What to expect at the 2013 Paris Air Show

AirInsight

Agenda

- Key Issues Facing the Industry
- New Products
- Technological Change
- The Two Newest Airplanes to Fly
- A Look Inside AirInsight's Crystal Ball

Key Issues Facing the Commercial Aviation Industry

Several Key Issues are Facing the Industry in 2013

- Accommodating Traffic Growth and Demand
- The Potential Oversupply in Narrow-Body Airplanes
- Are the Useful Lives of Airplanes Getting Shorter?
- Fuel Prices – Rising, Stable, or About to Fall?
- Technology – The Technology Advantage for 787, A350 and CSeries
- China and Russia – Emerging Giants or Paper Tigers?

Accommodating Traffic Growth and Demand

- Traffic will continue to grow 5-6% per annum over the next 20 years according to Boeing and Airbus Forecasts
- That means traffic doubles every 13-14 years
- But airports, runways and gates won't double during that time
- Implications:
  - Larger aircraft
  - Higher density seating
  - Higher load factors
  - Increased delays
  - Overcrowded facilities

London Heathrow

How will Traffic Growth be Accommodated?

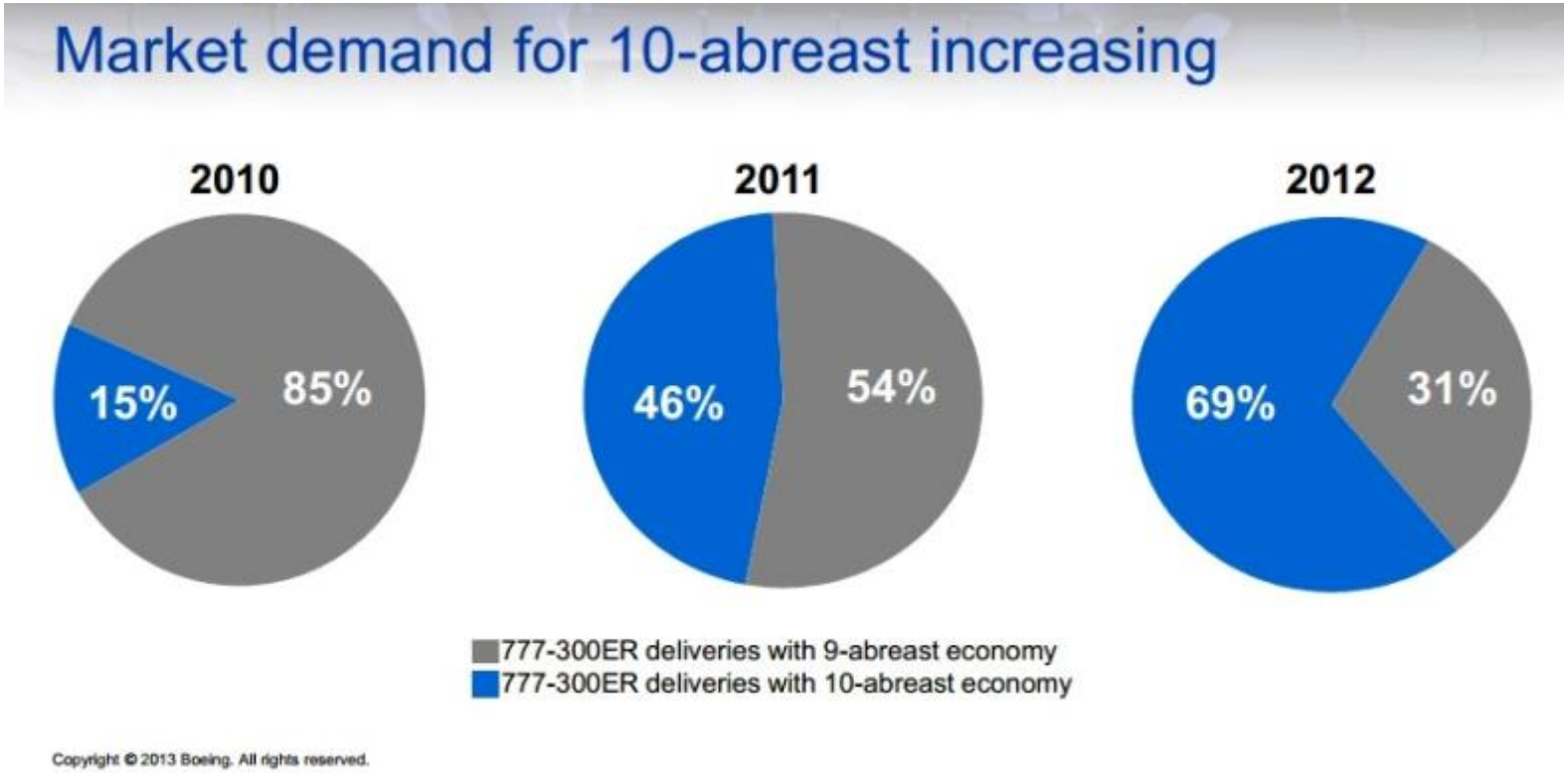
- Larger Aircraft
  - Sales for A320neo and 737MAX do not parallel their earlier versions, with larger models now in vogue

