



# Composite Materials for Next Generation Commercial Aircraft

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**BOMBARDIER**

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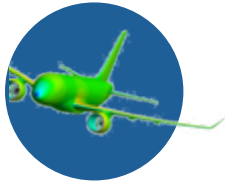
# Forward-looking statements

This presentation includes forward looking statements. Forward looking statements generally can be identified by the use of forward looking terminology such as “may”, “will”, “expect”, “intend”, “anticipate”, “plan”, “foresee”, “believe” or “continue”, the negative of these terms, variations of them or similar terminology. By their nature, forward looking statements require us to make assumptions and are subject to important known and unknown risks and uncertainties, which may cause our actual results in future periods to differ materially from forecasted results. While we consider our assumptions to be reasonable and appropriate based on information currently available, there is a risk that they may not be accurate. For additional information with respect to the assumptions underlying the forward looking statements made in this presentation, refer to the respective Forward-looking statements sections in BA and BT in the MD&A of the Corporation’s annual report for fiscal year 2009.

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All amounts are expressed in U.S. dollars unless otherwise indicated.

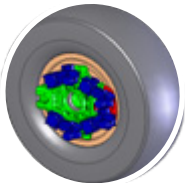
# Program Strategies For Commercial Aircraft... A Complex Equation



Technology Selection At All Component Levels



Trade Studies & Life-Cycle Cost Analysis



Technology Readiness Roadmap



Airline Input Validates Progress and Decisions

# Products that revolutionized commercial airline networks



## *The CRJ Revolution*

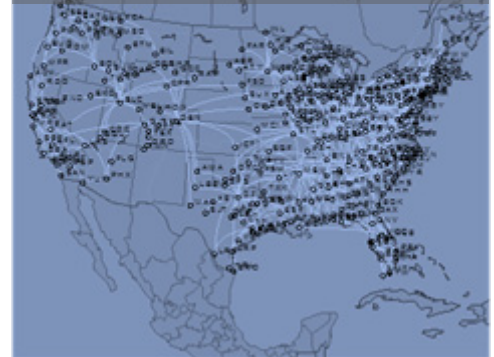
- Expanded regional airline range
- Open numerous hub feed opportunities
- Enabled Airlines to better match capacity to demand



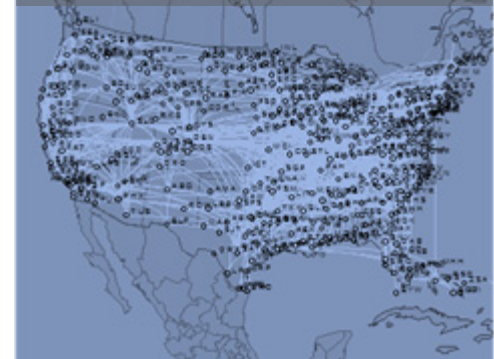
## *The Q400 Revolution*

- Short-haul speed of a jet
- Significant cost per-seat reductions
- Enhanced cabin experience with NVS system

