technology engines on existing or new development programs - much like the GTF forced re-engining programs for A320 (neo) and Embraer EJets (E2). Re-engined models should appear in the 2018 time frame, given typical lead times.

Let's look at some of the activity in the last six months:

ATR cleaned up at Paris, with an order from Danish leasing company Nordic Aviation Capital (NAC) for up to 90 aircraft, with 35 firm orders. Leasing firm HGI Aviation Division, part of HGI Capital, contracted for 10+10 ATR-72-600s for Passaredo Linhas Aéreas. Air Lease Corporation ordered 5 additional aircraft, and the totals at Paris were 83 firm orders and 90 options. Since Paris, NAC has increased its order for an additional 15+25 aircraft after a deal placing 35 aircraft with Garuda in October.

Bombardier, by contrast, had a quiet Paris, with Alaska Airlines ordering 3+7, and Arik Air ordering four Q400 aircraft. But since then, activity has picked up. In August, at the MAKS AirShow in Moscow, Bombardier and Rosteknologii signed an agreement for up to 100 Q400s to be built in a joint venture in Russia, and Ilyushin Finance placed a letter of intent for 50 of those aircraft.

In October, Luxair ordered 1+1 Q400, and in November, at the Dubai Air Show, announced a series of orders, including 2+2 for Air Côte d'Ivorie, Palma Holdings (a leasing company) for 4+4, Nok Air for 2+2+4,

and Abu Dhabi Aviation for 2. Nok Air will also be the launch customer for the extended seating option, bringing the capacity of the Q400 to 86 passengers.

In December, Nantong Tongzhou Bay Aviation Industry Co. signed for 30 Q400 aircraft, providing Bombardier additional presence in China. Momentum for the Q400 program has changed dramatically in the last six months, with a series of new customers, new customers and maintenance capabilities in Africa, and strong penetration of both the Russian and Chinese markets, that offer significant potential.

The turboprop market benefits, like the jet market, from lessor interest. OEMs see a steady flow of orders from lessors as they replace older aircraft, and provide equipment for growth or help get new airlines started. ATR has clearly benefited from its NAC relationship. We expect to see the same occur for Bombardier with Ilyushin Finance. Garuda was able to place its ATRs into service quickly because NAC provided the market with the necessary liquidity.

For the second half of the year, through December 13th, ATR totaled 98 firm orders plus 115 options, and Bombardier 91 plus 63 options. What does this resurgence mean, and how long will it last?

Turboprop Orders June - December 2013

OEM	Orders	Options	Total
ATR	98	115	213
Bombardier	91	63	154
Total	189	178	367

The answer is that regional operations remain sensitive to fuel prices, and turboprops, which are more efficient than jets for short-haul operations, remain a logical choice for this sector. With markets in Russia, India, and China emerging with new requirements, the turboprop manufacturers are well positioned to provide both replacement and growth lift in those markets, which we expect to drive growth over the next five years.

No. 100, December 23, 2013 Replacing the 757

The two big OEMs tell us they have a ”natural” replacement for the 757 -- the A321neo and 737-9MAX. Unfortunately, neither option appears optimal, as both fall short on range, payload, and runway performance. Is there a market for a true 757 replacement, and should this be the next airplane developed by Boeing or Airbus? Let’s take a look at the 757 market, operators and outlook.

The current status of 757 fleet is that 1,049 were delivered, and 986 are still flying. The following table lists the active fleet by the largest 757 operators. A total of 63 aircraft, or 6.4% of the fleet is parked and more than half of those aircraft are currently parked by the largest operators.