Historic Deliveries through 31 March 2013		
737-700	1229	
A319	1366	
Under 150 seats	***2595***	***26.6%***
A320	3274	
737-800	2877	
150-180 seats	***6151***	***63.0%***
A321	797	
737-900	220	
over 180 seats	***1017***	***10.4%***
TOTAL	9763	

New Model Orders thru 30 May 2013		
737-7 Max	30	
A319neo	45	
Under 150 seats	***75***	***2.1%***
A320neo	1631	
737-8 Max	1182	
150-180 seats	***2813***	***80.3%***
A321neo	449	
737-9 Max	164	
Over 180 Seats	***613***	***17.5%***
TOTAL	3501	

How will Traffic Growth be Accommodated?

- Increasing Seating Capacity



The Potential Oversupply of Narrow-Body Planes

- Airbus forecasts 19,518 new narrow-bodies needed over next 20 years
- Boeing forecast even more, at 24,670
- But production rates are going up dramatically
- With COMAC, Mitsubishi and Irkut joining Embraer, Sukhoi, Bombardier, Airbus and Boeing, the field is becoming more crowded
- A potential bubble in narrow-bodies may be building

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

That would yield more than 28,000 aircraft over 20 years

Conclusion: Somebody isn't going to produce all of the airplanes they currently contemplate

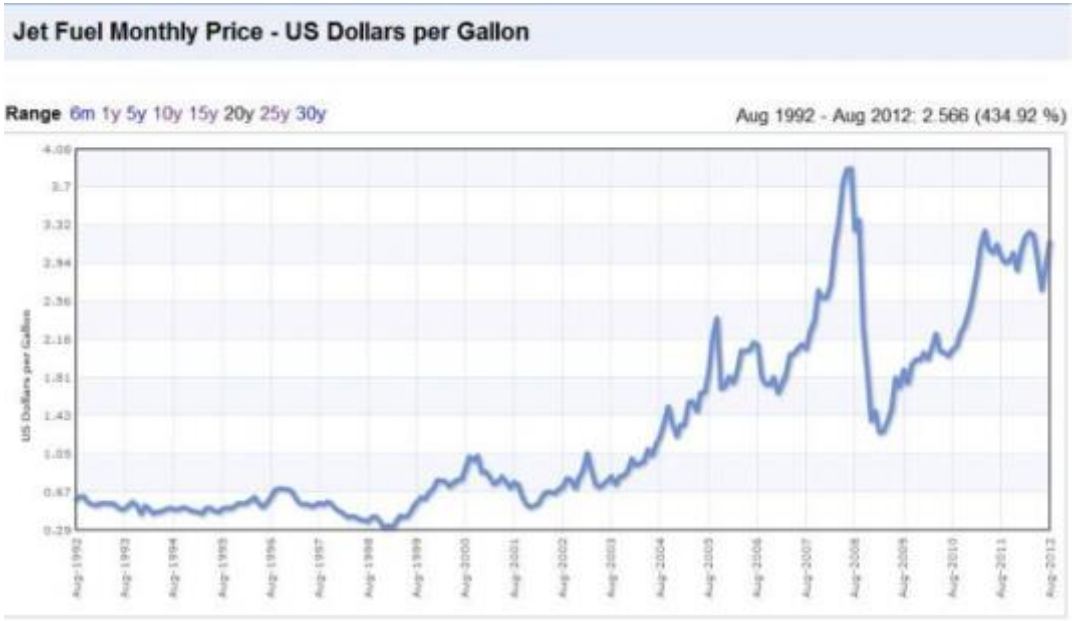
Are the Useful Lives of Aircraft Getting Shorter?

