



The Boeing Company

A Market Analysis

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Executive Summary

Boeing is at an interesting stage in the Company's history. After serious delays to its 787 program that have worn heavily on the firm's credibility, its new plane is at last in flight tests. But other programs have also seen delays; the 747-8, the 767 tanker and the 737 Wedgetail. These gnawing problems have taken the shine off the Company's pristine reputation. The Company is paying out a lot of money in compensation at a time when this is most uncomfortable in terms of the business cycle.

Moreover, certain decisions have left the Company open to recurring labor troubles. While its labor relations have not been friendly for a long time, the decision to open a second 787 line in South Carolina was not executed in an especially collegial manner. Though it could be argued Boeing's unions have made Washington State less attractive, Boeing did not take the high road in its negotiations with the union—having all but signed a deal with South Carolina even while it was negotiating with the IAM 751 local.

Possibly one of Boeing's biggest deals is the pending USAF tanker deal and Boeing lost against the Airbus-derived offering in five competitions so far. However, within the United States Boeing has the ability to compete quite differently. Boeing has allies across the nation and marshaled them to ensure that an Airbus-based product cannot win easily. While in financial terms the tanker sale is not compelling—we're talking of only 12-18 airplanes a year in addition to an annual commercial production of about 485 annually—Boeing cannot bear to see its primary rival gain a foothold on US soil. Using its allies as cover, Boeing is playing every card it can to throw up hurdles for the Northrop Grumman/EADS team. These appear to have met with some success.

Boeing has to also consider the future of its two money-makers – the 737 and 777. Both programs face rising competition. The former is seeing a wave of new competition come up from below. In addition Airbus is likely to announce a significant update to its competing A320 at or before the Farnborough Air Show in July. This is forcing Boeing to consider responding by either updating or replacing the 737. Boeing's finances make a replacement very difficult and another update to the 737 is challenging but feasible. Boeing's next decision on the 737 is being driven by outside forces. The 777, though it is the benchmark airliner in its class, was dismissed as "old technology" in the recent United Airlines competition. Virgin Atlantic Airways also views the 777 thusly. Airbus' A350 is succeeding to draw sales because it is seen as "new technology." This is also going to force Boeing to react.

This report describes the challenges facing Boeing and the unfortunate timing these events have on its management.

Overview

The Boeing Co. is one of the world's largest aerospace firms, with more than US\$60bn in annual revenues. It is comprised of three basic business lines: Boeing Commercial Airplanes (BCA), Boeing Capital Corp. (BCC) and Integrated Defense Systems, now renamed Boeing Defense, Space & Security (BDS). BCA and BDS each account for roughly 50% of the revenues, with BDS typically slightly more. BCC is the "house lessor/financier" for BCA, providing customer financing as a funder of last resort.

BCA and BDS each have a number of business units to specialize in segments of their respective industries. For example, BCA business units include those that provide maintenance, repair and overhaul services; pilot training; and maps and navigation services. BDS has some 300 military programs, from the high-profile and easily recognizable C-17 to the lesser-known and more recent emphasis on Unmanned Aerial Vehicles and Systems (UAVs and UASs) and cybersecurity.

The focus of this Report is on Boeing Commercial Airplanes. We will, however, also include discussion of the 737-based Wedgetail and P-8A Poseidon programs and the KC-Tanker based on the 767 and potentially the 777, all derivatives of commercial programs.

Boeing Commercial Airplanes

Program Challenges

The Boeing Co. is arguably going through one of the most difficult periods in its history. The problems associated with the disastrous 787 design process, development and production have cost Boeing billions of dollars in overruns, customer penalties, cancellations (nearly 100 at this writing) and untold customer goodwill. Since the dawn of the jet age, with the then-revolutionary 707 followed by the equally revolutionary 747-100, Boeing has had only two instances in which it was unable to develop and deliver new airplanes on schedule. The first was the development of the 747-100. It is widely acknowledged that development of the 747-100 in the 1965-71 period nearly bankrupted the company. Development costs, serious problems with the Pratt & Whitney JT9D engine of such degree that 747 airframes were parked on the tarmac with cement blocks hanging from pylons in place of the tardy engines, and entry-into-service during what was then one of the most severe post-War recessions of the US combined with a number of other factors to nearly bring Boeing down. The second was the development of the 747-400, in which flight control software problems delayed delivery to launch customer Northwest Airlines by four months.

The problems with, and emanating from, the 787 program cannot be overstated. The plane is over-weight and fuel burn specifications remain challenging. The first flight was more than 2 1/2 years late. Entry-into-service is forecast by Boeing to be in 4Q2010 compared with the May 2008 EIS originally scheduled. We believe Boeing will be challenged to meet a 4Q EIS, but do not yet rule out the possibility.

Boeing previously acknowledged increasing the 787 research and development budget by US\$1.5bn before discontinuing announcing such increases. The company announced a write-off of US\$2.5bn in recognition that the first three 787 aircraft have no commercial value. Boeing

spent US\$1bn to purchase the Vought Aircraft facility in Charleston (SC) in July 2009. Boeing previously purchased Vought's 50% share of Global Aeronautica in Charleston, for US\$55m. In December 2009, the Company purchased the remaining 50% for an undisclosed sum. South Carolina and local jurisdictions have provided some US\$900m¹ in incentives that will more than offset the US\$750m to expand the Charleston plant to accommodate the second production line of the 787.

Boeing had to dispatch hundreds, if not thousands, of engineers to its industrial partners in Japan, Italy and Charleston to work through problems at these locations. The full amount of R&D overruns has not been announced by Boeing, nor for any customer penalties. Aerospace analysts put the all-in costs for the program as high as US\$20bn, a figure we can neither confirm nor dispute.

The problems associated with the 787 are not confined to this program, however. Development of the 747-8, essentially concurrent with, but slightly trailing the 787, has also been negatively affected. The business plan called for engineers assigned to the 787 to be released to the 747 as progress was made; this did not occur and the shortage of engineers on the 747 caused Boeing to outsource engineering to companies in Spain, Russia and elsewhere. Some of the critical work came back requiring major rework by Boeing's engineers, already stretched and diverted to the 787 program. Delays in the 787 flight test program resulting from the problems with software, structural issues, quality control, production and more, delayed flight testing for the GENx engines that will power both the 787 and the 747. The plan called for the 747 to gain test results from the 787 GENx flight testing. As a result of cascading 787 delays and emerging issues in of its own, the 747 is now a year late. Boeing has taken a forward loss on the program of US\$1.4bn because of the delays as well as the global downturn in the cargo market.

We also have solid reason to believe that the resource diversion to the 787 over the entire developmental period has robbed engineers and other resources from new airplane programs that would have enabled Boeing to design replacements for the 737 and 777 to meet advances in new, environmentally and economically beneficial technologies and to meet threats from Airbus and, more recently, emerging market competition. The resource and cash diversion to the 787 program have severely inhibited new airplane programs. Boeing says that with respect to the 737 replacement, new technologies won't be ready until the 2020 decade and this may or may not be entirely true—though we agree that it is mostly true. With respect to the 777, Boeing says that until Airbus more clearly defines the A350-1000, deciding what to do with the competing 777-300ER has to wait. This is only partly true, in our view, and in any event does not address the fact that the 777-200 series is already "dead," leaving the A350-900 free to grab this market segment. Boeing indefinitely put off development of the 787-10, which was envisioned to replace the 777-200. The Company has also indefinitely put off the 787-3, a high-density, shorter range model that in any event has not sold well and probably won't be missed.

We believe that in retrospect Boeing was lucky it lost the 2007 competition for the KC-X USAF aerial tanker, for which the Company offered the conceptual KC-767 Advanced Tanker, an

¹ The number keeps growing. Boeing asked for a one-year secrecy on the amount but the local newspapers have dug out, and continue to dig out, information. The first report was \$270m, then \$450m and more recently \$900m+.

amalgamation of major components from the 767-200, 767-300 and 767-400. Devilishly and effectively, if unfairly, dubbed the “Frankentanker” by critics, Boeing would have been hard-pressed to provide the engineering necessary to develop the tanker on time and on budget had it won the award. After all, five years after the proposed delivery date, Italy is still waiting for its KC-767 tankers based on the existing 767-200 airframe. By the time the third round of KC-X competition is run, with a contract award date goal of August 2010 (probably optimistic on several levels), Boeing should be in a position to provide the engineers needed to execute should it win the contract this time.

Program Successes

Understandably the program challenges received all the press and attention. Nothing gins up the media, analysts and pontificators like failures: failure to meet deadlines, failure to meet deliveries, failure in design-and-execution. However, it is important to note that Boeing's legacy programs are doing just fine, and that innovation isn't dead. We will discuss this in more detail with respect to the 737 program, where Boeing has engaged in some innovative thinking that will keep Airbus on its toes. Continuing Product Improvement Programs are a key to improving legacy airplanes. These serve to refresh, even if sometimes only marginally, legacy airplanes. The challenge is when is a marginal refresh not enough. Boeing is rapidly reaching this point with both the 737 and the 777.

Boeing has taken an industry-leadership role in Biofuel research and it is working in cooperation with Airbus to develop improvements to air traffic management systems worldwide. Its Lean Manufacturing implemented following the 1997 production debacles has saved an unidentified amount but over the years we believe that Lean and related just-in-time programs resulted in the savings of billions of dollars. We think this remains one of the great untold success stories at BCA.

Shifting the 737 line to a moving production line was accomplished several years ago and the 777 line followed more recently. Boeing is moving the 767 production line to the aft part of its current bay to make room for the 787 Surge Line, and in doing so will implement Lean Production that will dramatically cut costs. This will provide benefits for this low-rate line, currently one a month, going to two a month in 2011. Additionally, this Lean line cost savings will be factored into the BDS bid to the USAF for the KC-767 tanker; a critical component in what has clearly become a price shoot-out in competition with Northrop Grumman's KC-30 offering—should Northrop decide to bid, which is questionable at this writing.

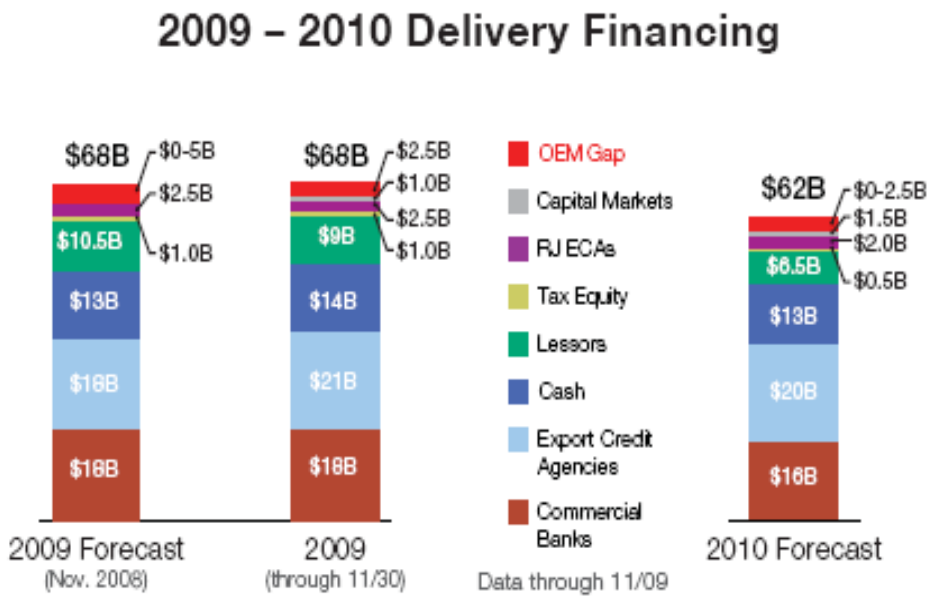
Despite the program problems with the 787 and 747-8, Boeing continues to maintain about a 50-50 market share with Airbus—though we previously forecast in our Emerging Competitors study that these two OEMs are going to see market share erosion to the new aircraft programs in Canada, China, Russia and Japan.

The 787 problems in particular, exacerbated by those in the 747-8 program, put a significant financial dent in Boeing's balance sheet. The full impact is still to be seen as customer penalties and disputes over payments to suppliers emerge following a full assessment as the 787 is righted. Boeing still is able to tap the capital markets to shore up cash positions. Boeing added US\$5bn in debt last year to boost its liquidity.

One of the most notable successes that has not received the recognition it deserves was the correct call on the so-called "funding gap" forecast by many in 2009. Many aerospace analysts and bankers suggested that airlines and lessors would not be able to finance between US\$10bn and US\$25bn of the US\$65bn in orders scheduled for delivery in 2009. This related to all aircraft types, from turbo-props to regional jets to mainline jets. Boeing, later joined by Airbus, forecast at the beginning of 2009 that this figure was a "manageable" US\$5bn. Boeing forecast that its Boeing Capital unit, responsible for customer financing, would have to step up for only about US\$1bn by the time all was said and done. Airbus forecast its likely financing for 2009 would be about €1bn.

On the 3Q2009 earnings call, Boeing announced that it then saw its final 2009 customer financing would be somewhat more than US\$800m. (Airbus remained about the same at that point.) BCC officials fairly burst with justifiable "I told you so's."

BCC in December issued its "funding gap" forecast for 2010 and sees this as US\$0-US\$2.5bn for all OEMs, or half of its forecast in December 2008 for the 2009 delivery year. BCC forecasts it will need to provide US\$500m in customer financing this year.



Source: Boeing Capital Corp

The other success story, defying skeptics, has been Boeing's ability to manage its delivery/order "skyline" to maintain production. Although some aerospace analysts, suppliers and lessor CEOs suggested that Airbus and Boeing needed to cut single-aisle production in 2009 and 2010 by 30%-40%, the two airframe OEMs steadfastly maintained that they didn't need to trim rates (and in the case of Airbus, it had already announced rate cuts to 34 A320s a month beginning in October 2009). Oversales of the 737 of some 100 737s in 2009 gave Boeing plenty of room to maneuver. Airbus had a similar number of A320 oversales in 2009.

Oversales in 2010 are less robust for both companies, and announced orders and delivery dates by Airbus citing some 2010 A320 positions speaks softness of the skyline and to the challenges Airbus has next year. Boeing has expressed confidence that it can maintain 737 rates this year. Boeing says 2011 is oversold but also notes that some positions are available in 2011.

We believe Airbus and Boeing have little choice but to maintain rates due to cash flow needs based on the program delays of the A380, A400M, 787 and 747-8; R&D/production cost overruns and customer penalties; and, for Airbus, the R&D associated with the development of the A350; for both companies, the R&D associated with the development of re-engine programs for the A320 and 737 families; and for Boeing, R&D to develop an enhanced or replacement airplane for the 777.

To be sure, there remain many challenges ahead for Boeing because of the 787 and 747 issues. But these need to be put into context for the company as a whole.

Penalties

Aerospace analysts are trying very hard to estimate what the customer penalties Boeing faces from the delays of the 787 and the 747-8. The analysts have expressed frustration that there has been no guidance from Boeing.

We share the frustration but there are logical reasons why no figure has been forthcoming:

1. Boeing still doesn't know the extent of the delays. The first flight occurred only in December 2009. The six flight test airplanes have yet to enter service as of the date of this report. It is unknown whether the flight testing will produce any problems that will add to delays.
2. The production ramp-up at Everett is a best-estimate. Given the production problems in the industrial supply chain, is the ramp-up realistic or will there be issues that will cause delays? **Significantly**, suppliers we have checked with at this writing are still waiting for direction from Boeing for production ramp information.
3. The assembly, training, learning curve and production-start of 787 Line 2 in Charleston is fraught with risks and unknowns that could cause production rate estimates to fall short.
4. The Surge Line for the 787 in Everett, where experienced workers are assumed to be able to assemble the Surge Line and get it running without problems remains to be seen -- there is always the "unknown-unknown," even with this line.
5. Until definitive delivery dates can be provided the 787 customers, penalties can't truly be calculated.
6. The first block of 787s will be overweight and may also fall short of Specific Fuel Consumption (SFC) guarantees, negatively affecting payload and range. Penalties are provided for these shortfalls.
7. Not all contracts specifically provide for penalties or contain a formula for them. Some contracts merely refer to "legal remedies" available to the customer.
8. Penalties may take many forms: cash; discounts on orders (perhaps retroactively on 787s or on new orders for any Boeing type); Boeing payments for leasing-in interim aircraft (as is the case for Qantas Airways and its Jetstar subsidiary, which leased-in

Airbus A330s); concessions of some other nature, such as spare parts, maintenance support, "Gold Care" 787 maintenance programs and a variety of other services that could be offered.

- Potential penalty payments due Boeing from its industrial partners and supply base for delays cause by them--or at least asserted by Boeing to have been caused by them.

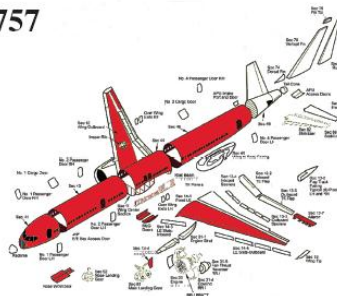
Outsourcing

Boeing has been increasingly outsourcing its airplane production, both domestically and outside the US. This trend has been increasing since the 737 and peaked with the development of the 787, which for the first time outsources major design, engineering and production of fuselage, wing, wing-box and horizontal tailplanes. Only the vertical tail is produced by Boeing in Washington State.