## US Regional Routes 1995 – 20-99 Seat Aircraft



## US Regional Routes 2009 – 20-99 Seat Aircraft



# Bombardier Belfast has a long history with composite materials

- Rolls-Royce
- Shorts
- Lockheed

1970's



Prepeg layup of secondary structure in glass and carbon

- Rolls-Royce
- Boeing
- Fokker

1980's

Prepeg honeycomb stiffened structures

- Bombardier
- Rolls-Royce
- Boeing
- Lockheed
- IAE
- BRR

1990's



Automated layup of monolithic primary structures

- Bombardier: CRJ NextGen, CSeries

2000's



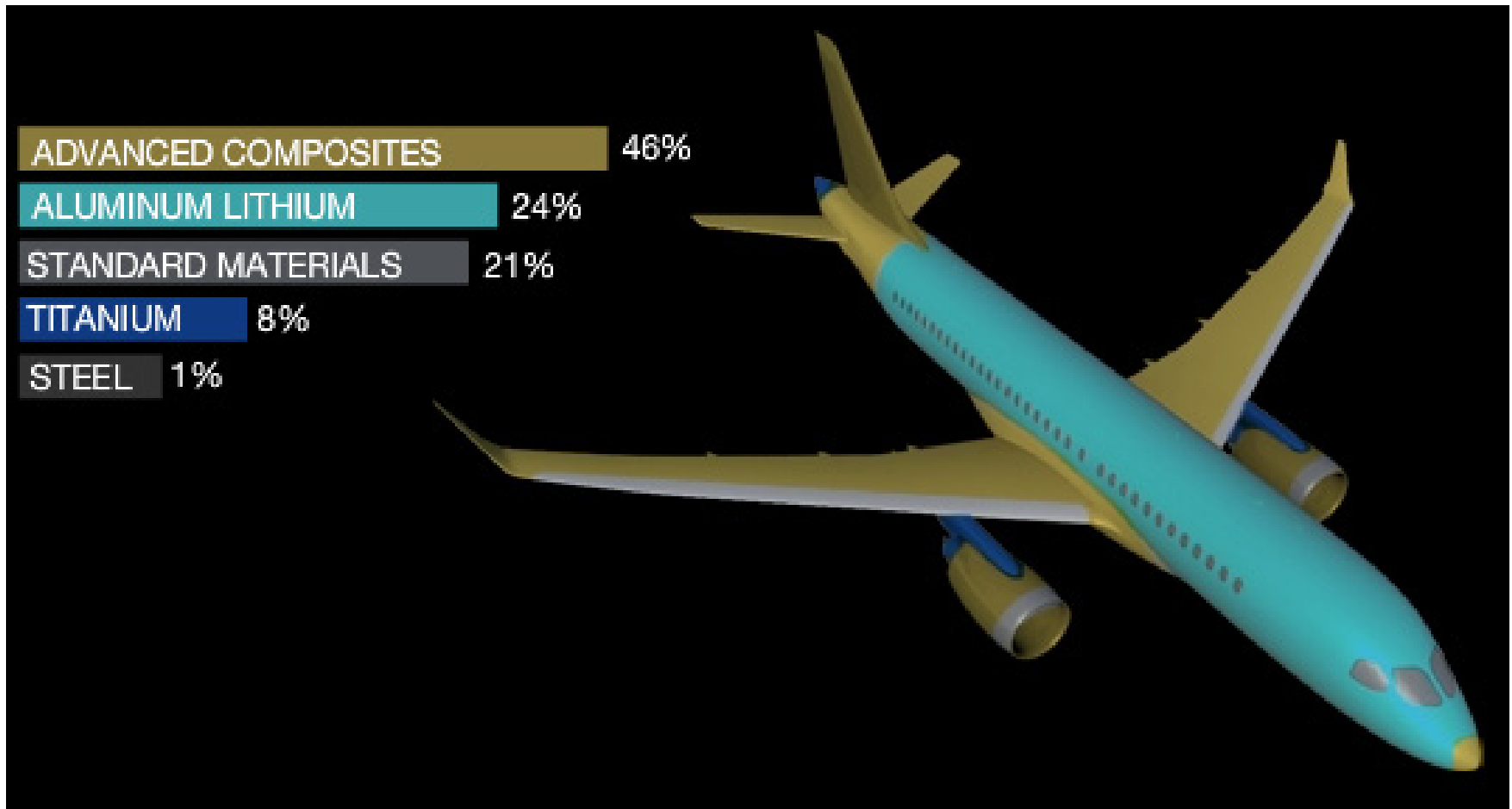
Monolithic structures using resin transfer methods