- Some theorize that the economic life of a narrow-body aircraft will be shortened from the 25-30 year timeframe by 3-5 years in the near future
- Neither Boeing nor Airbus believe this to be the case
- Economic obsolescence takes a long time to occur, as fuel costs versus capital costs provide clear economic tradeoffs
- Those tradeoffs differ for narrow-body and wide-body aircraft
- Northwest kept its DC-9 fleet alive in the 1990s through refurbishment for an additional 15 years
- High fuel prices and efficient new engines are cited as a key factor
- But the 737-8MAX is only 4% more efficient in total operating costs than the current 737-800NG
- Is 4% enough to merit the capital cost differential for a replacement? The answer is no.
- So 737-8MAX will likely replace older 737 Classic and MD-80 models, over which there is a larger economic gap
- Overall, we don't believe lives are becoming significantly shorter – but this also depends on the airplane – as demonstrated by the MD-11 and A340

Fuel Prices – Rising, Stable, or About to Fall?

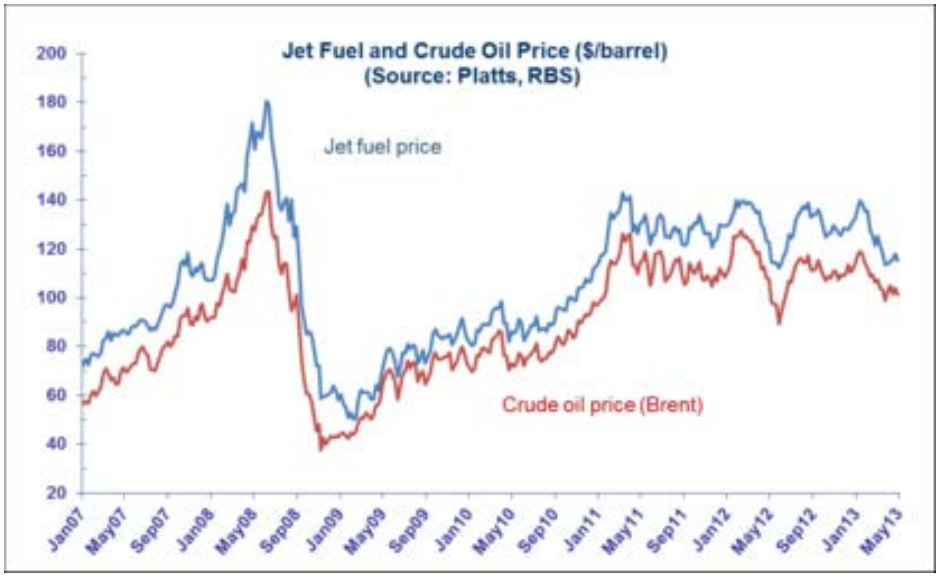
With fuel a key component in airline economics, fuel prices make a significant difference in the economics of older aircraft

- Should fuel prices rise, this will increase demand for more efficient new aircraft
- But should they remain stable or fall, this will extend the economic life of older aircraft, decrease retirements, and reduce demand for new aircraft to replace older, more inefficient models



Fuel Prices – Rising, Stable, or About to Fall?

- Adam Pilarski at Avitas believes fuel prices are about to tumble, as autos become more efficient and demand falls while supply is growing – back to $40 per barrel
- Should that turn out to be true, that changes the economic equation for new aircraft
- Our view is that we will see price stability, and therefore a mild price drop in real terms, with oil in the $100 per barrel range in 2013 dollars for the foreseeable future – which translates to modest deflation in real terms



Technology – How Large an Advantage

- The three all new technology airplanes – 787, A350 and CSeries, all utilize new materials, advanced systems, and technology to their advantage
- Lighter weight of composites, fly by wire systems, advanced aerodynamics, and aluminum-lithium alloys generate overall operating cost improvements of 15%-20%
- That advantage is significant, and has resulted in lower prices for competing “existing technology” aircraft