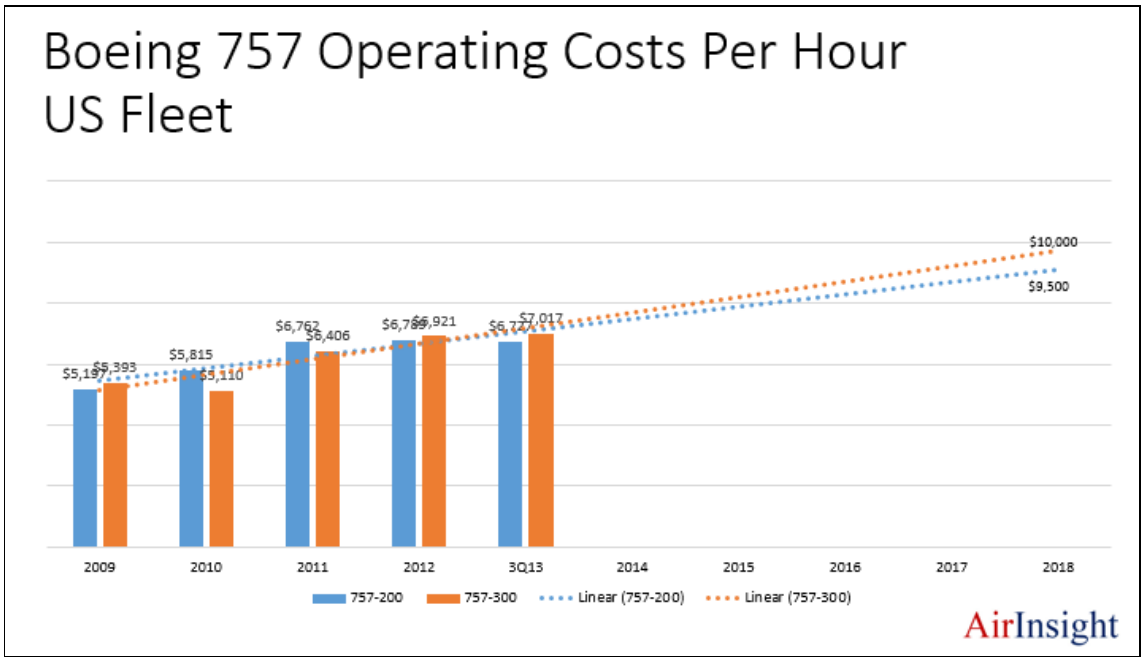
	Active	Share
DELTA AIR LINES	189	19%
UNITED AIRLINES	152	15%
AMERICAN AIRLINES	110	11%
FEDEX	87	9%
UNITED PARCEL SERVICE	75	8%
US AIRWAYS	24	2%
ICELANDAIR	22	2%
DHL AIR	22	2%
THOMSON AIRWAYS	16	2%
THOMAS COOK AIRLINES (UK)	14	1%
CHINA SOUTHERN	14	1%
CONDOR	13	1%
JET2.COM (DART)	12	1%
EAT LEIPZIG	11	1%
SHANGHAI AIRLINES	10	1%
	986	78%

The typical ranges flown by these aircraft are displayed below. The 757-200 has a range of 3,900 miles without winglets and 4,100 miles with winglets. The 757-300 numbers are 3,395 and 3,595 respectively. While most operators utilize the 757 domestically, quite a few operators utilize the 757 on transatlantic services. The benefit of the extended range for this aircraft is the capability to utilize the aircraft on long-thin routes. Transatlantic operations with the A321 and 737-900, and A321neo and 737-9MAX will remain difficult, but are easy for the 757.

	757-200	757-300
United Air Lines Inc.	3,085	1,652
Icelandair	2,976	2,562
US Airways Inc.	2,066	
Delta Air Lines Inc.	1,902	1,363
American Airlines Inc.	1,873	
Federal Express Corporation	1,142	
United Parcel Service	910	

As a result, airlines would keep the 757 in service if costs were not rising for the aging fleet. The 757-200 passenger fleet is on average 19 years old, the 757F fleet averages at about 21 years and the 757-300 passenger fleet averages at 11.5 years old. There are only 55 757-300s in service.

Operating costs for the 757 continue to rise as the aircraft ages. The following chart shows hourly operating costs from US DOT Form 41 for operations by US airlines.



The 757 operating costs are rising and we expect, all things being equal, that in five years' time the typical 757 will start to reach operating costs at the level of current 777-200s, clearly becoming uneconomical.

We can say with some confidence that the 757 is aging and that decisions on replacement need to be made, especially given the lead times on new aircraft such as the A321neo and 737-900MAX. Buying an A321ceo or a 737-900ER would not be an optimal replacement decision given the availability of more efficient aircraft. Unfortunately, the 757-200 does not have a natural replacement among the current options. Moreover, there are nearly 1,000 757s needing replacement. That is not an insignificant market.

With both major airframers focusing on derivatives, can Airbus add more fuel capacity and range to the A321? Should Boeing rethink its 787-3 option as a potential replacement for the 757, as it had planned

similar capacity? Or is this an opportunity for somebody else? We think this could be an opportunity for the Yak 242-400 (formerly known as the MC-21). The prototype is supposed to be unveiled in 2015. Although the Russian aerospace industry is not transparent enough to know the true status of the program, it will use the Pratt & Whitney GTF engine that should deliver excellent economics, and Sukhoi is responsible for a superb looking and highly aerodynamic wing. If UAC, the new Russian national aerospace company, could get through red tape faster, we might be more confident that an airplane could be indeed be unveiled in 2015.