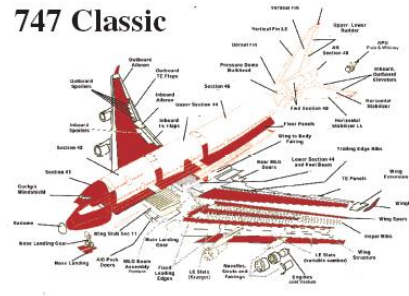
737 Classic



757

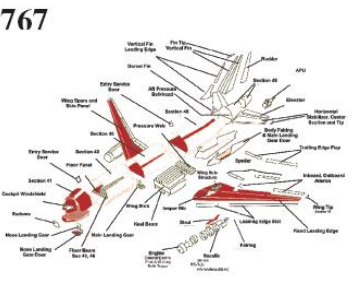


747 Classic

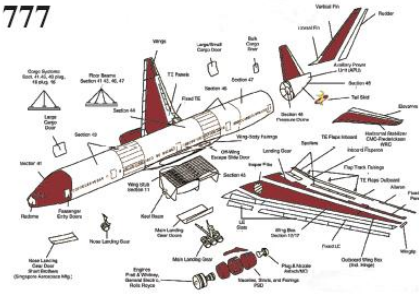


Colored areas are what our IAM Members generally make!

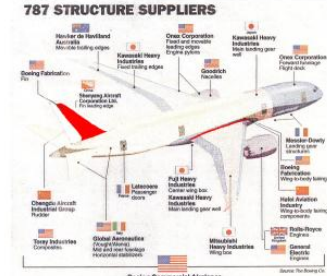
767



777



787



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Source: IAM

This outsourcing has been a major cause for the delays and a major irritant to the labor unions, the International Association of Machinists (IAM) and the Society of Professional Engineering Employees in Aerospace (SPEEA). Both unions warned Boeing in advance of outsourcing the 787 of quality, design and production problems. While a major motivation on the part of the unions was clearly to protect members' jobs, and may have been thus dismissed, it is equally clear that they were right. Boeing has since admitted as much, saying that some future engineering and production on the 787-9 will be brought "in-house."

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Boeing so far has declined to quantify precisely how much work outsourced on the 787-8 will be brought back in-house for the 787-9, but the Company announced that the 787-9 will be assembled in Everett and not Charleston.

Boeing now owns all of the Charleston facility, through which 787-9 segments will flow on the way to Everett for final assembly. Boeing also announced that it is establishing “dual sourcing” in Charleston to diminish reliance on the sourcing covered by the IAM 751 local in Seattle. This includes the vertical tail component referenced above. Boeing said it does not want to be wholly captive to a unionized area that will entirely shut down production in the event of another strike.

We remain unconvinced that Charleston could operate independently of Everett even if the former remains non-union. We believe the two plants are so inter-dependent that a labor strike in Puget Sound will inevitably disrupt Charleston.

Outsourcing remains a continuing issue for the unions and one that contributes to the labor strife experienced by Boeing. CEO Jim McNerney has made it clear over and over that despite the flawed execution on the 787 program, he believes that outsourcing remains the fundamental future of airplane production at Boeing.

Why is this the case? To understand this, it is necessary to briefly examine the history that led to the unprecedented level of outsourcing for the 787.

1. It is first necessary to recall that in 2003, when Boeing was debating at Board level whether to proceed with what was then known as the 7E7, financial risk was the driving factor. Although Boeing has since tried to rewrite history to say that outsourcing is necessary in a global market place for strategic and sales reasons (all of which may be true), the debate in 2003 on the McDonnell Douglas-dominated Board was all about financial risk. The risk-adverse McDonnell Douglas crowd demanded that financial risk be minimized and that R&D costs for the 7E7 come in at about 60% that of the 777. The 777 is widely believed to have cost twice its budget, coming in at a reported final total of US\$12bn-US\$14bn. Boeing has never confirmed this number. Ironically, Jim McNerney, who then was a member of the Board but not CEO, warned that too much emphasis was being put on cost, according to an article at the time in *The Wall Street Journal*.
2. When McNerney was in his executive career at GE, among the assignments during his long tenure was that he became CEO of a new GE Asian division with the specific charge of developing GE’s business in China. When McNerney took on the assignment, GE had no revenue in China. When McNerney moved on to GE Engines several years later, the company’s revenues in this developing market were US\$3bn.
3. Jack Welch, former CEO of GE Corp., had this to say about outsourcing in an audio recording circa 2001:

When we started out our globalization efforts, I would say it was all about selling our products there. That’s stage 1 in any globalization effort.

Stage 2 is making it and selling it there. And sourcing product and our service there.

Stage 3 is the one we're in now in a big way. It is by far the most difficult. It is globalizing intellect. That's where it really gets close to home.

Our job this morning (unintelligible) our average cost of an engineer in Cleveland is US\$150,000.... The average price of our engineer outside Shanghai is US\$17,000. The average price in India is US\$12,000, PhDs. Hungary, US\$24,000.

Are they not smarter? They are. Are they as smart? For sure. What are we doing hanging out in Cleveland with a bunch of engineers? We don't need it. It's wrong. It makes no sense. It makes no sense.

Welch's view about outsourcing was well ingrained at GE for many years, and this is the environment Jim McNerney came from.

4. After McNerney became CEO of 3M, he continued the philosophy he learned at GE and began to outsource research and development that had previously been done in-house. Part of this related to cost-cutting at 3M and part of this related to tapping into emerging markets. McNerney's entire career has included developing business in and partnering with emerging markets. Nothing suggests he will change his DNA.

What are the implications to Boeing for the future? Boeing's new airplane programs will be outsourced. Direct Boeing jobs will be reduced accordingly.

Labor

In addition to the irritants out-sourcing causes labor, relations between the International Association of Machinists (IAM) and the Society of Professional Engineering Employees in Aerospace (SPEEA) and Management have been and remain contentious.

The IAM struck Boeing in 2008 for 57 days and 28 days in 2005. The IAM voted to strike in 2002 but failed to get the two-thirds majority required to affect the walk-out. It is this kind of unrest that Boeing executives point to when officials complain of disruptions in production.

Management has been engaged in a long effort to cut costs and this involves outsourcing, described above, and cutting benefits to IAM members. Both are key to the labor unrest, according to union officials. While officials recognize that outsourcing cannot be stopped, they argue that Boeing has taken the practice too far to the detriment of skill-sets, efficiencies and the company as a whole. They only need point to the 787 program to make their case.

As for take-away of benefits, one labor official told us that the last two strikes, and the near-miss on the 2002 talks, could have been avoided if Boeing did not seek take-aways.

Management points out that labor costs in other parts of the country and in places like China are sharply lower than with Puget Sound (Seattle) and this is both true and only partly true. For example, entry-level wage costs at Charleston's 787 plant are just shy of US\$15 per hour; the

IAM entry-level labor cost at Everett, the primary 787 plant, is just shy of US\$17. This is a mathematical different of 13%, which is not small in isolation, but against this must be weighed skill-sets and efficiencies of the Everett facilities that are clearly superior to the “greenfield” Charleston plant. Benefits and the cost of doing business between Puget Sound and South Carolina also are factors.

The wages between China and Puget Sound are vastly different, without the benefits to worry about (nor pesky things like environmental laws). With respect to wage differences between Puget Sound, Japan and Italy, neither of the latter two may be considered to be low-cost solutions. This is where spreading the financial risk factors in.

Boeing made the site selection for 787 Line 2 all about the IAM, saying that unless long-term production stability was achieved in Puget Sound, Line 2 would be located in Charleston. The IAM stunned Boeing negotiators by offering to extend the current contract from its 2012 expiration to 2020. Boeing said it wanted a 10 year extension, to 2022. The two sides had other issues, some of which on the IAM side were more of national-IAM interest than local-IAM interest and never had a chance of being accepted by Boeing. But the IAM local claimed Boeing never negotiated and only used the IAM as a whipping boy to locate Line 2 in Charleston. Subsequent events provided solid evidence that the labor negotiations were indeed a sham and that the decision to locate Line 2 in Charleston was made months before.

Additionally, while Boeing officials told Washington State elected officials that incentives weren’t an issue—that the only issue was the IAM--the company secretly negotiated some US\$900m in concessions from South Carolina.

In the aftermath of the decision to locate Line 2 in Charleston, the IAM was furious, feeling used and lied to. Such is the state of labor relations going into 2010.

As for SPEEA, the last time this union struck was in 2001 but relations are nonetheless contentious. The battle over take-away of benefits is alive and well, in addition to SPEEA’s current effort to begin organizing the Charleston plant.

We have this advice for the IAM: The IAM National’s interests do not always coincide with the interests of IAM 751, the Puget Sound Local, and therefore national interests can be a detriment to the Local achieving a mutually agreeable solution with Boeing Management. However, the reputation and public image of persistent militancy of IAM 751 membership is harming Washington State aerospace and Boeing. We confirmed to our own satisfaction that the reputation of IAM 751 to strike Boeing has caused enough unhappiness and disruption with Boeing customers that it does make relations with long-time and potential customers more difficult.

Furthermore, we are aware of instances where aerospace companies looking to site new jobs and new production are either reluctant to consider Washington State or immediately rule the State out because of the IAM 751 militancy.

We recognize and concur with many of the complaints IAM has about Boeing Management’s approach to labor relations. We particularly found Boeing’s actions with respect to 787 Line 2 and representations to Labor and Washington State Elected Officials to be disingenuous at best.

Events subsequent to the discussions made it clear IAM 751 was being used only as a stalking horse and whipping boy to get more incentives out of South Carolina.

That said, IAM membership must recognize that Boeing has the upper hand about future programs. Having now set the precedent of establishing 787 Line 2 outside Washington in a non-union location, *there will be no hesitancy* of repeating the process with future airplane programs. The IAM (National and Local) must ratchet back the militancy. ***This is a war it cannot win.*** The war may become one of attrition, and Boeing clearly holds the winning hand.

At the same time, Management must recognize that engaging in persistent open warfare with Labor is detrimental for Boeing, its customers and all other stakeholders. The Unions were right about 787 outsourcing. The more enlightened leadership at IAM 751 and SPEEA recognize that Boeing is going to continue down this path but argue there is an acceptable middle ground that Management has yet to acknowledge. Labor has pride in its work and wants Boeing to succeed in Puget Sound. A new era of cooperation must be found. Jim Albaugh, appointed CEO of Boeing Commercial Airplanes in September, has a major opportunity to effect positive change.

2012 Labor Negotiations: IAM 751 and SPEEA contracts both become amendable in September/December 2012. All stakeholders—Labor, Management, non-union Boeing employees, customers, suppliers and investors—will be watching the negotiating process very carefully. Washington State elected and appointed officials and other companies will as well. The level of distrust that exists today between Labor and Management, in both directions, is palpable. While we certainly do not expect negotiations to go smoothly, since they never seem to, we hope that an agreement can be reached without even the threat of a strike or a strike vote. The unions and management must find a way to reach acceptable accords for the good of all stakeholders and, in the case of Washington State aerospace, to tone down the perception that this heavily unionized state cannot have labor peace.

Washington State Business Climate. We also have this advice for the elected officials in Washington, from the State to the Local levels: Washington aerospace as a whole, going beyond the perpetual debate about Boeing legislative desires, is dependent upon lowering business costs and finding a way to provide more flexibility for government to offer incentives, training and financial support. The incentives provided by South Carolina point out some of the key disadvantages facing Washington State in competing with other states for aerospace business. While the Washington State Constitution includes certain prohibitions on financial aid that South Carolina could offer, Port Authorities in Washington have greater leeway. Much of the “Boeing Agenda” in the Legislature is beneficial to other aerospace companies and business in general. The Legislature and other elected officials have been too complacent and cite a “wake-up call” every time Boeing does something significant out of state. The problem is that these same officials keep hitting the snooze button and the plane is leaving the gate.

How is Boeing positioned vis-à-vis Airbus?

Boeing lost its market leadership position to Airbus during the last decade, and is a solid #2 in what is currently a global duopoly. However, with emerging new entrants, both competitors share of the commercial aircraft market will erode over the next two decades from near 50% parity to market leaders with about 30-35% each.

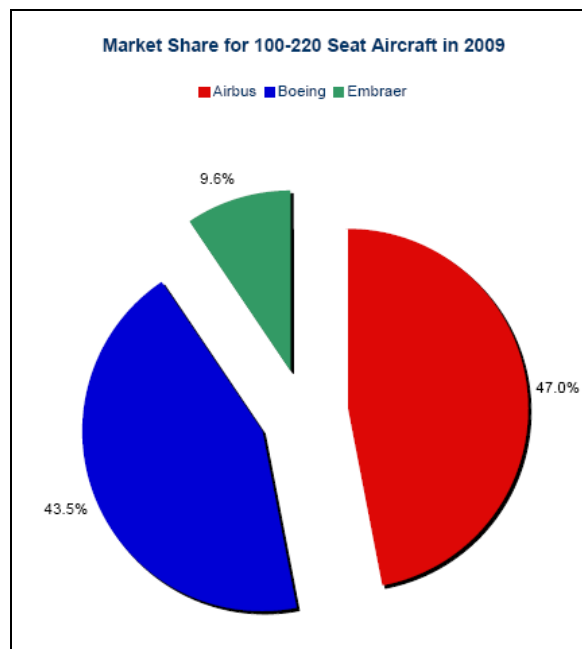
Currently, each competitor has an order backlog of about 3,400 aircraft, with Airbus slightly higher and Boeing slightly lower. Examining the market by sector finds Boeing well positioned in narrow-body airliners, somewhat well positioned in medium to large wide bodies, and unfavorably positioned in very large aircraft.

Narrow-body Airliners

Boeing is today well positioned versus Airbus in narrow-body airliners, as its 737NG, updated in 1996, is equal to or marginally better than the Airbus A320 Family, whose design dates to 1988. But just as Boeing updated its 737 Classics into the NG (EIS 1997), Airbus is ready to announce an upgrade to its A320 that enables it to leapfrog the 737NG. This will force Boeing to upgrade or replace its 737 series if it is to remain competitive in the narrow-body market.



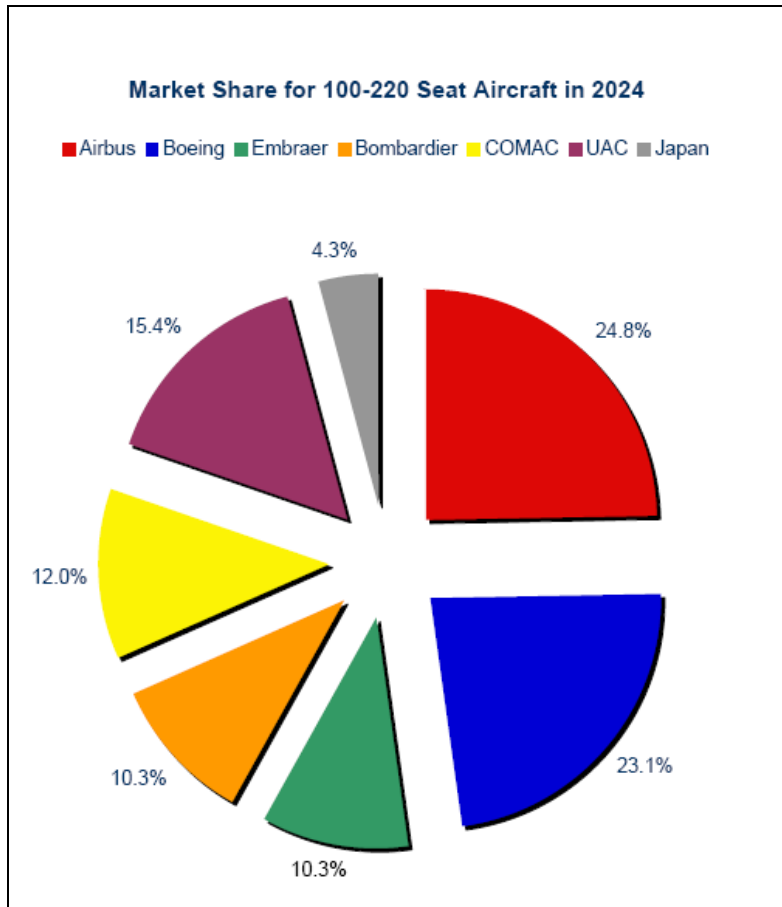
The Chart on the following Page indicates the current market share in the hotly contested single-aisle battle for the 100-220 seat segment.



Source: AirInsight

Neither Airbus nor Boeing currently have plans to introduce a totally new aircraft before 2024, as neither company can afford the development costs as a result of cost overruns on the A380, A400M, 787 and 747-8 programs respectively. The companies originally discussed replacing narrow-body aircraft around 2016. As a result, the existing models need to be upgraded with the most current engine technology to achieve a portion of the economic improvements airlines seek. It appears that Airbus now has a slight advantage in updating its A320 family. New "sharklets" (winglets) will be introduced on production models in 2012, providing a 3.5% improvement in fuel economy. Airbus said last September that it will decide by year-end whether to re-engine the family. We believe that Airbus will decide to do so and could advance the announcement to this summer, perhaps at the Farnborough Air Show in June. An A320RE would likely see an EIS in 2015/16 and remain in production through 2024—and perhaps well into the second half of the 2020 decade. This would force Boeing to either re-engine the 737NG with new technology engines, or accelerate a 737 replacement program. We believe Boeing will choose the former, as the greater need will be for a 777 replacement.

It is important to note that new technology competitors are taking aim at the 100-150 seat market segment including the Bombardier CSeries, Mitsubishi RJ, Embraer E-Jets, COMAC C919 and Russia's MS-21 as committed competitive programs plus the Kawasaki YPX awaiting launch. The narrow body market will become increasingly competitive, and Boeing's market share will fall significantly by 2024 (See Chart on the next Page). Embraer is now studying a further growth of its E-Jets to about 122 seats, roughly the same size as the A319 and 737-700. While we do not believe it likely the direct A320/737 competitors, which are the CSeries at the low-end and the C919 and MS-21 at the high-end, present much of an immediate threat to the duopoly enjoyed by Airbus and Boeing, we also view these airplanes as precursors to full families that over 20 years will shift the dynamics of commercial airplanes.