China and Russia – Emerging Giants or Paper Tigers

Russia

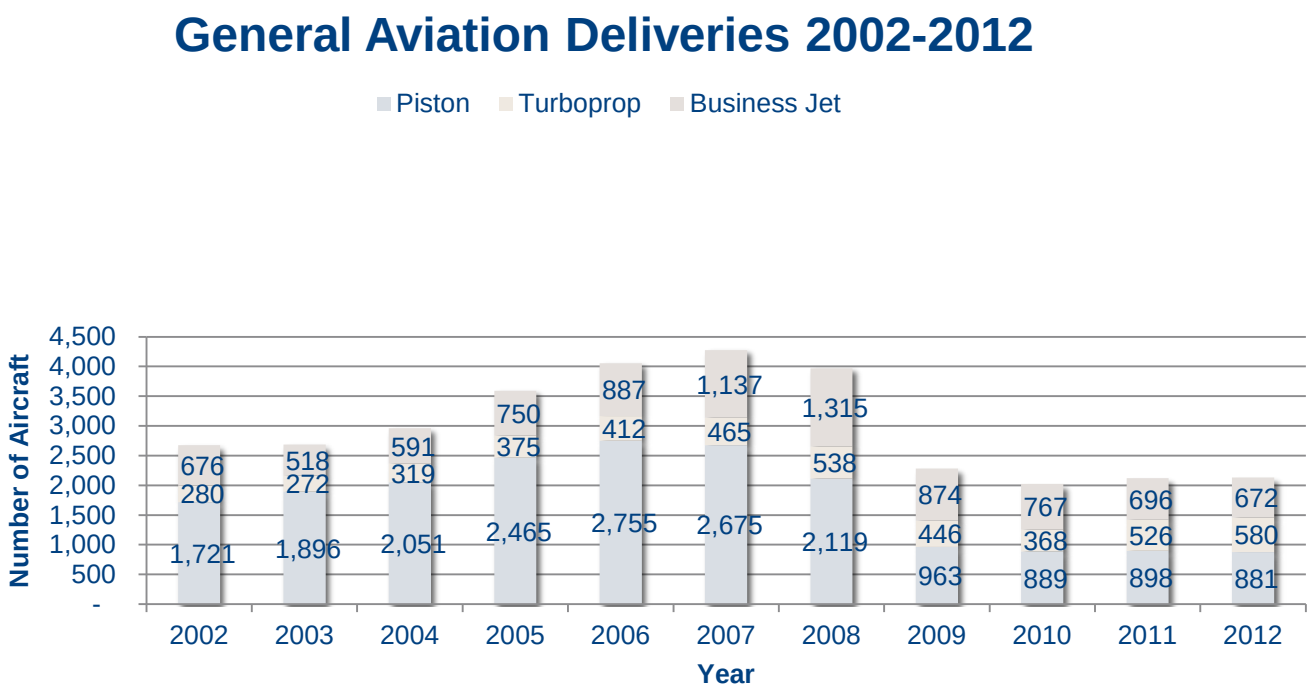
- Sukhoi Superjet – with Western engines, avionics, and components, still isn't selling well in the West
- Irkut MS-21 – that is A320/737 sized with new PW GTF engines appears excellent on paper, replete with Western components
- But can Russia deliver the new program on-time, on-budget, and meeting specifications?
- If they can, it will be a great airplane – but the jury is out as to whether they can sell it in the West, as service and support are critical elements

China

- COMAC is attempting to enter the airliner business with the ARJ-21 and C919, in the 70-90 and 150-200 seat ranges, respectively
- ARJ-21 program has been a failure, with massive redesign required and is 4 years late
- C919 program is largely being designed by Tier 1 Western subcontractors, but integration and manufacturing skill still lacking in China
- While the future looks bright, current programs are a "paper tiger"

The Business Aircraft Market

- The market is finally starting to turn, but not yet to growth levels of last decade
- Bombardier had most significant growth in 1st quarter, and Hawker Beechcraft, after bankruptcy and dropping its jets, the biggest deficit
- The top end of the market, Gulfstream G550-650 and Bombardier Global models, are selling well in Asia
- International growth will be a driving force over the next decade



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New Products to be Flying and Announced