The market is clearly looking for a 757 replacement and neither the A321neo nor 737-9MAX achieve the combination of capacity and range that the 757 offers. UAC could do well in this segment, if it can deliver with the Yak-242. But this will require a substantial cultural change, including program transparency and better marketing and support for airline customers. Could a new player develop the solution the airlines are looking for? Stay tuned, as on paper, the Yak242-400 is closer to a 757 replacement than either the A321neo or 737-9MAX. Of course that requires many hurdles to be crossed, not the least being FAA certification. The delay in the SSJ being put through FAA certification is noteworthy.

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No. 101, December 30, 2013 A look back at a turbulent 2013

As we near year end, we wish all of our readers, friends and acquaintances our best wishes for a happy holidays and a healthy, happy and prosperous 2014. It is time to take a look back at what was a very turbulent year in aviation, with higher than normal amplitudes for impact on the industry, its participants, and the traveling public.

Let's take a look at the turbulent highlights, and low lights, of the year.

January started with Embraer selecting the Pratt & Whitney GTF for the re-engining of its E-Jets, joining Bombardier, Airbus, Mitsubishi and Irkut as customers for the GTF engine. This was an important win for Pratt & Whitney, displacing the GE CF-34 on the aircraft.

January also brought the grounding of the Boeing 787, after two incidents of battery fires aboard JAL and ANA aircraft. Fortunately, unlike the previous groundings of the DC-10 and before that the Lockheed Electra, there was no loss of life with the 787. The issue of Lithium-ion batteries and safety concerns caused Airbus to change the initial specification of the A350 after the 787 problems, and after freighter crashes carrying Lithium-ion batteries as cargo, remains a concern for the industry.

February brought the USAirways takeover of American Airlines in bankruptcy, with the USAirways management team led by Doug Parker taking over a larger airline for the second time (American West and USAirways). David has swallowed Goliath again. With preliminary agreement, it would take the remainder of the year to become effective in December.

February also brought Boeing's redesigned "super box" battery solution for the 787, only six weeks after the grounding. This culminated a very intense effort at Boeing to provide a solution in the event of a fire, as well as redesigning some battery components to provide further protection from a "runaway" situation within the battery itself. Yeoman efforts at Boeing paid off in a quick redesign for FAA consideration.

March brought the reveal of the Bombardier CSeries in Montreal, which had moved from a paper airplane to a real one. While it would require several additional months until first flight, this was a good sign for customers and suppliers that the CSeries was moving forward on its new schedule.

March also brought the delivery of the 100th A380, to Malaysian Airlines. This was a milestone for a program that has repeatedly struggled since its delayed introduction, slow production ramp-up, and a major engine incident on Qantas flight 32.

JAL ordered the A350 in March, which appeared to be a slap in the face of Boeing, its traditional supplier, during the 787 grounding. This was a major customer conquest for Airbus.

The second quarter brought a major Airbus order at Lion Air in early April, adding to a string of former all-Boeing customers that went Airbus that includes Norwegian and American Airlines. The outlook for Boeing was appearing bleak early in the year, between the 787 grounding and Airbus conquests of formerly all-Boeing customers.

Also in April, Porter Airlines in Canada announced an order for the CSeries, along with a plan to expand Billy Bishop Airport on the lakefront in downtown Toronto to enable service to western Canada and the west coast of the US. The order is contingent on approvals from three agencies, including the City of Toronto for the modest runway expansion.

Late in April, British Airways placed a major order for the A350, replacing 767 and 777 in its fleet. This made it quite likely for Iberia to follow with its own order later on.

Etihad announced a joint venture with Jet Airways in India that included purchasing 3 slots at London Heathrow airport and re-routing London service for Jet via a connection in Abu Dhabi. The network provides Etihad access to 23 cities in India, and expands the total network from Etihad's 88 cities and Jet's 77 to more than 140 unique cities in total.

In May, the A350 rolled out, in preparation for its first flight. Anticipation mounted for a potential first flight before Paris.

The 787 returned to service in May, ending a nightmare scenario for Boeing. Airlines began lining up for compensation payments and future considerations from Boeing that could take the form of discounts on future products or other concessions, or even cash payments. Airlines were again flying the Dreamliner, which would continue to receive scrutiny for every fault and flight cancellation in the press.