# Integration means taking a *Big Picture & Long Term* view

Factors Considered	Option A	Option B	Option C
Technology Readiness for EIS	●	●	●
Initial Investment Cost	●	●	●
Structural Weight	●	●	●
Maintenance Costs	●	●	●
Corrosion Resistance	●	●	●
Vulnerability to ground handling damage	●	●	●
Inspection and Repair Time	●	●	●
Manufacturing Complexity	●	●	●
Marketing Appeal	●	●	●

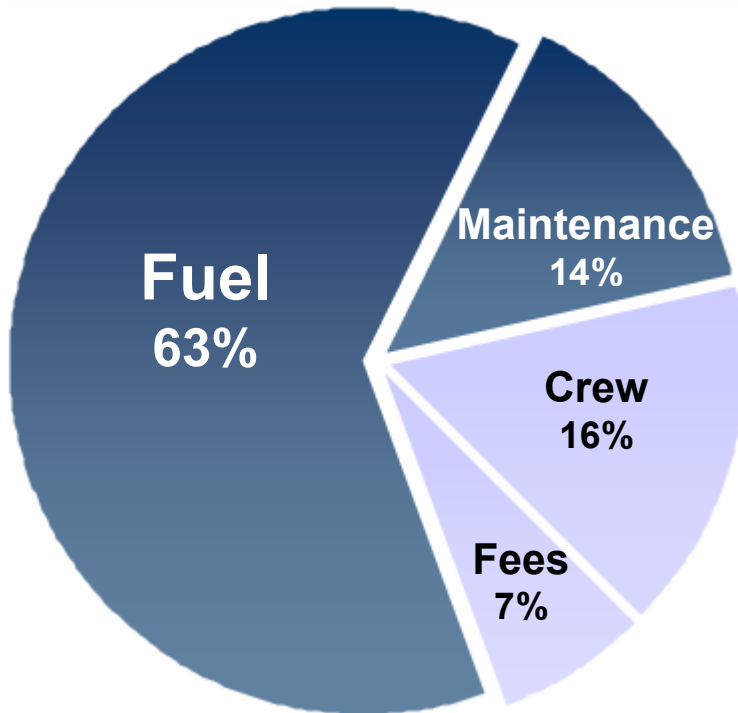
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# Correct material technology reduces empty weight