Source: AirInsight Forecast

Information is beginning to emerge that Bombardier may develop a 150-seat version of the CSeries. This will be a direct threat to the A320 and slightly larger 737-800. A 150-seat CSeries may be expected to be lighter and economics more favorable than even a re-engined A320 or 737-800. However, with full families of airplanes and far greater financial resources, Airbus and Boeing could easily aggressively out-price a “CS500”² Entering this arena is dangerously risky for the perpetually financially-challenged Bombardier.

Narrow-body airliners will likely continue to increase in size. But as the regional jet manufacturers invade the 100-150 seat market, providing new competition for Airbus and Boeing, the two major manufacturers are likely to focus on the 150-220 seat range, larger than their current models in the next generation.

² Bombardier’s CS100 represents the 110-seat CSeries; the CS300 is the 130 model; thus we logically call the 150 version the CS500.

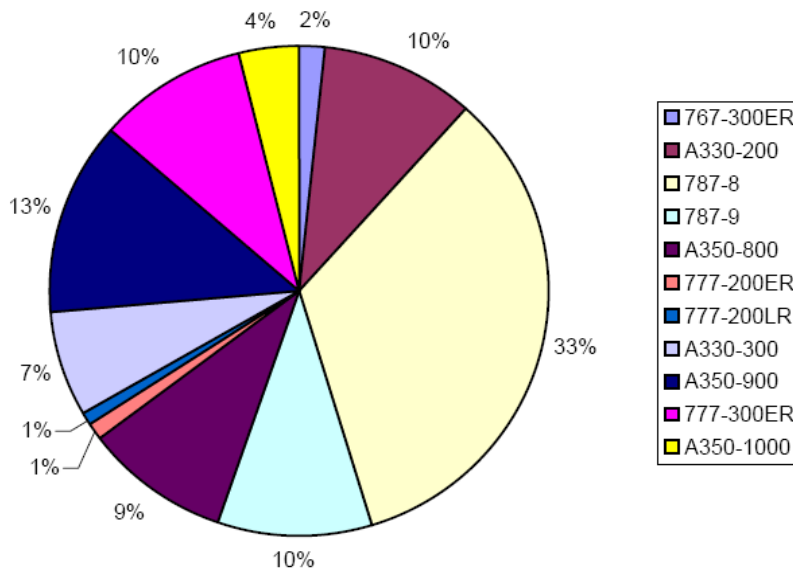
Medium- to Large- Widebody Airliners

Boeing is currently in a competitive dogfight with Airbus in the medium- to large-widebody segment. At the smaller end of the spectrum, the 767 series, which the 787 will replace, is economically obsolete, resulting in a market advantage for the Airbus A330. However, the 787 will leap frog the A330, and shift the market leadership for medium- widebody airliners to Boeing.



At the top end of the market, the two-engine 777 has outpaced the four-engine A340 in the marketplace, providing Boeing leadership in this segment. Airbus countered with the A350XWB, which will compete with both the 787 and 777 and leap frog the 777, making the latter economically obsolete when the A350 is introduced. This requires a response from Boeing.

Backlog 12/31/2009



Source: Airbus, Boeing data 31 December 2009

Very Large Airliners

Boeing is unfavorably positioned against Airbus in the passenger segment for Very Large Airliners, with the A380 having a significant advantage over the 747-8I, which to date has been a commercial failure. Many airlines are replacing 747-400 aircraft with slightly smaller 777-300ER models, and potentially the A350WB-1000. The 747-8, like the Airbus A340, is a four engine aircraft trying to compete in a two engine world. The 747-8 will be a niche airplane, primarily for the freight market. The passenger model is “dead,” in our view, caught between the A380 at the top end and the 777-300ER/A350-1000 class immediately below it. Had Boeing been able to produce the 747 on time and on budget, the dynamics might have been different. As it is, the program isn’t going to recover its development costs. Canceling the program outright is not an option, for customer penalties and supplier commitments would be too costly. But we question the wisdom of continuing the program much beyond its current order book, a position we have now also adopted with respect to the A380.



Boeing CEO Jim McNerney believes in the 747 program and the 747-8I. On the year-end 2009 earnings call, McNerney reaffirmed Boeing’s commitment to the program and inferred it will be profitable if it achieves half of the 740 sales Boeing projects for the VLA market over the next 20 years. We remain far more skeptical.

However, in the cargo sector, the cancellation of the A380F program by Airbus left Boeing as the only manufacturer of a large freighter, ceding that market to the 747-8F. The 747-8F, with 76 orders, should prove operationally successful when the market for air freight begins to recover. Today's deep recession in air freight volumes illustrates the depth of the global economic recession, which has led to overcapacity and depressed demand for new freighters in the short and intermediate term.

Airbus vs. Boeing

Here is a synopsis of how the two companies stack up as 2010 begins. Airbus began 2010 with a backlog of 3,488 undelivered orders, and Boeing 3,375, illustrating Airbus slim market share advantage over Boeing. With a higher backlog, it is likely that Airbus will maintain its leadership position in the marketplace for during the next decade.

BACKLOG FOR CURRENT PRODUCTION MODELS			
	Total Orders	Total Deliveries	Backlog
Airbus			
A318	79	68	11
A319	1,411	1,083	328
A320	3,611	1,731	1,880
A321	622	443	179
A330-200	520	325	195
A330-200F	64	-	64
A330-300	382	247	135
A340-500	31	26	5
A340-600	97	95	2
A350-800	182	-	182
A350-900	248	-	248
A350-1000	75	-	75
A380	202	23	179
TOTAL	7,524	4,041	3,483
<i>Narrow Body</i>	<i>5,723</i>	<i>3,325</i>	<i>2,398</i>
<i>Wide Body</i>	<i>1,801</i>	<i>716</i>	<i>1,085</i>
Boeing			
737-700	1,628	1,134	494
737-800	3,194	1,806	1,388
737-900	253	69	184
747-8i	32	-	32
747-8F	76	-	76
767-300ER	568	537	31
767-300F	82	54	28
777-200	491	451	40
777-300	410	221	189
777F	68	16	52
787-8	656	-	656
787-9	195	-	195
TOTAL	7,653	4,288	3,365
<i>Narrow Body</i>	<i>5,075</i>	<i>3,009</i>	<i>2,066</i>
<i>Wide-Body</i>	<i>2,578</i>	<i>1,279</i>	<i>1,299</i>

Data as of 31 December 2009, Sources Airbus and Boeing

Airbus

With Airbus a spectator to Boeing's difficulties with the 787 and 747 programs, and the A350 still three years in the future (if entry-into-service is 2013 as promised), one would think the European manufacturer should be looking at a good year. But there are significant challenges ahead that make 2010 anything but sanguine.

1. The order skyline for the A320 family is probably a lot softer than has been let on. Airbus and Boeing maintained high production rates in 2009 because of oversales and skillful skyline management. Boeing continues to maintain that its 737 production rate of 31 a month is good this year; Airbus is a bit more iffy, acknowledging it is now looking ahead only six months in advance vs. the typical nine months and it is possible that a rate reduction from 34/month is not out of the question for 2010. We have been watching A320 orders announced in 2009 and there have been some with delivery positions in 2010 and 2011—which indicates to us that the skyline is pretty squishy. Keep a close eye on these signals.
2. The Final Request for Proposals from the US Air Force is due out this month, perhaps around mid-month—at which time we'll see whether Northrop Grumman and EADS, the Airbus parent, decide whether to submit a bid for the A330-200 based KC-30 tanker. Airbus is counting on winning this contract as the basis for establishing a production line for the A330-200F in Mobile (AL). Without the tanker contract, Airbus says there is no business case for the Mobile production line. With the contract and the line, Airbus wants to build the freighter there—and we believe the A330 passenger line will follow and perhaps future airplane programs as well. While Boeing wants the tanker contract on its own merits, we have always held the greater strategic battle Boeing wants to win is to keep Airbus from establishing a US production line. This is another key development to watch this year.
3. The final World Trade Organization decision on illegal subsidies to Airbus is due early this year and with it, we hope, a published version of just what the WTO found is prohibited and what is allowed for subsidies and launch aid to Airbus. Up to now, all the world knows is what politicians supporting Airbus or Boeing positions say and why should we take anything the politicians say at face value? The final findings will be used by Boeing supporters to further knock down any effort by Northrop and EADS to win the tanker deal.
4. But the Interim Report by the WTO on the European Union's case on "illegal" subsidies to Boeing is also due out this year, likely too late to be of any use in the tanker competition, assuming Northrop stays in it. (The USAF, it will be remembered, said it will not consider either finding; the politicians will simply use the findings for political points.) The expectations are that the WTO will find that Boeing also sinned.
5. Airbus still has problems with the A400M and A380 programs; and challenges with the development of the A350. Details will be discussed within these program sections below.

A320 Family

Setting the production rates and soft skyline aside, the A320 family program is humming along nicely. The most significant event last year was the decision to equip new production airplanes with “sharklets,” the Airbus-designed version of winglets, to replace the wingtip fences that have adorned the airplane since inception. These will be available from 2012 and will improve fuel burn by about 3.5%.

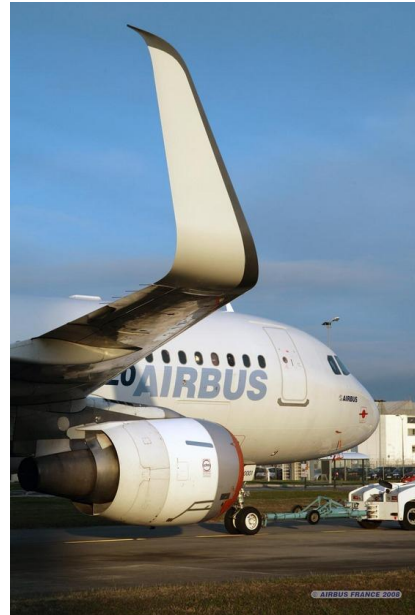
The A320 will be first, followed by six months with the A321 and then the A319. Sharklets on the A321 will be just enough to give the airplane better US trans-continental range, which is marginal today. (Even the A320 occasionally has range issues in certain wind conditions.)

This will be followed in 2010 by a decision whether to re-engine the airplane with a new generation engine. We believe the answer will be yes and that Airbus will offer the CFM International LEAP-X and the Pratt & Whitney P1000G Geared Turbo Fan (GTF). The GTF will almost certainly be marketed through PW’s joint venture International Aero Engines, which currently supplies the V2500 engine in competition with CFM’s CFM-56 power plant. These new engines promise fuel burn improvements of 12% to 16%. Coupled with the sharklets, you are looking at a gain for the A320 family of nearly 16%-20% over today’s airplanes.³ Boeing will have no choice but to respond with a re-engining of the 737 (see below).

An A321WRE will be a strong competitor to replace United Airlines’ 94 Boeing 757s; Boeing will be hard-pressed to match even with a 737-900RE. We think Airbus will be the favorite in UAL’s competition to be initiated this year.

A330 Series

This airplane program continues to hum along, given new life by the problems with the Boeing 787. The development of the A330-200HGW (High Gross Weight), with a 7,200nm advertised range, is within 6% of the advertised range of the 787-8 of 7,650nm. Despite weight and Specified Fuel Consumption (SFC) issues, Boeing says its airplane will meet customer guarantees. Test flights, now underway, will affirm or invalidate these assurances. If the 787-8 falls short on range, the aging A330 will maintain competitiveness with the 787-8.



³ We believe the Airbus A340-600 test-bed results of the PW P1000G GTF show that installation on the A320 family will actually show a fuel burn improvement closer to 10% than the 12%-16% PW advertises for the engine.

Although the A330 is of current generation design, and therefore has higher operating costs than those projected for the 787, Airbus has argued from the launch of the 787 that the slightly larger A330-200, carrying more passengers and more cargo, can produce an estimated US\$192,000 per year per airplane more revenue than the more efficient and less costly 787. There are all kinds of variables that can reduce or increase this number, of course.

Airbus has no choice but to promote the A330-200 as hard as it can; it offers no new generation competitive airplane to the 787-8, which carries 210-250 passengers vs. the A330-200's 250-293 passengers.

The A330-300, with a 295-335 passenger capacity and a 5,650nm range, is promoted by Airbus as a perfect medium-range aircraft for intra-Asia, Europe-Africa and US-Trans Ocean routes.

Airbus expects the A330 will be sold alongside the A350 for many years. The backlog at December 31 for the A330P and A330F is 394, or 4.3 years at current production rates.

A340 Series

No change from 2009; dead product; still not buried. With Virgin Atlantic's cancellation of the last of the outstanding orders for the A340, the way is clear for Airbus to formally close this product line, which would leave only the 747-8 and A380 as four engined aircraft in production. At December 31, there was a backlog of just seven A340s.

A350 Series

Airbus promises a 2013 EIS for the A350-900, followed at yearly intervals for the -800 and -1000 derivatives. Given the history of program execution for the A380 and A400M, as well as the composite-related problems with Boeing's 787 and the 787 knock-on effect on the Boeing 747-8, observers are understandably skeptical whether Airbus can meet these EIS dates.



Aerospace analyst Richard Aboulafia, who is widely if somewhat unfairly perceived as anti-Airbus, already predicts a two-year delay. (Aboulafia's anti-Airbus image comes from his unrelenting criticism of the A380 program and the fumbling efforts to settle on an A350 design. He believes the A350 XWB is a winner, despite concerns over EIS, and he credits Airbus for putting money into R&D during the decade Boeing was miserly in the same area.)

We think it is too early and too severe to be predicting two-year delays, and so do A350 customers we've talked to. But we are hearing through suppliers that they are concerned critical decisions are taking longer at this stage and delays of six months are being speculated.

Airbus is well aware of its challenges and the need to perform on time and on budget. Officials not only have their lessons learned from the A380 and A400M debacles, they have closely watched the problems with the 787 and vow to avoid making the same mistakes in the A350 program.

When we visited Airbus in September, one of our prime missions was to drill down on the A350 program and how Airbus would keep it on time. We came away convinced officials have a reasonable plan, but as those at Boeing found out, execution is the hard part. It remains so with the A350.

With the first lay-up of composite structure for the production A350—test composite structures have been built for some time—2010 will be the time to really begin to pay attention to milestone progress and indications whether program delays will be forthcoming.

A380

At this time last year, we actually thought Airbus had its production issues sorted out for this airplane—though we expressed dismay that officials said it would still be three years before production ramped up to the planned four-per-month (which was before the depth of the global economic crisis became clear). But Airbus still doesn't have its act together on this airplane. This remains a financial albatross and instead of getting better it seems to be getting worse.



Despite initially predicting it would deliver 21 A380s in 2009, Airbus delivered just 10. Instead of original plans for 45 deliveries this year, the new target is 20. The Company acknowledged that the A380 will be a financial drag for years to come. To be sure, a few deferrals were at customer requests but these cannot mask the reality that the program remains a huge financial drain. Production costs remain out of control. Our back-of-the-envelope estimate is that the reduced delivery stream in 2009-2010 will cost Airbus about US\$5bn in cash flow from the absence of delivery payments.⁴

Boeing reduced its 20 year forecast for Very Large Aircraft from 940 to 740, with only 500 of these being passenger models, split between the 747-8 and the A380. We think this is a bit conservative but Airbus continues to stick to its forecast that there will be 1,300 VLA -Ps sold over the next 20 years, a figure we believe to be wildly optimistic. (It took Boeing more than 35 years to sell 1,400 747s.)

⁴ This figure is probably high. We do not know actual sales contract prices and use a \$150m per airplane figure for launch customers. Pre-delivery payments also must be factored in and we do not know the amounts (typically 30%, however) and schedule of payments.

In 2007, after the delays in the program were first quantified as two years, Airbus said it would have a break-even of 425 A380s. Officials stopped talking about break-even long ago. With the continuing production, delays and cost issues, the break-even has to be moving to the right. We were once of the opinion that Airbus could break-even in 10 years. We now doubt this can be achieved in 20 years, but admit that this is a WAG (wild-assed guess) as opposed to any financial analysis.

We have been a consistent supporter of the A380 and believe it will indeed prove to be a technically proficient airplane that passengers enjoy. But given the long-term financial implications, we have to ask, has the time come for Airbus to cut its losses and terminate the program? While we continue to believe that the company will sell 500-600 airplanes over 20 years (down from our previously target of 700), if you stand little chance of making money, why bother? The resources are better put to use on the core A3-Series programs.

A400M

At the start of 2009, we wrote that last year was the year Airbus had to get the A400M flying. It did, barely, with the first and second flights in December. Real testing, however, won't begin until this year.



This troubled program has the potential to be more harmful to Airbus than is generally recognized. See the Special Comment at this end of this report for details.

At this writing, the future of the program is anything but certain. Airbus CEO Thomas Enders threatens to cancel the A400M; partner governments, looking at 40,000 jobs, say they want the program to continue "but not at any cost." Negotiations continue.

Along with the A380, this program diverts critical cash and engineering resources from the core A3-Series airplanes that are the company's bread-and-butter. We remain concerned that the continued diversion of resources will work to the detriment of the A350, inevitably leading to delays on this airplane that is critical to the future of Airbus. A similar diversion of resources at Boeing to the 787 has been detrimental to the 747-8 and future airplane programs.

The issue for Airbus is that the A400M is actually an innovative design that fills a good slot between the aging Lockheed Martin C-130 and the larger Boeing C-17. We think the airplane has good potential if the engine/software problems have been sorted out. Still, only EADS/Airbus member countries plus Malaysia have ordered the airplane (South Africa canceled). Does this airplane truly have a future in worldwide military and humanitarian service or is it merely a jobs-and-prestige program?