- The race for first flight has been won by the Airbus A350 with Bombardier CSeries next up. Major announcement from Embraer launching the re-engined E-Jets with the PW GTF.
- While we don't expect the CSeries to show up at Paris, Airbus could do a fly-by from Toulouse with the new airplane
- Major announcements from Boeing will include launch of 787-10, and more information on 777X, which is now being discussed with airlines
- Boeing might wait to formally launch 777X until Dubai, with Emirates the potential launch customer

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Technological Change

- Engines were the primary driver of aircraft economic change, and remain so today
- New technology narrow-body engines from PW and CFM enable neo, MAX, CSeries, EJet2, MS-21 and C919
- New technology wide body engines from GE and RR permit 787, 777X, and A350
- PW's geared turbofan is a game changer, and GE's ceramic matrix composites provide dramatic improvements
- Materials and Aerodynamics have joined engines in providing economic change
- Composites and lighter weight Aluminum alloys are reducing weight and fuel consumption
- New "plastic" airplanes like 787 and A350 offer significant improvements over older models, in the range of 15-20%
- Computation fluid dynamics computer technologies are driving aerodynamic improvements and capabilities

Leaders in Technological Change

The Leaders:

- Engine Configuration
  - PW with geared turbofan
- High Temperature Materials
  - GE/CFM with Ceramic Matrix Composites
- Composite Materials
  - Boeing with 787
  - Airbus with A350
  - Bombardier with CSeries wing
- Aluminum Alloys
  - CSeries with Al-Li fuselage
- Fly by Wire Designs
  - Parker Aerospace

Does Technology Leadership Mean Market Success?

- The short answer is yes
- But, there are technology risks, as Boeing discovered with 787, that can lead to unanticipated consequences
- Applying new technology while minimizing risk is a key factor in success
- The aircraft manufacturers have learned from each others mistakes, and the emerging aircraft have much shorter delays than their predecessors

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The Two Newest Airplanes to Fly

Bombardier CSeries

- 110-155 seat narrow-body
- Domestic short-haul focus
- Aluminum-lithium fuselage
- Composite wings
- Pratt & Whitney GTF engines

Airbus A350XWB

- 275-350 seat wide-body
- International long-haul focus
- Composite fuselage
- Composite wings
- Rolls Royce Trent XWB engines

A350XWB Has Three Models

- A350-800
  - 270 seats competing with 787-9 and replacing A330-200
- A350-900
  - 314 seats competing with 787-10 and replacing A330-300
- A350-1000
  - 350 seats competing with 777-300ER

A350XWB

Order Book

	A350-800	A350-900	A350-1000	TOTAL
Firm Orders	92	444	110	**646**

Outlook

- Very competitive aircraft, competing with 787 and 777
- Outflanked by Boeing with smaller and larger models, but at the hot spot in the wide-body market
- Key will be development of program without glitches associated with 787, and on-schedule introduction to service
- With test aircraft ready to fly-by at Paris, signs are promising

The CSeries

CS100

- 110 seat model that accommodates smaller routes with seat mile costs comparable to larger aircraft
- Economics enable favorable pricing into smaller airports, unlike existing regional jets that require higher fares

CS300

- 135-155 seat model that can compete with existing 737-700 and A319 models on trunk routes with lower seat-mile costs that even the re-engined A319neo and 737-7Max
- Can economically compete with 737-8MAX and A320neo while offering smaller size and lower risk for airlines serving smaller markets

CSeries

Order Book

	CS100	CS300	TOTAL
Firm Orders	63	82	145
Options	52	72	124
Purchase Rights	0	20	20
Total Contracted	***115***	***174***	***289***
Not under contract			
Commitments	17	52	69
Options to Commitments	18	15	33
Total Uncontracted	***35***	***67***	***102***
Program Total	**150**	**241**	**391**

Outlook

- Will likely have at least one major order and one commitment turn into an order at Paris
- Quite likely to meet goal of 300 firm orders for program by entry into service in 2014
- Won't outsell A320neo or 737MAX, but will be leader in its seat class under 150 seats
- Program will have adequate demand to become profitable

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A Look Inside AirInsight's Crystal Ball

- Paris Announcements
- Market Growth
- Economic Changes
- Winners and Losers