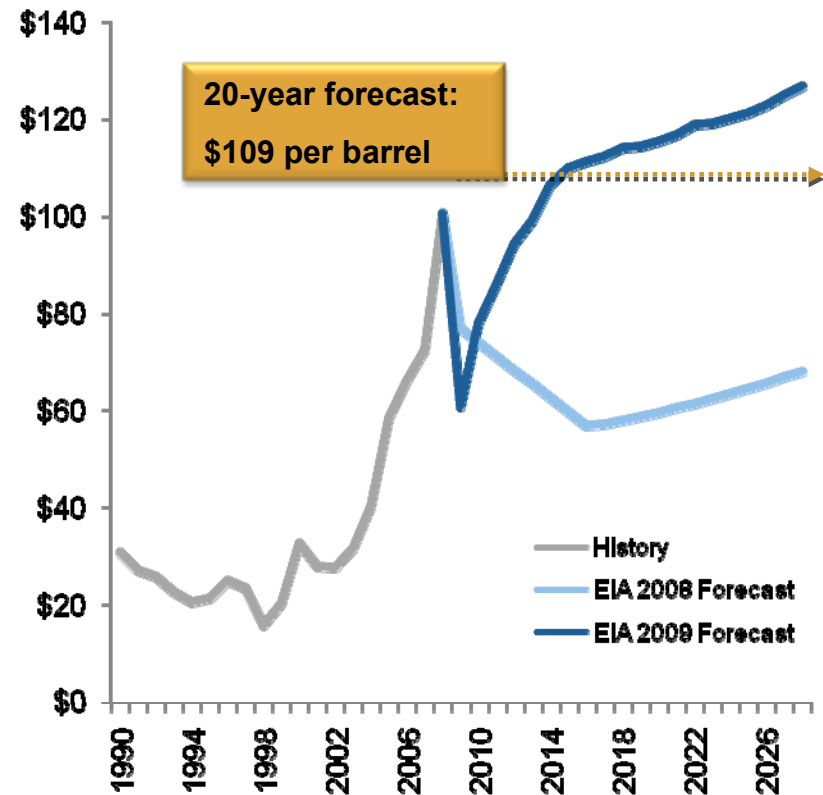


# Fuel efficiency will be the primary driver in both airline profitability and aircraft design

## Cash Operating Cost Profile: North American Airlines



## Oil Price History and Forecast

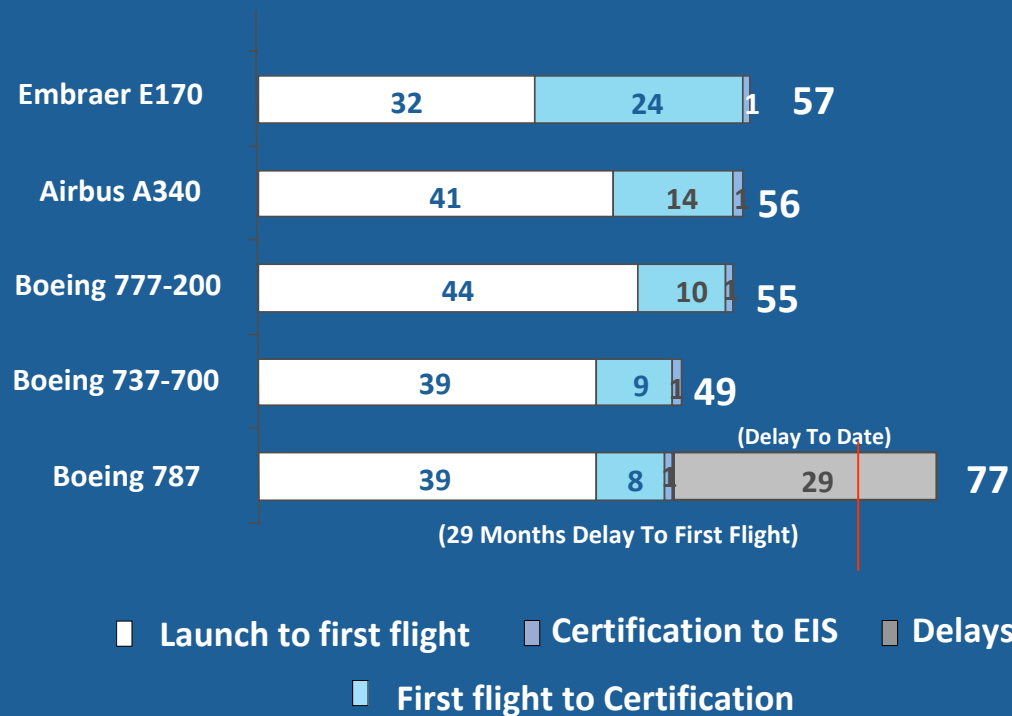


Assumptions: 500 nm Mission; Fuel Cost: 3.00 US\$/USG.



# CSeries 60+ months program timeline from launch: Aligned with new technology requirements

## TIME-TO-MARKET COMPARISON FOR CLEAN SHEET DESIGN AND MAJOR DERIVATIVES INDUSTRY COMPETITORS, # OF MONTHS



# Integrated supply chain models are part of our history

- Why the Integrated Model?
  - Leveraging supplier expertise and know how
  - Working as an integrated team
  - Suppliers provide not only components, but full solutions from the early design phase and beyond manufacturing