Canceling the program means Airbus will have to repay several billion Euros to customers, unless they are willing to simply write off these amounts. Thomas Enders, the Airbus CEO, was quoted in a French newspaper within the last week suggesting the program could be canceled.

Given the implications and the European way of doing business, we can't dismiss this possibility. But in the end we think prestige and jobs will override business sense.

KC-30 MRTT

This month will be critical for Airbus, its parent EADS and its tanker partner Northrop Grumman. The US Air Force is expected to issue its Final Request for Proposal for the KC-X contract to provide 179 tanker-transporters to replace the 50-year old Boeing KC-135s. Northrop says it won't bid unless specifications are changed because in its view the Draft RFP tilts toward the smaller Boeing KC-767 (we generally, but not entirely, agree).



From the start of the 2007 competition, won by Northrop but overturned by the Government Accountability Office, we said that if all the USAF wants is "just" a tanker, the KC-767 is the choice. If the USAF wants a highly flexible multi-role tanker-transport, the KC-30 is the better choice. We also believe there is a strategic argument, as well as a political one, that supports buying both airplanes because there are simply different mission requirements. But the Pentagon is adamant that it will not split the order, in large part for budgetary reasons and follow-on operational costs of acquiring and assimilating two fleets of tankers.

We believe the Obama Administration should take a large chunk of the Stimulus money and fund a dual source procurement, doubling the production rates in the process. This approach will have more meaningful jobs-creation and industrial base preservation than allocating some of the money to silly things like a California dinner train. Allocating Stimulus money to the Boeing and Northrop tanker programs will also provide critical, expedited replacement of the aging KC-135 tankers to support our Armed Services who remain in harm's way in two wars.

Winning the contract is critical to world-wide tanker sales; many countries follow the US lead, though it must be acknowledged that in each case where the KC-30 competed with the KC-767 outside the US, the KC-30 won.

Winning the contract is also critical to the Airbus strategy of establishing a commercial A330-200 production base in the US. Northrop and EADS promise to build a tanker assembly plant in Mobile (AL) if the KC-30 is selected. Airbus pledged to build the A330-200F there if this happens and expectations are that the A330P will follow. But no tanker contract, no US plant.

And this is why we believe Boeing and its supporters are fighting so hard to block a tanker award to Northrop. This, we believe, is more important to Boeing than winning the tanker contract,

though we also acknowledge Boeing wants the contract on its own merits as well as to keep EADS out of the largest DOD contract to come along in years.

The MRTT is running about 18 months behind schedule for delivery to launch customer Australia. About six months was due to customer change orders, according to the RAAF and EADS. The balance rests with developmental issues.

Boeing

There is no getting around it: 2009 was an awful year for Boeing despite the better-than-expected financial results and nearly all of the bad tidings can be traced to the 787 program. (We speak of BCA; Defense also had a bad year; the Pentagon decimated Boeing's defense programs in the FY2010 budget.)

At the start of 2009, we wrote that Boeing was then projecting first flight for the 787 in April. This slipped to June, and in a monumental embarrassment, Boeing promoted a June 30 test flight during the Paris Air Show June 15-16, only to take it all back on June 23 with the sixth program delay. The first flight finally occurred December 15, followed December 22 by the first flight of Airplane #2 and the second flight of Airplane 1 on December 30.

The 747-8 program was delayed as a result of resources that continued to be diverted to the 787 program and its own design issues.

The KC-767 International program remains troubled, despite completing deliveries to Japan.

While these programs dominated the headlines, they also overshadowed the successes. The legacy airplane programs (737, 767, 777) went smoothly all year. Production rates on the 737 were maintained at 31 per month all year despite skeptics and calls to reduce rates. The 737-based P-8A rolled out and is in flight testing. The long-delayed 737-based Wedgetail finally entered testing. Delivery to Australia remains pending at this writing. Boeing Capital Corp. proved correct with its forecast that there was a management customer funding gap of US\$0-US\$5bn vs. dire predictions that the gap was US\$10bn to US\$25bn.

Challenges facing Boeing this year include:

1. Successful completion of the 787 flight testing program on a very aggressive schedule of 8½ months. Certification is required before delivery of the first airplane, said only to be in the fourth quarter, but reported by Flight International as potentially at the end of September. All Nippon Airlines is the first customer.
2. First flight of the 747-8, perhaps as early as this month, followed by a flight test program and 4Q2010 delivery.
3. A decision on whether to re-engine the 737.
4. Maintaining 737 production rates at 31 per month to maintain cash flow.
5. Managing the "skyline" (the order book) for the 737 in particular this year.
6. Relocation of the 767 line to the aft bay of the hangar it occupies to make room for...
7. The Surge Line for the 787 while the...
8. Second 787 production line is built in the greenfield Charleston (SC) plant.

Here is a program-by-program rundown for 2010.

737 Family

Boeing's venerable line continues to be the unheralded flagship of the company. The 787 and 747 may be sexier and the 777 is a solid performer, but it is the 737 that is purchased in the greatest number and sustains the cash flow more than any other 7-Series airplane.



Boeing continues to provide modest improvements for the airplane. Officials announced last April that it will introduce aerodynamic improvements and the CFM-56 Evolution in 2011 that will improve fuel burn 2%; and a 787-inspired Sky Interior in 2010. The Sky Interior has a “wow” effect that will overshadow the 2007 update by Airbus of the A320 Family interior, a highly functional and attractive upgrade that nonetheless is conventional in its look. These Boeing improvements keep the 737 slightly ahead of the A320 Family in performance, look and feel.

But the advantages will be short-lived. In 2012, Airbus introduces the “sharklet” winglet on the A320, with installation following by six months on the A321 and A319. The sharklet improves the SFC by about 3.5%, which depending on the plane-for-plane match up is predicted by Airbus to give the A320 Family a one-to-three point SFC advantage over the 737s. Boeing unofficially believes the sharklets only allow Airbus to catch up to the 737 SFC. Airbus is also implementing aerodynamic improvements to reduce SFC by another 1%.

Either way, the 737's SFC advantage is diminished or overcome by the A320 enhancements.

Boeing might be able to “live with” this situation since the lighter-weight 737 means lower landing fees and maintenance is said to be somewhat less on the 737. The 737-800 also typically carries 12 more passengers than the A320, providing greater revenue opportunity. But Airbus is, in our view, certain to decide this year to proceed with a re-engining program for the A320 Family that will add another 12%-16% improvement in fuel burn.⁵ Boeing cannot let this stand, and we believe Boeing will likewise announce a re-engine program for the 737. Airbus will likely have an EIS of 2015 and Boeing will follow in 2016. This is because we believe Airbus will launch its re-engine program with the Pratt & Whitney P1000G, offered via its joint venture International Aero Engines. We think Boeing will launch with the CFM LEAP-X engine, which won't be ready for service until 2016, based on today's information. We understand that PW is aggressively pursuing at least a dual-source engine supply for the 737 and do not rule out this prospect, though at this stage we believe this to be a long-shot.

⁵ See our Comments in Footnote 4 on this point.

These improvements will, we believe, push replacement airplanes out to the latter half of the 2020 decade unless some regulatory environmentally-based legislation intervenes or a dramatically better airplane technology emerges in the first half of the 2020 decade. We see the A320 and 737 families being around for another 15-20 years.

747-8

This program is struggling. Freighter sales are stalled due to the continued global cargo market depression. Passenger sales are stalled, spurred we believe with the recent order for five from Korean Air Lines by compensation for 787, 747-8F and 747-400BCF delays to KAL. We think there will be more 747-8 passenger orders placed this year, but we also think these will be to customers affected by delays to the 787 and possibly the 747-8F programs and as a result, any 747-8I sales will be sharply depressed in pricing.



Canceling the program has too much collateral damage to customers and suppliers, as well as Boeing's already tattered reputation and balance sheet. This program will continue to limp along. Boeing CEO McNerney remains upbeat about the 747 program, however.

767

Like the A340, this is a plane that won't die. Unlike the A340, the 767 is still a viable program, if reduced to a back-up for the 787 delays. At year-end, there was a backlog of 59 aircraft, or 4.5 years at the current one-per-month production rate. The current plan is to go to two per month in 2011. If Boeing wins a tanker contract with the KC-767, another rate increase of 1 to 1½ a month will be forthcoming from 2015.



Because of the need for a 787 production Surge Line (see 787 discussion below), the current 767 line will be relocated to the aft part of the bay it now occupies. A Lean production line will be implemented, reducing unit costs by about 20%. Relocation begins this year and will be completed next year.

The long-term future of the 767 depends on the tanker contract.

777

This stalwart airplane is a superb long-haul machine. But the countdown to its end-of-life is underway.

The 777-200 is essentially already dead. There are few -200ER sales and the -200LR is a niche airplane; niche airplanes historically have a short life. The -200LRF will enable the 777 line carry on for a respectable period when the passenger versions are eclipsed by the next generation of airplanes. The A350-900 already dominates this market segment.



The 777-300ER continues to dominate its class, which is opposite the morbid-bound A340. With the development of the A350-1000, the 777-300 days are numbered. The conundrum at the moment is what Boeing will do about it. The answer is, wait another year to decide. The A350-1000 still is too early in development for Boeing to have a clear picture of the threat the Airbus poses. Airbus claims the -1000 will have up to 25% better operating economics than the -300ER. We're told Boeing believes this will prove to be only about 10%. If Boeing is correct, the company might be able to get away with major upgrades to the airplane for about 20%-30% of the cost of developing a new one. Even if Boeing can't precisely match the presumed 10% A350-1000 gain, because the 777-300ER carries slightly more passengers and more cargo than the -1000, the A330-200 vs 787-8 argument recounted under the A330 segment above is reversed here in Boeing's favor.

On the other hand, if the Airbus assumptions of a 25% operating improvement are correct, Boeing will be faced with a decision to design an entirely new airplane. But this is a decision for 2011 and we are getting ahead of ourselves.

For 2010, Boeing previously announced production of the 777 will reduce from seven to five a month from this June. Other than this, the word for the 777 this year is "status quo."

787

At long last, Boeing got its first flight in December. Now, as many say, comes the hard part, though it is hard to see how flight testing can be much harder than the difficult birthing of this airplane.

Accordingly to Flight International, four test airplanes are to be in service by the end of February and all six by the end of April. This is two months faster than Boeing CEO Jim McNerney told analysts on the third quarter earnings call. Flight testing is scheduled for



8½ months, faster than the 12 months announced on June 23 when the June 30 first flight was postponed for the sixth time. First delivery to launch customer All Nippon Airlines is planned for the end of September with 10 787s delivered to this customer by year-end, according to Flight.

If all this comes to pass, there will be a huge sigh of relief worldwide.

KC-7A7 Tanker Program

Boeing took a new approach to the KC-X tanker competition at the Paris Air Show, announcing that it is prepared to offer the USAF either the KC-767 or a tanker based on the 777, the KC-777. Speculation has arisen that Boeing might submit two bBDS, one for each airplane, to bracket Northrop's KC-30 bid—should Northrop decide to proceed with one. We think Boeing will submit only one bid, for the KC-767, in a configuration that is close to that of the Italian tanker. If Northrop drops out, there is no need for Boeing to submit two bBDS. If Northrop stays in, we still think Boeing will submit only a KC-767 proposal. All the sunk costs are in this program, while the KC-777 is entirely a developmental airplane. The DRFP discourages developmental aircraft, according to those who have slogged through the entire document.

We remain concerned that Boeing has yet to deliver the KC-767 to Italy, now some four years late. We are told problems remain with the centerline hose-and-drogue system (Boeing has never confirmed or denied this). We are also told that issues remain with the wing-mounted refueling pods, though Boeing says these have been fixed. Although Boeing intended to deliver the first of four tankers to Italy last year (“the Year of the Tanker” in a Boeing internal message), that this still has not happened indicates all is not well. Since the US tanker is similar to the Italian tanker, we remain skeptical about the program.



The fourth KC-767 for Japan was ferried to Japan from Wichita for delivery to Boeing's Japanese partner, Itochu Corp., in December 2009. Itochu delivered it to the Japan Ministry of Defense on January 12, 2010.

Boeing continues to complete the Italy flight test program and to address test results. Boeing then will work with the US Navy to schedule and complete a Military Utility Observation (MUO) required under contract. Boeing then begins the Tender for Acceptance process with the Italy defense service for delivery. Boeing still is not forecasting any dates concerning these remaining milestones.

Boeing's Defense unit has restructured the tanker program, shifting the tanker headquarters to Puget Sound and engaging the P-8A team to benefit from the success of this program should Boeing win the KC-X contract.

P-8A Poseidon

This 737-based airplane is designed to replace the aging P-3A Orion as a sub-hunter and airborne detection system. The P-3A is based on the Lockheed Electra four-engine turbo-prop designed in the mid-1950s.



The Poseidon rolled out from the Renton factory last year and is in flight testing. The successful management of this program serves as an example for the KC-767 tanker team. The tanker team is now consulting with the Poseidon team for lessons-learned on running a successful program. This is a Boeing success story of 2009 that got submerged in the bad news that dominated the headlines.

All three P-8A flight test aircraft completed first flights in 2009 and the first plane, T1, began its Navy flight test program in the fourth quarter. Following additional instrumentation checks and a few more flights in Puget Sound, T1 will fly to Naval Air Station Patuxent River (Pax) in second quarter 2010 for completion of flight test. Test aircraft T2 will begin mission system flights early this year and along with T3 will transition to Pax later in the year.

The first ground test aircraft, S1, continues its static testing that began last April in Renton. Just prior to the end of the year, BCA completed assembly of S2, which is the program's fatigue test article. Boeing will begin assembly of the second three flight test aircraft this year along with the first P-8I aircraft for India as well. We expect to receive the first P-8A production contract this year. Boeing's P-8A industry team continues to meet program milestones and is on schedule to deliver Initial Operating Capability to the war fighter in 2013.

Wedgetail

This 737-based program was not a success story. An electronic surveillance airplane for Australia and Turkey, it is years late. Entering testing in the second half of last year, Boeing has written off hundreds of millions of dollars in connection with this program. Acting as the systems integrator, Boeing had problems with the Northrop Grumman electronic gear, which was responsible for a good portion of the delays.



CEO McNerney believes there is an international market for this airplane once it is delivered and in service.

Boeing's financial prospects

Boeing's short-term financial prospects remain challenged, and the outlook for the intermediate-term also appears weak, given investment requirements to maintain market leadership with key products. This is not to suggest that Boeing is in danger of financial collapse; it is not. But the balance sheet has been badly damaged and Boeing has been shoring it up by taking on new debt. To preserve cash, Boeing is now contributing stock to company pension plans in lieu of cash.

Boeing now forecasts zero free cash flow this year and perhaps US\$5bn in positive cash flow next year. The Company took on US\$5bn more debt last year to fund operations, and the interest expense that goes with it.

We believe the balance sheet damage resulting from the 787 and 747 programs effectively prevents Boeing from proceeding with an entirely new single-aisle airplane, which otherwise would have enabled the Company to deal Airbus a one-two blow had the 787 program achieved promised targets. The problems emanating from the 787 program squandered a five-year lead for this ground-breaking airplane to perhaps half and the lost opportunity to deal Airbus a crippling blow by creating a successor to the 737 using 787 technology. It also squandered the opportunity to decide on its own timetable and with its own options what to do about a 777 successor. Boeing's decisions on the latter is now forced more by Airbus and the A350 than by flexible management options at Corporate Headquarters.

Despite this, Boeing has an opportunity to regain the initiative if certain Bad Things happen at Airbus. See our Special Comment at the end of this report for a discussion of this point.

Boeing's commercial unit is currently supported by revenues from two aircraft types, the 737 and 777, each of which currently have market leadership positions and are under competitive threat from Airbus. The 787 program, which will provide market leadership in the medium widebody segment, has not yet generated cash flow and, given the additional expense and delays, will take years longer to break even than originally planned. The 747-8 program is also delayed and over budget, in a market segment that is not particularly robust today. The Company has already taken a US\$1bn forward loss on the program, meaning it will never make a profit, although it will positively contribute to cash flow at some point.

Boeing's two programs generating cash flow have each been targeted by Airbus for competitive response. These two programs will likely require another US\$5bn and US\$15bn of investment, respectively over the next five years. Given the losses incurred during the development of the 787 and 747-8, the key issues are when the new programs will be announced and where will the additional capital come from.

The implications for shareholders are significant -- Boeing needs to continue to play "leap frog" with Airbus if it is to maintain market leadership in key sectors, or lose further ground to Airbus from a strong number 2 to a weaker competitor.

How sound is its “parity position” with Airbus?

Boeing has, in this decade, dropped from the market leader to the second largest competitor. Airbus has gained market leadership, and is likely to continue to maintain that market leadership in the near term. Boeing had an opportunity to overtake Airbus, which was having extraordinary difficulties with the A380 program, but its own problems with the 787 have given the Airbus A350XWB a window of opportunity to compete. The A350XWB, which has now passed the 500 order plateau, is rapidly catching up with the 787, which has fallen back to 850 orders with recent cancellations resulting from program delays. What could have been a five year advantage for Boeing has shrunk to 2.5 years. New customers, however, will find it difficult to obtain a delivery position from Boeing, which needs to make up for delayed orders, providing Airbus an opportunity to compete within the same time frame, which it is doing quite well.

We do not expect Boeing to catch up to Airbus in the near term. An upgrade to the A320 family could provide it a short-term advantage over the 737NG, the A330 is selling better than the 767, the A350 is catching up with a delayed 787 and aging 777 program, and the 747-8I is proving to be a market failure that will face as uncertain a future as its A380 competitor. We expect Boeing to continue to remain a strong number two in the market, but its two most profitable programs, the 737 and 777, will be under threat from an upgraded A320 and the forthcoming A350XWB, resulting in pressure on margins.

Will Boeing succeed with growing competition?