In early June, Lufthansa commented on replacing the 747-8 with 777-9X sometime in the next decade. This would result in a very short economic life for the 747-8 in passenger service, and does not bode well for that model.

Paris brought the launch of the 787-10 by Boeing, and the formal launch of the E2 from Embraer, each with a large launch order from United and SkyWest, respectively. But if Paris 2011 was the show of the new, and Farnborough 2012 the MAX, then Paris 2013 was the wide body show, with Airbus flying the A350 and the launch of the 787-10. While there was speculation about the 777-X, that launch would wait until Dubai.

On July 15th, an Ethiopian Airlines 787 caught fire on the ramp at Heathrow, damaging a significant portion of the fuselage. This additional fire didn't help the airplane's reputation, but fortunately it was parked and did not burn until six hours after arrival, with no injuries. An Emergency Locator Transmitter appeared to be the cause of the fire.

In August, Mitsubishi announced a delay in the MRJ program, with industry analysts questioning whether a delay might cost orders.

Also in August, the Department of Justice filed suit to block the US-AA merger, citing competition at several airports, most particularly Washington Reagan. A settlement was widely expected, despite the uncertainties associated with the current administration.

August also brought a Russian joint venture to Bombardier to assemble the Q400 turboprop in Russia for the Russia market. That agreement included a potential order for 100 aircraft, including an initial order of 50 from Ilyushin finance.

September brought the certification of the Trent 1000 for the 787-9, clearing the way for launch customer Air New Zealand's first aircraft. The 787-9 is due to fly to New Zealand and Australia for tests and PR this

week.

September brought the first flight of the CSeries that proved so quiet that about half the first flight audience didn't realize the aircraft was taking off until it left the ground. Bob DeLuce, CEO of Porter, nicknamed it the WhisperJet, and he was right. The name may stick.

The following day, Boeing's 787-9 made its first flight in Seattle, indicating that the follow-on models of the 787 might not experience the delays of the original model - great news for Boeing.

Two days later, Lufthansa confirmed orders for the A350-900 and 777-9, becoming the launch customer for the latter, even though the program had not been formally announced.

That same day, India's Tata announced that it is re-entering the Indian airline market in a joint venture with Singapore Airlines. Tata Airways was the predecessor of Air India, which it was named after nationalization in the 1950s.

Late in the month, Norwegian announced publicly its displeasure with reliability on the 787, after a couple of cancelled flights. The number of airlines knocking at Boeing's door for compensation for various 787 issues continued to grow.

October was relatively quiet, but the Japanese government issued additional takeoff and landing slots at Haneda, Tokyo's downtown airport. Of the 16 slots allocated, 11 went to ANA and 5 to JAL, with 4 slots for destinations in the US yet to be decided. Many saw this as payback to JAL which was close to the previous government.

At the end of October, Airbus issued sleep research on aircraft, concluding that sleep was improved with a wider seat. With typically wider seats on its models than competing Boeing models, Airbus created a campaign around the 18 inch wide versus 17 inch wide economy seats. This was aimed squarely at the 777X, which will utilize a 17 inch seat while the A350 offers an 18 inch standard. Airlines mostly yawned. But all A350 customers have stuck with the wider 18 inch seat.

In November, the US-AA merger was settled, with divestiture of slots at Reagan and La Guardia, and slots at three other airports. This outcome was expected, and the merger has gone forward.

The Dubai Air Show brought the launch of the 777-X, with large orders from the big 3 Gulf carriers, Emirates, Etihad and Qatar. The show also brought an order for 50 A380s from Emirates, plus an order for the CSeries from Iraqi Airways.

December brought us an A340 improvement program from Airbus and Rolls Royce to bring A340-500/600 operating costs in line with competing aircraft, including a "four for the price of two" program from Rolls Royce, guaranteeing comparable engine maintenance costs to two GE-90s as found on the 777. Then came an easing of sanctions against Iran. Several A340s are currently available, that might be ideal for Iran Air once more sanctions are lifted.

As we approach year end, the industry has quieted down after an up and down year. Overall, 2013 has gone from a bleak start to a strong recovery for Boeing, a milestone year for Airbus, a new program making progress at Bombardier, a merged AA-US providing competitive balance, and profitable US airlines that

have benefited from capacity discipline. With the exception of the 787 problems, 2013 was, overall, a successful year for our industry.

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