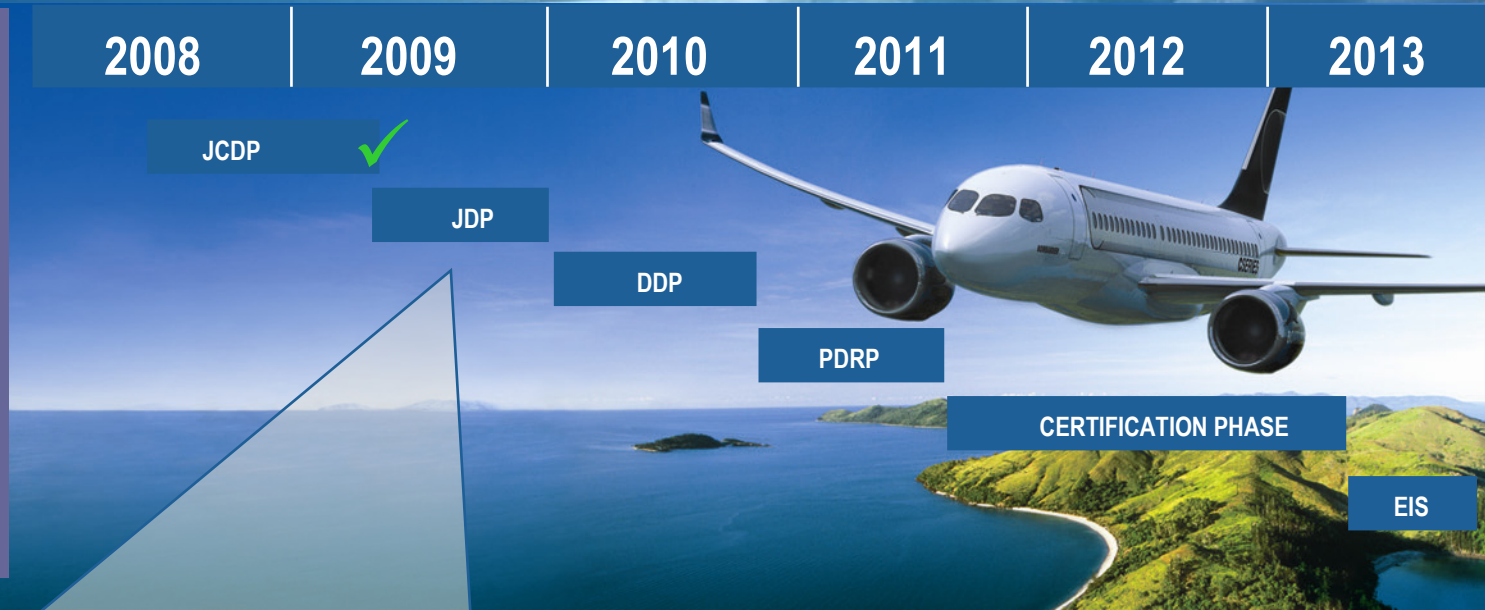
Bombardier pioneered the model in the 90s,  
Airbus and Boeing followed later

Bombardier designed 3+ clean  
sheets and has 15 years of  
experience with this system



# A “Gated” approach ensures integrated progress

## CSeries Development Program



- **Successfully completed JCDP exit**
- **Interim and Preliminary Design Review sessions on plan**
- **More Than 275 Supplier Representatives On Site and all major suppliers secured**
- **Ramp-Up of CSeries Resources to 1,200 employees**
- **Held ground breaking for *New Wing Assembly* building and *CIASTA* facility in Mirabel**
- **Technology Demonstrators: Advanced Aluminum Fuselage Barrel & CFRP Wing Demonstrator Rig**

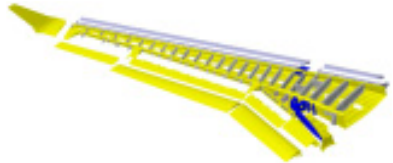
JCDP: Joint Conception Definition Phase  
JDP: Joint Definition Phase  
DDP: Detail Design Phase

PDRP: Product Definition Release Phase  
EIS: Entry Into Service  
CFRP: Carbon Fiber Reinforced Polymer

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# All technologies fully demonstrated before design freeze