Boeing and Airbus will likely cede the low end of the narrow-body market to Embraer and Bombardier as regional jets grow in size and these manufacturers compete with what once would have been considered trunkliners. This will reduce volumes, over the longer term, for the smallest 737 variants, and result in the 737 replacement being a larger aircraft in the 150-220 seat range, replacing the larger 737 models and 757 sized aircraft.

Growing competition in Russia and China will also impact Boeing and Airbus, as governments will likely strongly influence, if not mandate, the use of domestically built aircraft. In Russia, the MS-21 from the restructured United Aircraft Company will compete directly with the 737 in the 150-212 seat range, with three planned variants. This could significantly reduce the potential market for Airbus and Boeing in Russia over the next 20 years.

China is developing its first major program, the C919, built with the support of western engine, avionics and component companies. This aircraft will also be competitive with the 737 and A320 families, utilize current technologies, and take a significant portion of the domestic Chinese market, as well as exports to China-influenced African countries. This could significantly reduce the available market in China over 20 years. When combined, these new programs will shift 4,000 aircraft from Boeing and Airbus to new competitors, resulting in a loss of 2,000 aircraft for Boeing, or approximately US\$150bn in revenue over 20 years.

What will happen with the WTO Dispute?

The US Trade Representative (USTR) prevailed in the Interim Ruling by the World Trade Organization that Airbus benefited from illegal subsidies. The scope of the win remains a question mark until the WTO issues its final report and publicizes the findings. The Interim Report is confidential, though leaks suggested that the A380 subsidies were most egregiously in violation of WTO rules. Less clear is how launch aid for the other A3-Series aircraft may be in violation. The US interests claim launch aid was entirely illegal on all A3-Series aircraft, while European interests claim launch aid is permissible if properly structured. Until the WTO ruling is published, the actual conclusions remain a matter of controversy.

The counter-complaint by the European Union over “illegal” Boeing subsidies has been heard by the WTO and the Interim Ruling is pending. It had been expected to be issued this month (February 2010), but the report will now be issued in June. It is widely expected that the WTO will find Boeing has illegally benefitted from subsidies from NASA, the Department of Defense and from various state tax breaks, notably those from Washington State in connection with the 787 assembly line in Everett. Boeing partisans already are dismissing the relevance of such findings as palling to launch aid.

Production: to Cut or Not to Cut?

Boeing last year announced that its 777 production will be cut from June this year from seven to five per month. Boeing officials continue to maintain that the 737 line can support 31 per month, unchanged from 2009, despite conclusions by some aerospace analysts (notably UBS Securities, which is particularly bearish) that 737 rate cuts are necessary by as much as 30%-40%, citing over-capacity in the airline industry. These cuts would bring 737 production rates down to 19 to 22 per month.

We closely tracked this issue throughout 2009, checking with Boeing contacts and those in the supply chain. While suppliers are much more skeptical about maintaining a rate of 31/month than Boeing, nobody we talked to either at Boeing or in the supply chain has ever discussed rate cuts this deep. The worst cut we ever heard Boeing talking about internally was to 24 a month and more likely in the 26-28 range.

But we believe Boeing needs to maintain the current production level to maintain cash flow because of the program problems and costs with the 787 and 747, so we don't expect to see rate cuts this year.

The question, then, becomes: Might there be a rate cut in 2011, once the 787 and 747 orders finally begin delivering and cash flow on these programs commence? We can make an argument that Boeing still needs the cash flow from the 737 and therefore may strive to avoid rate cuts anyway.

More to the point is the question about over-capacity. Airbus believes the airline industry will recover beginning mid-year 2010; Boeing's forecast is about a year later. These forecasts pre-date the Christmas Day bombing attempt on Northwest Airlines Flight 253 and subsequent vows

by Al Qaeda to make more attempts. The impact of these events and new security rules on air travel has yet to be assessed. Should Al Qaeda succeed in a terrorist attempt against airliners, any recovery will be delayed and in this case, we expect that Airbus and Boeing would have no choice but to reduce single-aisle production rates. Absent this, we believe both companies hope their forecasts of recovery will enable each to avoid rate cuts.

Key Risk Factors

Boeing generally is considered to have a better customer-quality profile than Airbus, and we broadly agree with this view. Boeing's Top 15 customers in Unfilled Orders (Table on the next Page) has its "problem children," but arguably represents less risk to cancellations and deferrals than the Top 15 Customers at Airbus.

Customer Risks

Boeing's Top 15 Customers

		B737	B747	B767	B777	B787	Total
1	LionAir	156					156
2	Dubai Aerospace	70	15		16	15	116
3	RyanAir	102					102
4	Air Berlin	75				25	100
5	GECAS	74			17		91
5	Southwest	91					91
7	ILFC	10				74	84
8	GOL	83					83
9	All Nippon	19		4	4	55	82
10	QANTAS	28				50	78
11	Aviation Capital*	72				5	77
12	American	68			7		75
13	China Southern	57			6	10	73
14	Continental	41			5	25	71
15	Air China	39			15	15	69

Source: Boeing Unfilled Orders, December 31, 2009, Company reports

*Includes five 737 delivery positions purchased from Delta Air Lines which do not transfer until delivery.

Airbus' Top 15 Customers

		318	319	320	321	332	330F	333	345	346	358	359	351	380	Total
1	Emirates											50	20	51	121
2	US Airways		8	50	14	20					18	4			114
3	Wizz Air			114											114
4	Qatar Airways			18	4						20	40	20	5	107
5	AirAsia			105											105
6	DAE Capital			70								30			100
7	AWAS			79		3		1			2				85
8	CASGC			78											78
9	CIT Leasing		21	39		9					5	2			76
10	TAM		8	30	9	4					12	10			73
11	IndiGo			71											71
12	Aircraft Purchase Fleet			45		12					12				69
13	Aviation Capital		7	55	4	0									66
14	QANTAS			49										15	64
15	easyJet		53	10											63

Source: Airbus Orders, December 31 2009

Strategic Risks

Boeing faces program risks—and rewards. As we noted in our August 2009 report on Airbus, the individual programs face risks and rewards. The following Table provides a snapshot look at BCA’s programs as we see them today.

Program	Upside Risk (or Reward)	Downside Risk
737	Stalwart, reliable program and steady cash-flow. First up with Enhancements (Sky Interior, 2010; engine and aerodynamic improvements for 2% SFC gain, 2011). Re-engine potential problems solved, enabling low-cost solution to upgrading the airplane while avoiding a high-cost replacement program.	Fuselage comfort remains a disadvantage to A320 Family; 2011 Enhancements will likely fall short of A320 2012 sharklet program SFC gains. 737RE SFC will likely fall short of A320RE by a percent or two or three, providing a competitive disadvantage that may be offset by inherently lower maintenance costs and lower landing fees. 737RE will likely follow A320RE by a year.
747-8	Every 747 sold probably eliminates an A380 sale, even though the 747 serves slightly smaller market segment.	The program won’t recover costs. Covers niche market segment between A380 and Large Medium-Body airplane. Niche airplanes never sell well.
767	Creation of Lean production line will sharply lower costs, which can be built into the Boeing bid for the KC-X tanker competition and potentially extend the life of new airline sales, small in numbers though these will be. The Lean line, coupled with the after-market blended winglet program, might breathe new life into the 767 commercial airplane, representing a low-cost solution to the cancellation of the 787-3.	Aging airplane is simply not competitive with A330.
777	777-200LR fills a super-long haul niche. 777-300ER is still the master of the Large Medium-Body segment. 777-200LRF will likely dominate its segment.	Niche airplanes don’t sell well. The 777-300ER is aging and threatened by A350-1000. 777-200ER is on its last legs, overshadowed by A350-900.
787	Still has great market potential despite excruciatingly painful birth.	Flight tests reveal a major problem; production ramp-up throughout entire supply chain, industrial partners and in Boeing’s assembly plants; creating Line 2 in Charleston; developing 787-9; developing 787-3 (or canceling this model); developing 787-10 (if at all).

Boeing faces major risks to its medium- to large-widebody market domination at the upper end. The following table shows the order backlog at December 31, 2009, where Airbus has made major inroads.

Aircraft	Pax 2/3 Class	Range NM	Backlog 12/31/2001	Backlog % of 1946	Segment Percent	Airbus Segment	Boeing Segment
787-8	210-250	7650-8200	656	34%	95.5%	0	100%
767-300ER	218-269	5990	31	2%	4.5%		
787-9	250-290	8000-8500	195	10%	34%	66%	34%
A330-200	253-293	7250	195	10%	34%		
A350-800	270	8300	182	9%	32%		
A330-300	295-335	5850	135	7%	32%	91%	7%
777-200ER	301-400	7700	23	1%	5%		
777-200LR	301	9380	17	1%	4%		
A350-900	314	8100	248	13%	59%		
A350-1000	350	8000	75	4%	28%	28%	72%
777-300ER	365	7930	189	10%	72%		

Source: Airbus, Boeing

Boeing has exclusivity to the 210-250 seat market due to the decision by Airbus to forego this segment, believing the seat-size is too small. On the contrary, we believe this was merely a public relations spin because Airbus had no choice but to do so because financial resources are committed to the cash-draining A380 program and the disastrous A400M contracts. At an average list price of US\$165m, the 656 787-8 orders in this segment represent a backlog of US\$110bn to Boeing—a huge revenue forfeited by Airbus.

Airbus is on a par with Boeing in the 250-300 seat market with its A350-800 vs. the 787-9, and when the unexpected sales success of the A330-200 is also considered, Airbus dominates this segment. Airbus “owns” the 300-350 segment, clearly demonstrating the 777-200 series is history. Boeing currently dominates the 350-370 seat segment, but we believe in time the A350-1000 will overtake the 777-300ER sales. Design freeze and an improving global economy are required for Airbus to surpass the sales of the 777-300ER, which is now considered old technology by a growing number of customers and observers.

In the total middle-market twin-aisle market, Boeing still dominates with a 53% share, largely on the forfeiture by Airbus of the 210-250 segment.

737 Family



Photo Credit: Boeing

Summary:

- Boeing originally planned to introduce a replacement airplane c. 2020.
- Mike Bair, VP Business Strategy and Marketing, told the Renton Chamber of Commerce October 27, 2009, that Boeing plans to build the 737 in Renton into the 2020 decade.
- Boeing likely to re-engine the 737 with the CFM LEAP-X with an EIS c. 2016 to tide the 737 over to a replacement airplane, to meet competition from Airbus and new entrants, and to meet demands by airlines for major fuel burn improvements of 10% or better sooner than later.
- Decision timeline for 737RE-LX likely second-half 2010; Airbus plans a decision on A320RE by YE2010 but may accelerate.
- Airbus now targets 2024 for a replacement to its A320 family. If Boeing matches timeline, this suggests a decision c. 2017-2019.
- Both Airbus and Boeing 2024 dates still could “move to the right.”
- Irkut of Russia selected the PW P1000G Geared Turbo Fan for its 150-seat MS-21.
- COMAC selected CFM’s LEAP-X for its 150-210 seat C919.
- Bombardier appears to be considering launching a 150-seat C Series. The 110- and 130-seat models used the PW GTF.

Boeing will likely decide in mid- to late-2010 to re-engine the 737 with the CFM International LEAP-X, with an EIS of 2016. PW is making an aggressive push for its P1000G GTF engine. We believe that Boeing re-engines the 737, the prospect of an entirely new replacement airplane will move from the first half of the 2020 decade to the second half. Boeing's 737 backlog of more than 2,000 Next-Generation airplanes stretches out into 2015-17 and there are no signs of orders stopping.

History

Boeing's 737 design dates back the 1960's. That the aircraft remains in production, and indeed has a production backlog through 2015, is among the aviation industry's great successes. The basic design has been constantly tweaked by Boeing, growing the airplane and extracting ever improved performance. The core design of the airplane was merely an adaption of the hull that started out as the 707 and went on to become the 727. To date the 737 has gone through nine variants - likely a commercial aviation record. The following image illustrates how Boeing keeps tweaking the design to extract every gram of efficiency from the 737.

Continuous innovation

- **Improved performance**

						
180-minute ETOPS (EIS 2000)	Blended winglet (EIS 2001)	High-altitude airport (EIS 2005)	Short field performance (EIS 2006)	CFM Tech Insertion (EIS 2007)	Carbon brakes (EIS 2008)	Performance Improvements (EIS 2011)
- **Improved comfort**

				
BigBins SM (EIS 2002)	Flight deck noise reduction (EIS 2004)	New lavatory (EIS 2005)	In-seat video system (EIS 2006)	737 Boeing Sky Interior (EIS 2010)
- **Improved navigation**

					
Head-up display (EIS 2001)	Vertical situation display (EIS 2003)	Cat IIIB (EIS 2003)	Navigation performance scales for RNP (EIS 2003)	GPS landing system (EIS 2005)	Electronic flight bag (EIS 2006)

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The 737NG is undergoing yet another tweak, announced in April 2009. Boeing will deliver its first 737 with the 787-inspired "Sky Interior" this year. When Boeing announced the new interior it also announced a set of airframe and engine improvements that will lower fuel consumption by

2%. These will be rolled into production as they are available with the entire package in place by mid- 2011.

The difficulty for Boeing is that, despite the popularity of the 737, the bracket this airplane falls in is growing ever-more competitive. On the lower end, regional jet makers building planes that are larger than their traditional 50-90 seat markets. Leading this group are Bombardier and Embraer. The former is going to produce its CSeries in the same seating capacity as the smaller 737-700. Bombardier has committed to a new engine that will ensure its airplane will have seat/mile costs between 15%-20% lower than the current 737. This development has put Embraer under some pressure - though it has been making strong statements casting doubt on the CSeries' ability to offer a significant improvement over its own very efficient 90-110 seat E-Jets. Bombardier is now reportedly considering a 150-seat CSeries model.

In Japan, Mitsubishi (a Boeing 787 contractor) is developing a 70-90 seat regional jet family, but is already talking about a 100-seat model. Kawasaki has floated a conceptual 150-190 seat airliner that, as yet, is merely a dream.

In China, there are two programs attempting to gather pace, one of which is a direct competitor to the 737 and Airbus' A320 families. In Russia, the SuperJet regional jet is being produced by the legendary Sukhoi firm, famous for its fighters. This is a 70-90 seat regional jet, and not a competitive threat, but Irkut has the 150-seat MS-21 on offer and recently selected the PW GTF for its power plant.

While arguably the COMAC C919 and Irkut MS-21s may offer limited competitive threat outside their home countries, sales losses in China and Russia to home-grown jets will obviously put a significant dent in the Airbus and Boeing sales.

Bombardier's 130-149 seat CS300 is in the same class as the Airbus A319 and 737-700. Offering a 150-seat "CS500" adds to the family of airplanes, an important concept without which was a key element in the demise of McDonnell Douglas. Taking on Airbus and Boeing in this fashion, however, is dangerously risky for Bombardier which has neither the financial resources on its own nor the broad government support similar to China and Europe to take on a protracted battle with Airbus and Boeing.

While Boeing faces rising pressure from below, it far more significant pressure comes from its peer, Airbus. Airbus announced in November it is proceeding with a blended winglet (a "sharklet" of Airbus design) for the A320 family, with EIS from 2012. This is expected to improve fuel consumption by 3.5%. Aerodynamic improvements call for another 1% gain. Boeing blithely dismisses these as only bringing the A320 to par with the 737. Airbus believes these will provide a point or two of advantage.

If Airbus decides to proceed with P&W GTF and CFM LEAP-X re-engine programs, as we believe it will, these promise 12%-16% better fuel consumption than today's CFM56 and IAE V2500 engines. Coupled with a 4% improvement due to sharklets and aerodynamics, the A320 family

theoretically could see consumption gains of 16%-20%.⁶ Boeing will be forced to respond with its own RE program.

Boeing has apparently resolved the thorny issue of re-engine physics on the low-slung 737. In a statement to us, Boeing said, "We are in the initial stages of assessing the viability of a re-engine program for the Next-Generation 737 as part of our normal, on-going Product Development efforts. While our initial assessment indicates that we have the flexibility to re-engine the airplane, we have not made a decision to move forward at this time. As the engine manufacturers bring their new ideas forward, we will continuously evaluate them in the context of what brings value to our customers. Reducing fuel consumption and emissions, and lowering community noise are key drivers as we consider the possibility of a re-engine for the Next-Generation 737."

There are two programs that offer Airbus and Boeing the level of savings sought. Pratt & Whitney has developed its geared fan "PurePower" P1000G GTF engine and its test performance has been promising. Airbus tested the engine but has not breathed a word about its findings.

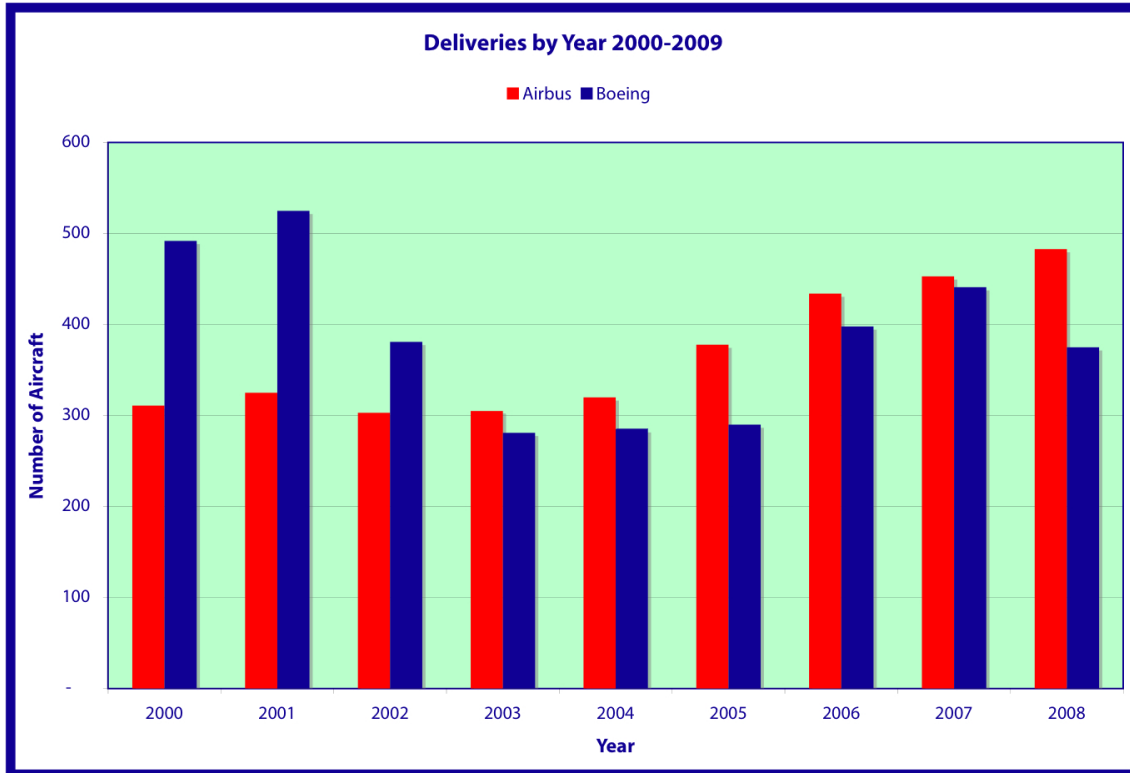
The second option is the CFM-56 LEAP-X. This engine is a significant update to the current most popular engine in the 737/A320 segment. Boeing selected the CFM-56 as its exclusive supplier on its 737NG family.

The PurePower engine has a large (72 inch) diameter fan and this brings constraints to the current 737 design, which has CFM-56 engines with a 61 inch fan diameter. The LEAP-X has a 71 inch diameter fan (20% bigger than the current CFM-56). So even if Boeing were to decide to remain with the CFM engine, it would probably need to revise the 737 landing gear to raise the airplane. Boeing has also figured out how to push the engine forward and up in an RE configuration.

Production Rate

Deliveries	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
A318				9	10	9	8	17	13	6	68
A319	112	89	85	72	87	142	137	105	98	88	979
A320	101	119	116	119	101	121	164	194	209	221	1,357
A321	28	49	35	33	35	17	30	51	66	87	385
Total Airbus	241	257	236	233	233	289	339	367	386	402	2,789
B737-600	6	4	5	6	5	3	10				39
B737-700	78	88	73	80	109	94	108	107	66	53	828
B737-800	185	168	126	69	79	104	172	214	193	286	1,459
B737-900		21	8	11	6	6		9	31	28	108
Total Boeing	269	281	212	166	199	207	290	330	290	367	2,434

⁶ See Footnote 4.



Projected Aircraft Residual Values

Detailed value forecasts prepared by the Arvai Group, including projections of base values as well as forecasts by economic scenarios, are available for purchase at www.iag-inc.com/store1.html.

Outlook

It seems reasonable to assume that Boeing, while undertaking constant research and thinking about a 737 replacement, will only be forced into formally shutting of the 737 production. This design has become the new DC-3. Produced for decades with ever-improving performance, the 737 is a legend. Boeing is perfectly rational to keep producing the plane as long as airlines continue to buy it.

It is clear that barring the use of more composites to make the plane lighter, the next step will be a re-engine process. This would be in effect, a next-next generation, or as we previously coined it, the 737RG (for Re-Generation).

747-8 Family



Photo: Boeing

Overview

- This program is struggling. Virtually no passenger model interest; freight model stalled due to global cargo traffic recession.
- Once the orders for the 747-8 peter out, this line will be closed.
- Timeline: There currently is a six year backlog, assuming no additional sales (an unlikely prospect), or until c. 2016. At best we would estimate the 747 will run its natural life cycle to the 2020-2024 timeframe.
- Although there has been much speculation about canceling the program before deliveries due to cost overruns and poor sales, we do not expect this to be the case.

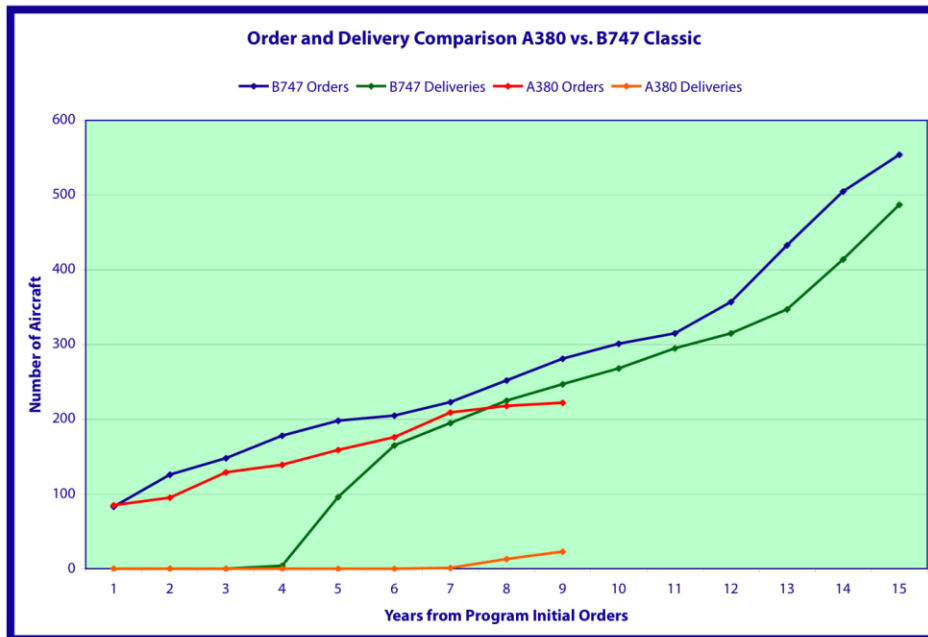
The venerable Boeing 747, first introduced in 1970, is nearing its fourth decade of continuous production with the introduction of the latest variants, the 747-8I and 747-8F. The 747-8F has generated an order backlog of 76 aircraft, as the largest western-built freighter with modern engines and fuel efficient economics. With the cancellation of the A380 Freighter, the 747-8F has the large capacity freighter market to itself. The passenger version 747-8I has not been well received in the marketplace prior to first flight, with orders only from Lufthansa for 20 and Korean Air for five (plus seven head-of-state aircraft), and stands well below the order book of the larger and more sophisticated Airbus A380, which has generated 202 orders to date.

For the first time since 1982, when the 757 and 767 were flight tested simultaneously, Boeing will test fly two aircraft types at the same time, the 747-8 and the 787. This will tax Boeing's test flight resources, and could be a potential source of additional program delays. Of the two programs, the 787 would take priority, given its larger order book and more lengthly delays, and many observers worry about a potential further delay in the 747-8 program.

The 747-8 has been called Boeing's answer to the A380, but doesn't come close in terms of capacity. The maximum capacity of the 747-8 at 550 economy seats is dwarfed by the A380 with 800 economy seats. In multiple class configurations, the aircraft are much closer together at 471 for the 747-8I versus 550 seats for the A380. However, the larger interior of the A380 offers much more space for bars, larger bathrooms, and better amenities in its lower density configurations, and has a much stronger passenger preference.

In high density configurations, the A380 offers significantly superior seat-mile economics to the 747-8I. At low density configurations, the incremental difference is marginal, with only about a 5% difference. While the next generation GE engines used to power the 787 are very efficient, they cannot of themselves make up the difference in scale to offer lower seat-mile economics.

This brings the question for very large aircraft down to traffic -- is there adequate traffic to support the larger A380 on the route, or would a smaller 747-8I, or perhaps a 777-300ER be a more prudent choice if the traffic and yields to support an A380 are questionable. The market has answered this question enthusiastically in favor of the A380, which has now passed the 200 order milestone, and the 777-300ER. The 747-8I has generated only a 20 aircraft order from Lufthansa and five from Korean Air Lines. We believe the KAL order to be a sweetheart deal in connection with delays of KAL's orders for the 787, 747-8F and 747-400 Boeing Converted Freighters. The 747-8I appears to be joining the failed Airbus A340 as a four-engine aircraft in a two-engine market. The forthcoming A350XWB-1000, in the 350 seat range, will also become a competitor for the 747-8I with better aircraft mile economics and better seat-mile economics. Historically, whenever a smaller aircraft offers similar seat-mile economics to a larger airliner, the market typically chooses the smaller model to generate higher yields on a particular route. Our conclusion: the 747-8I is dead as a passenger aircraft before it hits the market, and will be a market failure however technically proficient the airplane proves to be.



Backlog and Outlook

Boeing has a very limited backlog on the 747-8I. With route dispersion and an emphasis on yield and load factors, airlines are trending towards smaller aircraft in the wide body category, and moving away from very large aircraft. Those carriers that are choosing very large aircraft to meet specific market needs with high traffic and limited capacity are choosing the A380 rather than the 747-8I. We believe the outlook for the 747-8I is quite weak, and likely to remain so without tremendous discounts to airlines. We do not foresee a market for more than 50-100 of this type, given the competition options above and below this type. Despite new technology engines and interiors, the design of the 747 dates from the 1960s, and is simply not competitive with newer technology competitors from Airbus and Boeing's own 777-300ER.

The backlog for the 747-8F is much better than that for the passenger version, with 76 aircraft on order. However, with the deep recession in the air freight market during the current economic recession, it is likely that several of the orders for freighters may be deferred, or possibly canceled. We believe the future of the 747-8I program will be in the freighter market, replacing earlier 747 models that will retire in the 2015-2030 time frame with more efficient replacements in a similar capacity range.

Aircraft Values

We do not believe that the 747-8I will be a market success, and as a result, market values for this aircraft will be significantly weaker than other models. Competing with the 777-300ER, A350XWB-900 and -1000 below it and the more modern A380 at the high end of the market, market demand for the 747-8I will be so limited that it will be difficult to project other than theoretical fair market values.

We expect the more successful 747-8F to retain its values reasonably well, as the supply-demand balance for aircraft will favor demand with cargo growth and the retirement of early 747 and MD-11 freighters.

767 Family



Photo Source: American Airlines. The after-market blended winglet reduces fuel consumption on the 767 by about 3.5%-4%.

- The passenger and freighter models are on borrowed time, with a current backlog of 59, or about 3 ½ years at the current production (1/month) and proposed (2/month from 2011) rate.
- The future of this line depends entirely on whether Boeing receives the KC-X USAF aerial tanker contract, initially for 179 airplanes and potentially about 400.
- Current USAF plan is to award contract in August 2010 (protests may follow). Current plan is for 12-18 planes a year, with production delivery beginning in 2015. Based on 15 airplanes a year from 2013, this means life in the 767 line to 2027 for 179 airplanes.
- KC-X aircraft beyond 179 may be larger than 767 (A330 or 777).
- The commercial line is getting a boost in production efficiencies as a result of the relocation to the aft bay in Everett to make room for the 787 Surge Line (see 787 above and in the 787 section.) The 767 production line will be reconstituted as Lean manufacturing, dramatically boosting efficiency and lowering costs. More discussion will be in the 767 section. The reduced production costs and the Aviation Partners Boeing winglet program might extend the life of the 767 now that the future of the 787-3 is in doubt.

Boeing's plan to implement a Lean production line for the 767 has significant implications for this aging product. Boeing tells us that the line will result in a 20% improvement in unit time in construction. This does *not* correlate into a 20% improvement in production costs, however. Production costs consist of materials (raw materials, fasteners, finished parts, and assemblies), perishable tooling, support labor, production labor and plant and equipment. Unit time improvements are directly related to reductions in production labor costs and have a proportionate decrease in support labor costs.

The reduced costs will not only enable Boeing to price aggressively for the 767-300ER and 767-300ERF for future sales, more critically, Boeing will be able to aggressively price the KC-767 (based on the -200ER) for the USAF tanker competition. This is especially critical because the competition has essentially become a price shoot-out over a Best Value contest. Northrop Grumman’s 2007 offering, the Airbus A330-200-based KC-30, was US\$15m less expensive per airplane than Boeing’s conceptual KC-767 Advanced Tanker. However, we expect Boeing this time to offer a variant of the existing KC-767 Italian tanker, reducing development costs. We also believe that Jim Albaugh, the new CEO of Boeing Commercial Airplanes, is willing to price the 767-200 more aggressively than was his predecessor, Scott Carson. In Boeing’s internal way of doing things, Boeing Commercial sells to Boeing Integrated Defense Systems the basic 767-200. BDS then installs military hardware and sells the entire product to the Air Force. Based on information we deem reliable, we understand that Carson was unwilling to provide “launch customer pricing” to BDS (and therefore the USAF) but that Albaugh is willing to do so.

Although Boeing will achieve cost reductions for producing the 767, don’t expect the list price to decline. When we asked Boeing about this prospect, the company replied: “Airplane pricing is based on several market forces and not based on cost. Improving our cost structure gives us more flexibility to meet market demands and remain profitable.”

Aviation Partners Boeing now produces winglets for the 767, but these will remain an after-market product and not an in-line production item.

Boeing designed a 21st Century look for the 787’s interior and has adapted this for the 747-8i and 737 (the latter known as the Sky Interior). But as yet there are no plans ready to announce to offer a similarly-inspired interior for the 767.



With the current A340 family scheduled for replacement by the three -member A350XWB family in 2013, and the 787 competing with the A330, the future order book will be dominated by new technology variants. With four years until the new technology offerings reach the market from Airbus, the A330 backlog of 397 aircraft remains strong.

Early in the decade, orders were fairly even between manufacturers. Boeing's launch of the 787 generated a spike of orders beginning in 2004 that was matched by Airbus launch of the A350XWB in 2006, with the difference between manufacturers reflected in the earlier launch of the 787. Both manufacturers have a healthy order-book for their new technology models, with 850 Boeing 787 and more than 500 A350XWBs on order.

777 Family



Photo credit: Boeing

- This program is the most vexing for Boeing of the legacy airplanes: the coming Airbus A350 is a major threat to the 777. The 777-200 series is already dead (or in the case of the 777-200LR, entirely a niche airplane). The 777-200LRF is, by definition of cargo aircraft, of limited production demand. The 777-300ER, while a superb airplane, is already being characterized by some airlines as “old technology” when compared with the 787 and A350.
- Given the cost overruns and customer penalties associated with the 787 and 747-8 programs, and the potential R&D for a 737RE-LX (LEAP-X, estimated at 20%-30% of an entirely new airplane) as well as normal cash flow requirements, does Boeing launch an entirely new airplane to replace the 777 or engage in a major enhanced derivative at less cost but perhaps limiting its competitive response to the A350?
- The A350-900 EIS (the 777-200 competitor) is scheduled for mid-2013. The A350-800 EIS (competitor to the 787-8/9) is scheduled for 2014. The A350-1000 EIS (vs. the 777-300) is scheduled for 2015.

- Launch lead times are 5-7 years, meaning Boeing has already missed the window to match the 2013 EIS for the A350-900. The launch date to match the estimate 2015 EIS for the A350-1000 is 2008 to 2010, meaning Boeing has essentially missed this opportunity as well (diverted as it has been by the 787 program). We estimate that the earliest Boeing will decide what to do about the 777 will be 2011, suggesting an EIS of 2016-2018 if a new airplane is chosen.
- An unknown: If the USAF launches the KC-Y follow-on aerial tanker competition in a timely fashion, the 777 might be a competitor. Initial plans were that the KC-Y would be a follow-on order of the KC-X and the KC-Z would be the larger replacement for the KC-10. There are too many unknowns to suggest timelines for this possibility

This aircraft has become the benchmark commercial airliner which has killed off its main competitor, the Airbus A340. Boeing successfully debunked the myth that a long range widebody airliner required four engines. The success of the 777-300ER almost certainly has impacted sales of the firm's flagship 747-8i. The airplane had something of a rocky start in that many industry watchers were skeptical that Boeing could offer a big twin that could compete with multi-engined competitors - not only the A340 but also the MD-11.

The 777 dates back to 1990's technology. It first flew in April 1994 and was designed to fit between the 767 and 747. Previously this segment had been the arena for the Lockheed L1011 and McDonnell Douglas DC-10 and later MD-11. As Lockheed quit the commercial aviation business, and McDonnell Douglas stumbled with new programs, Boeing saw the development of the 777 as opportune. It was possibly the best bet the company made since the 747.

The first 777 built was named "Working Together" as the design was evolved with input from eight major customers. The first model was the -200 which started flying in 1995 and then in 1997 a larger -300 model was introduced.

The prospect of a 777-300ER-E (Enhanced) is vexing. Assume Boeing's assessment of the A350-1000 efficiency improvement of only 10% is correct.⁷ Aerodynamic improvements typically only provide a 1%2% improvement in fuel burn. Passenger interiors, such as adding the "Sky Interior" to the 777, provide some maintenance gains, as would any systems improvements. GE might be able to tweak engine SFC, CO2 and NOx issues, but all-in, will this make a 777E competitive with a "10%" A350-1000? Boeing will have to adopt the A330-vs-787 revenue strategy advanced by Airbus to counter the continued deficiencies.

Would Boeing pursue a new wing for the 777E? This is the approach taken for the 747-8 and it proved far more costly than originally anticipated. New engines? Is there enough of a market for GE to take this risk?

An entirely new airplane makes the most sense—if Boeing could afford the risk.

⁷ We do not support this assumption.

787 Family



Boeing Photo

Overview

- Line 2 to be located in Charleston (SC); construction begins on plant this year, production line construction in 2011, first airplane assembly in 2012 (after eight month run-up) and goal of 3/mo by late 2013.
- Line 2 initially to produce 787-8 at rate of 3/mo. Has capacity to go to 5/mo. Boeing program spokesperson unsure if capacity is 7/mo, which would match Everett (WA) capacity.
- Surge Line in Everett to commence as construction of Charleston line continues and comes on-line. First airplane off line three months after operational. Operational while Line 2 coming on line. To be disassembled after Line 2 fully and smoothly functioning.
- Surge Line to be in forward bay now occupied by 767. 767 to move to aft part of the bay.
- Future of Surge Line unknown: will it be stored? Will it stand by to be active at Everett if demand requires it? Will it be located in a third location, possibly China?

Future Production Rates

- By late 2013, Boeing expects to produce 10 787s per month in Everett and Charleston (7 and 3 respectively).
- Delays and need for new delivery slots require up to 14/month in the minds of many aerospace analysts.
- Boeing acknowledges that the Everett and Charleston permanent lines have capacity for 12/mo (7+5), but it is unclear if 14/mo (7+7) can be achieved (setting aside supply chain

- issues). The Surge line could make up the difference between 12 and 14 a month or allow Boeing to go beyond 14/month (to 16-17/month?)
- Driving factor is: Can the supply chain meet these high production rates?
 - At some point in the future, 787 rates will have to be reduced from 10 (or higher) due to economic conditions or reduced demand or, ultimately, winding-down of the natural 787 product life.
 - The question then is which production line suffers the reduction, Everett or Charleston? Our prediction is that Everett will be the line reduced for several reasons:
 - Corporate desire to preserve the Charleston facility
 - Corporate desire to produce the 787 in the lowest-cost environment
 - Corporate desire to reduce exposure to militant IAM
 - Other airplane programs exist at Everett
 - Once Line 1 is reduced or shut down due to factors above, will it come back? Our view is likely not.
 - Timeline? Depends on economic conditions, but disregarding this variable, widebody airplane programs tend to begin a wind-down after 20-30 years. In this case, 2031-2041 would be the expected life cycle for the 787. (Note: 2040/1 happens to be when the current Boeing lease on Everett expires, but this is coincidence, not a planned coordinated timing.)

The Boeing 787 Dreamliner has been the main focus of attention at Boeing in recent years, to the point of distraction for other programs. Perhaps the most anticipated airliner since the 747, the 787 will utilize innovative technologies to reduce operating costs as well as provide the most environmentally friendly commercial aircraft. With the demise of the Sonic Cruiser program in late 2002, in the wake of the 9/11 terrorist attacks, the 7E7 program was launched with a new team in January, 2003. In April 2004, All Nippon Airways became the launch customer for the program, with initial deliveries scheduled for 2008.

The 787 program is focused on operational efficiencies, and Boeing projects 20%+ lower operating costs for the 787 when compared with its predecessor 767 models. These cost reductions are generated by three key factors -- improvements in engine technology (about 1/3rd), improvements in aerodynamics and weight reductions through extensive use of composite materials (another 1/3rd) and advanced aircraft systems (the remaining 1/3rd). As the first commercial aircraft to utilize composite materials for primary structure, Boeing has discovered that development, testing and certification have not been a smooth process.

The program is running about 2½ years late. Initial customer aircraft will not meet planned specifications, and between cost overruns and penalty payments to customers, the program budget has flown past US\$20bn in some analyst estimates, with dramatic and large negative impacts on both Boeing's earnings and market capitalization.

Boeing decided to undertake two major strategies that entailed significant risk when it launched the 787 program. The first was the use of advanced composite materials for primary aircraft structure. The second was splitting the workload among a series of international program participants, and for the first time having major sections of the aircraft not produced at Boeing, creating an entirely new production process. A confluence of failures in each of these major risk

areas cascaded into a series of delays, expensive cost overruns, alienation of customers and significant penalty payments for failure to deliver new aircraft as promised.

The technological risk of an all-composite fuselage for the 787 represents a "bet the company" decision for Boeing. If Boeing is correct and the lightweight fuselage is effective in use, the program will be a great success.

The risk of international construction and a new supply chain represent a radical departure for Boeing. While Airbus, organized initially as an international joint venture, has for years been joining conventional structures built in several places, Boeing lacked that experience in multi-national manufacturing and logistical coordination. In addition, since the fuselage sections are made of composites, they represent a different technical challenge for joining, with exceptionally close tolerances on very large composite items. Delivering that level of perfection and precision is not easy, even from one part of an assembly line in the same facility to another. Delivering it across continents can be extremely problematic, as Boeing discovered as the first few sections from multiple locations were delivered for assembly but did not properly align.

Managing a global supply chain requires a different style of management than the command and control structure employed within a single facility. Boeing has had a difficult time making the transition from a primary manufacturer to that of a systems integrator of components from a global supply chain. While Boeing has made the appropriate adjustments, the learning curve has been quite steep and painful.

When all problems are worked out, it remains unclear if Boeing will achieve its goal of assembling the 787 in three days as the nearly finished components from suppliers are flown in on converted 747 Dreamliners and those completed sections rapidly joined into an aircraft at the final assembly facility. Regardless, this compares favorably to the 767, which takes 21 days in final assembly to complete, and the 737 at 11 days.

Had the program met its initial time line, more than 200 aircraft would now be in service, delivering a major blow to Airbus.

The Aircraft

The Boeing 787 is a light- to medium-widebody aircraft, aimed at replacing the Boeing 767, which was no longer competitive with the more modern Airbus A330 family. Three variants of the aircraft were planned. The 787-3 is intended for short-range domestic operations, the 787-8 and larger 787-9 for intercontinental operations, with very long-range and ETOPS capability. The 787-8 will be the first aircraft certified, followed by the 787-9. The future of the 787-3, ordered by launch customer All Nippon Airlines (ANA), is now in question after ANA and JAL canceled all 43 orders for this version. Boeing is reevaluating this sub-type and it may be canceled.

A stretched version, the 787-10, has been discussed but work on this variant was suspended at the height of the program difficulties. It is unclear when, if at all, Boeing will seriously pursue this version.

Model	787-3	787-8	787-9
Seats	290 to 330 passengers	210 to 250 passengers	250 to 290 passengers
Range	2,500-3,050nm	7,650-8,200nm	8,000-8,500nm
Wing Span	170 ft. (52m)	197 ft. (60m)	208 ft. (63m)
Length	186 ft. (57m)	186 ft. (57m)	206 ft. (63m)
Height	56 ft. (17m)	56 ft. (17m)	56 ft. (17m)
Cruise Speed	mach 0.85	mach 0.85	mach 0.85
Total Cargo Volume	4,400 cubic feet	4,400 cubic feet	5,400 cubic feet
MTOW	364,000 lbs.	484,000 lbs.	540,000 lbs.

Innovation is a key element of the 787, which is the first commercial airliner to utilize an all composite fuselage, interchangeable engines, innovative aerodynamics, computer driven advanced systems to optimize performance, and a more modern interior, with larger windows, electrochromic windows, and indirect lighting. These innovations have captured the attention of customers which, along with lower operating costs, have resulted in record orders for the 787 prior to the first flight of the aircraft. The 787 order book currently stands at 851 aircraft, and during 2009 the aircraft generated 24 net orders despite 83 cancellations due to program delays, down from more than 900 last year at this time.

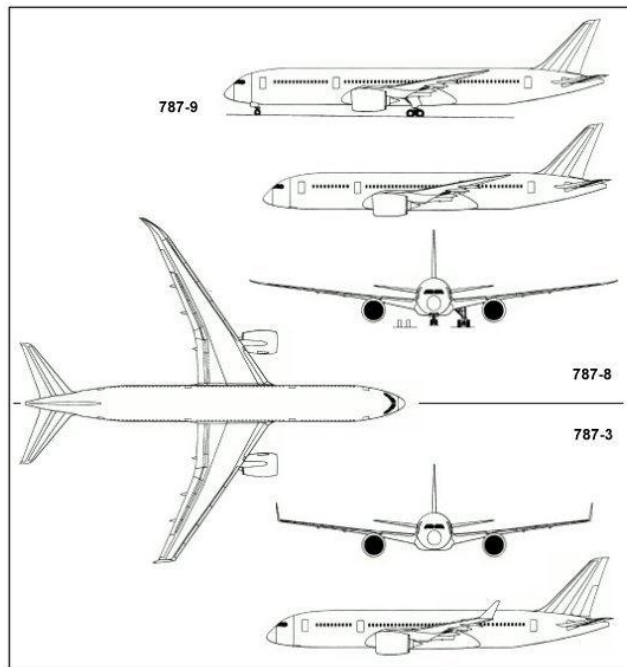


Image credit: Aerospaceweb.org

The 787's use of advanced composite materials for primary aircraft structure is a radical departure in commercial aircraft. About half of the 787 will utilize composite materials, versus only 15% for the 777, the last aircraft designed by Boeing prior to the 787. The advantages of composite structure are low weight, and high strength. The disadvantages to composites include higher material costs, low electrical conductivity to dissipate lightning strikes, and the difficulty in detecting damage, which typically works from inside out, rather than outside in as with metallic structures. The net weight savings from composites is significant, about 10,000 lbs. for the aircraft, which contributes significantly to the lower fuel burn and lower operating costs for the aircraft.

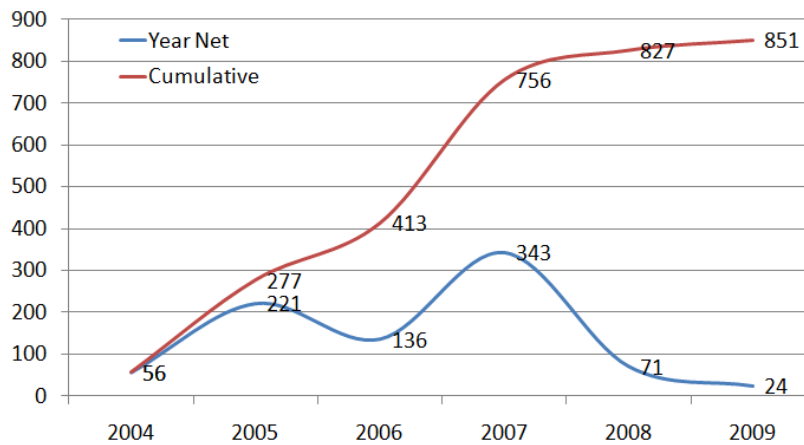
A second major departure for the 787 is the use of advanced electrical systems for elements of the aircraft that were formerly hydraulically or pneumatically controlled. "Fly by Wire" controls have been used in aircraft for many years, and Boeing has pushed the frontier forward with the elimination of bleed-air systems from the engines for de-icing, changing to a new electrical system, elimination of some hydraulics to save weight, and even elimination of pneumatic brakes, replacing them with electronically actuated brakes. These system improvements also save weight, enabling better operating efficiency as well as reducing maintenance costs.

The 787 will utilize new technology engines from Rolls-Royce (Trent 1000) or General Electric (GENx) to power the aircraft, each of which is significantly more efficient than the prior generation of engines they provided. This will also be the first aircraft with "interchangeable engines," enabling an airline to switch between the Rolls-Royce or General Electric engines installed on the aircraft within a short period of time. The engines will have a standard interface with the aircraft, and Boeing has indicated a target of 24 hours for an engine change of this nature. Such engine changes between different types would not be economically feasible on prior aircraft models, given the non-standard interfaces common on today's aircraft. This will allow customers, for the first time, to cost-effectively change engines should one of the companies develop a significant advantage over another during the life of the airframe, or to provide fleet compatibility should an aircraft powered by a GE engine be sold to a RR operator, or vice-versa.

Market Success

The Boeing 787 has become that most successful aircraft program in history before its first flight, having generated, prior to recent cancellations, more than 900 orders prior to first flight. The current order book stands at 851 aircraft,

787 Orders



Source: Boeing

The customer base for the 787 is widely based, and geographically widely distributed. As illustrated in the following table, the program is not highly concentrated in a handful of customers.

				Concentration	
	787-8	787-9	Total	Customer	Cum.
ILFC	67	7	74	8.7%	8.7%
All Nippon Airways	55		55	6.5%	15.2%
Qantas	15	35	50	5.9%	21.0%
Air Canada	37		37	4.3%	25.4%
Etihad Airways		35	35	4.1%	29.5%
JAL International	35		35	4.1%	33.6%
Qatar Airways	30		30	3.5%	37.1%
Unidentified Customer(s)	12	16	28	3.3%	40.4%
Air India	27		27	3.2%	43.6%
LAN Airlines	18	8	26	3.1%	46.7%
Air Berlin	25		25	2.9%	49.6%
Continental Airlines	11	14	25	2.9%	52.5%
British Airways	8	16	24	2.8%	55.3%
Gulf Air	24		24	2.8%	58.2%
Aeroflot	22		22	2.6%	60.8%
ALAFCO	22		22	2.6%	63.3%
Singapore Airlines		20	20	2.4%	65.7%

Northwest Airlines	18		18	2.1%	67.8%
Air China	15		15	1.8%	69.6%
China Eastern Airlines	15		15	1.8%	71.3%
Dubai Aerospace Enterprise	15		15	1.8%	73.1%
Virgin Atlantic Airways		15	15	1.8%	74.9%
TUI Travel PLC	13		13	1.5%	76.4%
Avianca	12		12	1.4%	77.8%
C.I.T. Leasing Corporation	10		10	1.2%	79.0%
China Southern Airlines	10		10	1.2%	80.1%
Ethiopian Airlines	10		10	1.2%	81.3%
Jet Airways	10		10	1.2%	82.5%
Korean Air	10		10	1.2%	83.7%
Kenya Airways	9		9	1.1%	84.7%
Shanghai Airlines	9		9	1.1%	85.8%
Air Europa	8		8	0.9%	86.7%
Air New Zealand		8	8	0.9%	87.7%
Air Pacific		8	8	0.9%	88.6%
Business Jet / VIP Customer(s)	4	4	8	0.9%	89.5%
Hainan Airlines	8		8	0.9%	90.5%
LOT Polish Airlines	8		8	0.9%	91.4%
VALC	8		8	0.9%	92.4%
Vietnam Airlines	8		8	0.9%	93.3%
Arik Air		7	7	0.8%	94.1%
AWAS	6		6	0.7%	94.8%
Monarch Airlines	6		6	0.7%	95.5%
Aviation Capital Group	5		5	0.6%	96.1%
LCAL	5		5	0.6%	96.7%
Biman Bangladesh Airlines	4		4	0.5%	97.2%
Icelandair	4		4	0.5%	97.6%
Royal Air Maroc	4		4	0.5%	98.1%
Royal Jordanian	4		4	0.5%	98.6%
Aeromexico	2		2	0.2%	98.8%
Azerbaijan Airlines	2		2	0.2%	99.1%
Nakash		2	2	0.2%	99.3%
PrivatAir	2		2	0.2%	99.5%
Uzbekistan Airways	2		2	0.2%	99.8%
Air Niugini	1		1	0.1%	99.9%
Travel Service	1		1	0.1%	100.0%
	656	195	851		

Despite cancellation of 83 in 2009, customers will remain committed to the aircraft if it now meets its targets for entry into service in the last quarter of 2010. We believe the market prospects for the 787, if it meets its performance and delivery targets, remain very strong. Boeing expects a production run of more than 2,500 aircraft during the life of the program, and we expect additional orders once the flight test program is completed and the aircraft certified. If Boeing meets this target, the program will produce a profit for the company despite the billions of dollars in cost overruns and customer penalties. We believe the break-even on the program now approaches 1,000 airplanes.

The major competition to the 787-9 will be the Airbus A350XWB, as the 787 is clearly superior to the older Boeing 767 and Airbus A330 models. While the A350 will be a larger aircraft, competing with both the 787 and 777, we expect at least equally compelling economics, as Airbus will also leverage similar composite technologies, advanced engines and advanced systems that drive efficiency in the 787. Just as Boeing projected cash operating costs and block fuel per seat to be about 20% lower than the 777 for the 787, Airbus is projecting 25% in each metric respectively for the A350, taking savings even further than the 787.

However, the A350XWB is a larger aircraft, and does not directly compete in the 210-250 seat sector, in which the 787-8 has become the most popular variant. With Airbus projecting 6,000 twin aisle aircraft and Boeing 8,000 twin aisle aircraft over the next 20 years, Boeing's projection of a production run with more than 3,000 orders for the 787 is not infeasible. A key element in the future decision process is aircraft size, and the proportion of traffic growth will be absorbed through higher capacity aircraft or through increased frequency. The former favors the A350XWB, and the latter the 787-8. It is our view that both elements will be true, and that each program will be successful in playing to its strength, with Boeing operators tending towards the 787 and existing Airbus operators taking advantage of commonality with the A350XWB series.

Competitively, the A350XWB has generated more than 500 orders since launch in only two years, an even faster early ramp-up than the 787, which achieved 291 in its first two years. However, some orders for the A350XWB carried over from an earlier A350 design, making the comparability of the time frames more difficult. Nonetheless, it appears that each of the new technology wide bodies, given an environment of high fuel costs, will achieve significant market success in replacing older aircraft.

Challenges

Boeing's delays have given Airbus, which was at least five years behind Boeing with its competing A350 program to cut the delivery gap in half. The A350, utilizing lessons learned from the 787, will be a slightly larger aircraft than the 787 covering both the 787 and 777 families in the marketplace with a single type. Airbus has positioned the A350 well, given the trends for growth in aircraft size over time. Boeing had a large market to itself in advanced technology aircraft, but squandered a distinct market advantage.

The combination of the high backlog at Boeing and program delays has limited Boeing's flexibility in offering early delivery positions to customers, and today, a customer could order a 787 or A350XWB for delivery in roughly the same time frame, circa 2015. As a result, Boeing's advantage in earlier delivery of an advanced technology aircraft has effectively been eliminated.

In addition, the "panel on frame" design of the A350XWB will likely prove less difficult to manufacture than the one-piece 787 fuselage sections, reducing the likelihood of a major program delay.

Delivering the aircraft rapidly to customers, and increasing the production rate to more than 10 per month will be Boeing's next major challenge after certification. Boeing has planned a second assembly line for the 787 in North Carolina, moving production away from Puget Sound. Management of a the new facility in South Carolina, the second assembly line, and training new employees will be a significant challenge as Boeing attempts to increase production to accelerate the already late deliveries to customers.

Safety

From an operational standpoint, the safety of structural composites remains a controversial issue. While structural composites have successfully been utilized in smaller personal aircraft, the 787 will be their first application in large commercial aircraft. The 787 will have more than 50% of its structure from composites, as opposed to 15% on the 777. Three areas of concern have been identified with respect to composite structures, crashworthiness, lightning protection, and repair and inspection protocols.

The crashworthiness of composites has been questioned by a number of engineers as not being as "tough" a material as aluminum during a crash. Aluminum structures are ductile, and deform during a crash, absorbing impact. Carbon fiber structures are brittle, and do not deform until they fracture. As a result, the impact absorption of a composite fuselage, unless strongly reinforced, would result in a disintegration of the fuselage in several crash scenarios, such as the Air France A340 that veered off of a runway in a crash in Toronto and landed in a 30 foot deep culvert. All of the passengers successfully escaped from that aircraft, the fuselage of which remained intact, and later began to melt during a fire after passengers had exited.

Critics fear a composite structure would likely shatter in that scenario, providing little protection to passengers, and enabling fire from fuel tanks to quickly enter the cabin. In addition, burning composites are quite toxic, and result in small shards of carbon fiber being released into the air. This toxic mixture has the potential to suffocate customers before they have a chance to escape. While Boeing meets existing FAA standards for composites, the certification process employed by the FAA is a work in process, and they are, to a great degree, learning with Boeing as they go.

The only crash of a large, composite airplane occurred when a Northrop Grumman B-2 bomber crashed on take off at Guam, with fire consuming the composite fuselage. Boeing is a major sub-contract on the B-2. The crash analysis revealed fire-fighting difficulties in extinguishing the blaze. The composite fuselage burned longer than fires in traditional metal fuselage airplanes.

Although composites are highly toxic, we spoke with airport fire officials in Denver and Los Angeles who attack every fire as highly toxic and dress accordingly. Airplane interiors contain composites and exteriors have increasingly used composites. The entire aft end of the A380 is composite and this represents as much as the 787 has in its 53% composite fuselage. The A380's

center wing box is composite. (That Airbus successfully built a composite center wing box and Boeing and its industrial partners had severe difficulties with this section and the wing-to-body join is significant, but this is an entirely different discussion.)

The additional threat to passengers from the increased use of toxic materials is something that will one day have to be assessed in a post-fire analysis of a composite airliner. But we note that the dangers of composites in fires are nothing particularly new.

Lightning protection of composite structures is also a critical issue, as plastics like composites do not conduct electricity away from the interior of an airplane as aluminum does. Boeing has implanted a copper mesh within the carbon fiber structure of the composite materials to provide a pathway for conductivity, and has even specially coated fasteners to provide additional protection. However, embedding materials into carbon fibers that behave differently when exposed to hot humid conditions on the ground and extremely cold dry conditions at high altitudes could result in potential damage to composite structures due to expansion and shrinking of that material embedded within the composite structure. The long-term impact of temperature cycles on composites with embedded copper mesh remain, to a great degree, an unknown risk with respect to potential delamination or degradation of composite structures.

A third element of risk is repair of composite materials. Damage to composites is difficult, if not impossible to detect by the human eye, and damage to composite structures often begins with microscopic cracks inside the material. Detection of damage requires the use of ultrasound or other high tech equipment to determine if damage exists, and whether moisture or other contaminants could cause delamination of the composite materials as the aircraft travels between hot/humid and cold/dry conditions during typical flights. The loss of several composite rudders on Airbus A300 and A310 series aircraft, which have resulted in Airworthiness Directives to inspect such composite surfaces, illustrate the potential problem of discovering structural damage on a composite airliner.

Compounding that issue are repair process for the inevitable "hangar rash" accidents caused by baggage loaders and other ground equipment. Aluminum aircraft often have "scab patches," which are sections of metal fastened over damaged skin to provide a sound repair. Composites require patching with special compounds, similar to the "bondo" repairs to a dent in an auto body using a plastic material. The long-term stability of these repair processes is of concern to many engineers.

One of the three authors of this report has substantial concerns about the safety of the 787 design, and plans to avoid the 787 whenever possible until its crashworthiness and long-term safety record can be determined.⁸

Outlook

Boeing remains confident in the 787 program, which barring additional unforeseen delays, should now reach customers in the fourth quarter of 2010. The 787-8, the most popular variant, provides an ultra-long range aircraft suitable for long-thin markets with seat-mile economic

⁸ To further delineate this point: The other two co-authors have no such qualms.

comparable to larger aircraft. As a result, the aircraft provides airlines flexibility for route development or additional frequencies in an era when expected congestion in air traffic control will make hub and spoke operations more difficult through frequency constraints. To date, 77% of program orders are for the smallest model, the 787-8, with 23% for the larger -9 model.

The 787-3 short-range version, originally scheduled for certification just after the -8 and before the -9, has been pushed back indefinitely.

There has been significant speculation regarding the potential introduction of a larger -10 model that would compete not only with the A350XWB-900 in the 300-330 seat range, but also compete with the 777-200LR. Boeing must decide soon whether to enhance the existing 777, or replace it with a newer technology. Our view is that an enhanced 777 will remain technologically inferior to the A350XWB, requiring Boeing to replace the 777 and continue its game of technological leap frog with Airbus. Should Boeing decide to replace the 777, the question will turn to size -- should Boeing stretch the 787 and make the base 777 replacement larger, or accommodate the 300-330 seat size of a potential 787-10 within the 777 replacement family?

Because many airlines are replacing the Boeing 747-400 with the 777-300ER (and notably not with the 747-8I, which has yet to generate market excitement), the competition between the A350XWB-1000 and 777 replacement may be critical in capturing the market for retiring 747-400s, which began deliveries in 1988 and will begin to retire in significant numbers between 2015-2030. There is a significant replacement market to capture, and Boeing's current lead with the 777-300ER may disappear as the A350XWB-1000 enters service.

We believe the 787 program will be quite successful, and should generate more than 3,000 deliveries through its first 20 years of production. The outlook for aircraft values will be strong for the popular 787-8 and -9 models, and the aircraft should hold its value well given its economic advantages.

787 Summary

Boeing "bet the company" with the 787 program. With six program delays and difficulties with structural composites that have reduced the confidence of potential customers in Boeing's ability to deliver the aircraft it promised, Boeing's financial strength and the ability to take advantage of ground-breaking technology has been compromised. With a program budget pushed by some estimates to more than US\$20bn, the impact on Boeing's cash flow, equity value, and flexibility for developing replacement programs for other models in its "Yellowstone" strategy for commercial aircraft have been dramatically impacted.

Despite these delays and difficulties, however, Boeing appears to have solved its major problems and will deliver on its promise of a more efficient, advanced technology airliner. The questions now come down to reliability, repairability, and the safety of structural composites in operation.

If Boeing engineers are correct, and the 787 is easy to repair, more reliable and more economic than existing types, and performs well, the 787 program will become profitable and as a

pioneer, Boeing will claim new territory and its associated benefits. If however, the aircraft has a catastrophic failure of its composite structure, or when the inevitable crash occurs does not perform well from a safety standpoint, the bet-the-company decision will have failed, and result in a financial catastrophe.

We believe the former will be the case, and that Boeing's bet-the-company program, which has resulted in significantly higher than expected costs, will become profitable. We have some indication the break-even point is now 1,200 airplanes or more, which suggests it will be 12-15 years before Boeing sees a profit on this program at currently projected production rates. If Airbus learns from the 787 program and can bring its program in on time and on budget, the significant benefits from being a pioneer will not be as robust as desired.

Boeing had a five-year technological lead on Airbus that it squandered into a 2 1/2 year lead through mismanagement and over-confidence. As a result, an once in a lifetime opportunity to re-capture market leadership from a competitor with an A380 program in difficulty did not materialize. In the game of technological leap frog, Boeing's delays have enabled Airbus to catch-up, and they are now poised to leap frog the 787 with the A350XWB and render the 777 economically obsolete. Boeing would have been in a position to execute its new technology strategy more quickly if the 787 program had not crippled its cash position. A second program just after the 787 in late 2008 would have placed enormous pressure on Airbus. Now, the shoe is on the other foot as the A350XWB threatens both the 777 and 747-8I programs, and a forthcoming A320 re-engining program will require a competitive response with the 737NG.

The Bottom Line: Boeing took on a risky program, couldn't deliver, and as a result will face increased competition for its cash cows, the 737NG and 777, each of which will need major enhancement or replacement. Airbus leap frogged Boeing with the A320 and A330. The 787 would have provided Boeing an opportunity to recapture its traditional role of market leadership. Unfortunately, the program delays will enable Airbus to maintain its market leadership position for the next two decades.

Boeing Military Programs Based on Commercial Derivatives

Boeing Integrated Defense Systems currently comprises slightly more than 50% of the Company's revenues. For purposes of this Study, we confine our detailed analysis to the commercially-based derivative programs, the P-8A Poseidon and Wedgetail (based on the 737); the KC-767 (based on the 767-200) and the conceptual KC-777 (based on the 777-200LRF).

On a macro level, we offer the following observations:

P-8: While the P-8 Poseidon program is on schedule and budget, some elements within the Navy have concerns that the aircraft may not be as operationally suited for the anti-submarine mission as the P-3 it is replacing. The difference is the ability for the P-8 to operate at the lower altitudes required to successfully utilize the anti-submarine detection and retain the mission capability to loiter over a target zone.

The 737, on which the P-8 is based, is designed for optimal performance at 30,000 feet. Operating at low altitudes, jets are not as efficient as turboprops, and fuel economy and range are greatly reduced operating at altitudes under 10,000 feet, required for antisubmarine

warfare missions. In addition, a swept wing jet is less stable at low speeds, which are often required to maintain contact with a target, than a straight winged turboprop. As a result, the P-8 may be less effective than its turboprop P-3 predecessor in executing certain mission requirements with current technology.

During the initial procurement, the preferences for a jet powered replacement for the P-3 won over advocates for turboprops, and Boeing won the competition over Lockheed Martin, who proposed a new build more modern update of the P-3 turboprop.

While the P-8 is faster and can reach a target areas more rapidly than the P-3, the mission requirements to loiter over a target at low altitudes may render the P-8 less effective than its predecessor. The P-8 utilizes the additional fuel tanks from the Boeing Business Jet (six fuselage tanks) to increase its range. Turboprops such as the ATR-42 and C-130 have been adapted by many countries to antisubmarine warfare missions, as they are more effective for low-speed, low-altitude flights due to their superior fuel economy at low altitudes.

The P-8 is equipped with six external and five internal positions for torpedos, mines, or missiles for battle. The plan for utilization of the aircraft includes coordination with the Broad Area Marine Surveillance UAV platforms that will replace some of the formerly manned mission requirements of the P-3, changing the role of the P-8 to include coordination of electronic resources.

In mid-2008, the Naval Air Systems Command changed its requirements for magnetic anomaly detection equipment, deleting the requirement to reduce aircraft weight by about 3,500 lbs. to improve aircraft range and endurance.

The P-8 program should, nonetheless, be successful for Boeing. While the initial mission requirements have been changed to provide additional range, the age of the P-3 will result in the need for replacements worldwide. With orders from India as well as the US, and anticipated potential orders from other countries, the P-8 program should generate more than 150 aircraft over the life of the program.

Wedgetail: The Wedgetail is based on the 737 program, and contains a large aerodynamic radar antenna atop the aircraft for electronic surveillance. While smaller than the 767-based AWACS aircraft, the Wedgetail is designed for similar missions, using a fixed electronically scanned rather than a rotating radar antenna.

To date, the program has been sold to Australian, Turkish and South Korean governments, with a total of 13 firm orders and 2 options. Based on its limited commercial success, we do not believe the Wedgetail will survive once its current backlog is delivered. CEO McNerney, however, believes there will be a greater international market once the Wedgetail is delivered and in service.

The company is 18 months behind schedule on the program, and Boeing has taken a US\$770m write off on the program. While additional potential customers include Italy and the UAE, delays on the tanker program for Italy have soured relationships with Boeing, and the UAE recently opened competition to Northrup Grumman, indicating a less than robust market reception for the aircraft. We expect this program to be an economic failure.

KC-767 Tanker Program: The tanker program, described earlier in this report, may be more a political decision than one based on the merits of the aircraft. While we believe the Airbus A-330 based offering is more capable than the Boeing 767 based tankers and would logically win the competition, political decisions are just that, and unpredictable as a result.

We frankly don't know whether the logical compromise--accepting both tankers with the A330-based KC-30 replacing the KC-10 and the 767-based version replacing the KC-135--will be the eventual result, or whether politics will result in Northrup Grumman dropping out of the competition, which it threatened to do, claiming that the latest RFP is biased in favor of Boeing.

Boeing fears that Airbus could gain a foothold building aircraft in the US should they win the program, and are pulling out all the stops to preclude that eventuality. But competition is good, as it will likely result in a better deal for the US military and consequently the US taxpayers. As a result, this program, while a strategic win, will have been subjected to sharp pencils in anticipation of a bid from EADS to gain a US foothold for Airbus, and don't anticipate this as being as large a financial boon to Boeing as otherwise might be expected.

As noted earlier, we believe the Obama Administration ought to use Stimulus money and fund procurement of the KC-767 and the KC-30.

Special Comment

Throughout this Report, we have based on observations and predictions on market conditions as they exist at this writing. There is a Wild Card that remains unplayed even as we publish this report that can have major effects on any number of scenarios we have discussed. This Wild Card is the Airbus A400M program.

Airbus and the government-customers of the A400M, who with the exception of Malaysia also are partners in the entire EADS/Airbus enterprise in one form or another, continue to meet in order to resolve differences over the fixed-price contract agreed at the launch of the A400M program. Because of developmental delays, the airplane is now running years late and at last count some €11bn over budget. The program cost Airbus US\$1.38bn a year at current exchange rates.

Airbus continues to seek more money from the governments, which have offered €2.2bn; Airbus seeks at least €2.4bn more.

Airbus CEO Thomas Enders has been quoted in the European press saying unless the contracts are renegotiated; the A400M threatens the viability of Airbus. This can be interpreted in many ways, the most dire of which is the financial collapse of the company. We don't believe this would ever be allowed to happen.

Our view is that the A400M more likely threatens the competitiveness of Airbus, most particularly vis-à-vis Boeing but also in the greater context of the emerging competitors over the next 20 years.

As we have related throughout this report, we believe neither Airbus nor Boeing have the financial depth today to launch new airplane programs to replace the A320 or 737 families, nor in the case of Boeing, for a 777 replacement airplane.

For Airbus, the endless cash drain on the A400M is particularly significant. (The deferred revenue on the A380 program is also a major concern.) The engineering and technical resource drain for the A400M from the core A3-Series current and future programs is also a major diversion from the core Airbus business.

We believe Boeing cannot afford new airplane programs to replace the 737 and 777 but what if, in a gutsy bet that would dwarf the risks Boeing took with the 707, 747 and 787 programs, the company assessed the financial weakness of Airbus due to the A400M and A380 programs, decided to roll the dice and skip a 737RE and/or 777E, going straight to new airplane designs? We do not believe Airbus can respond with a new A320 at this time, and this is the cash-cow for Airbus and for EADS.

Could Boeing come up with a replacement for the 777 that would be marginally or significantly better than the A350? We certainly cannot rule out this possibility.

We think it unlikely that Boeing will pursue a replacement 737 now, preferring to do so for the 777—but based on information we received in preparation for this report, we cannot rule out the possibility.

Airbus has several A320 replacement designs “on the shelf,” but would need the funding to proceed to development. With the company remaining committed to the A380, a horse it cannot now get off of, the financial strains of the A400M take on added importance. If an agreement can’t be reached between Airbus and the government-customers, Airbus may cancel the program with the prospect of having to refund more than €7bn, a move that will financially crush the cash cushion EADS has. If Airbus continues the program under the current contract conditions, the financial drain will harm the A3-Series that not only is the core of Airbus but the soul of EADS.

In the end, we think pragmatism has to prevail. The Europeans have spent 40 years building up Airbus and creating EADS to become major global players. Setting aside all the US-Euro debate over subsidies, for the Europeans to threaten the competitiveness of Airbus, which makes up about 70% of the EADS revenues, is at best perplexing. The Europeans have a chance to do more harm to Airbus, EADS and the 40 years of progress than anything the US Trade Representative or Boeing can do.

The Europeans also have the chance to hand Boeing a golden opportunity to reclaim the initiative lost with the 787 program delays and leap ahead of Airbus for decades. Will the Europeans take this opportunity, or will they realize the damage they are flirting with?

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Mr. Hamilton joined the airline management ranks in 1979. In 1989, he and a partner formed Linkraven in Britain. During the 10 years Mr. Hamilton and his partner owned and operated Linkraven. The influential publications regularly beat larger and more established magazines and newspapers with news about the airline industry. Mr. Hamilton is frequently called by broadcast and print media to offer expert analysis about the issues of the day. He is a regular contributing writer for Commercial Aviation Online (the successor to *Commercial Aviation Report*, which is now part of the Flight International family of publications) and *Armed Forces Journal*, a defense magazine.

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