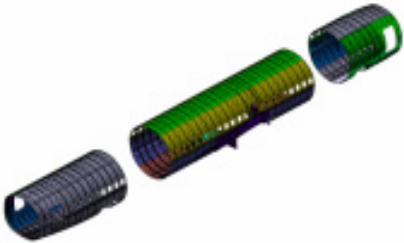
## Composite Wing Demonstrator (Belfast)



**Largest Resin Transfer Infusion (RTI) wing demonstrator. Will test extreme real-life static loading conditions**



## Fuselage Barrel Demonstrator (Shenyang to Montreal)



**Advanced aluminum alloys test barrel will simulate three times aircraft design life**



## Test pieces being produced in Bombardier St-Laurent

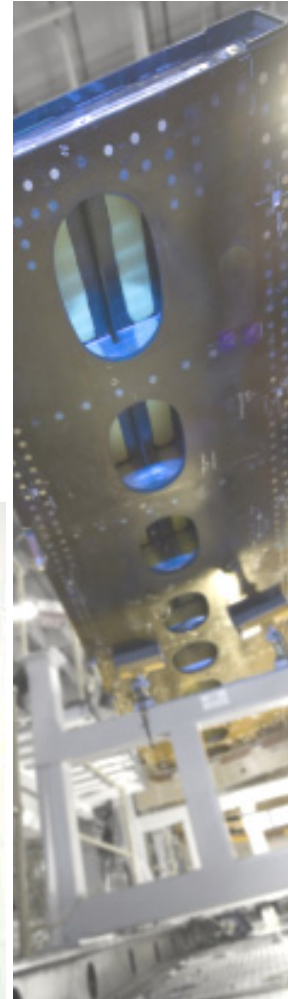


**First aft fuselage panel (AFP) composite skin and Cockpit Center Post test piece**



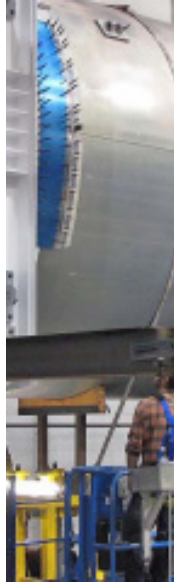
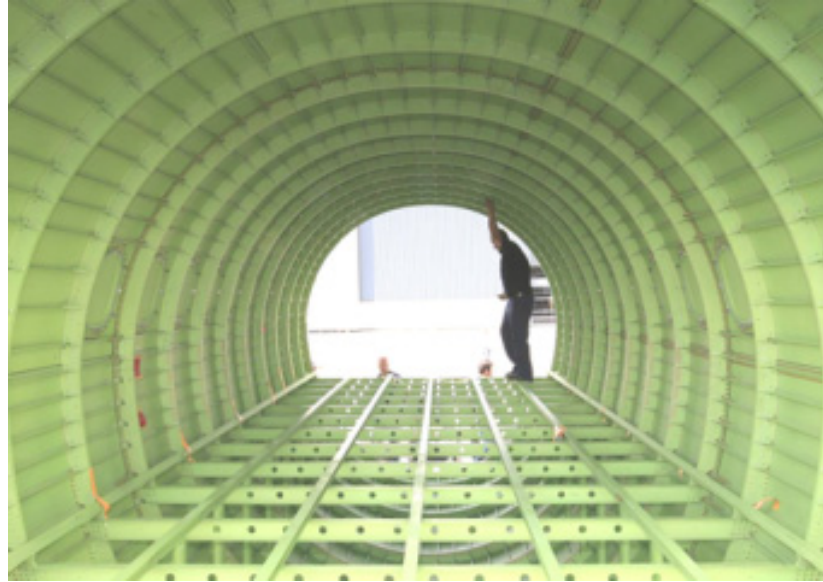
# Single piece RTI wing panel already completed

- **Wing demonstrator on-track** two years before production
- **Construction of 600,000 square feet factory** has started
- Largest ever single inward investment in Northern Ireland

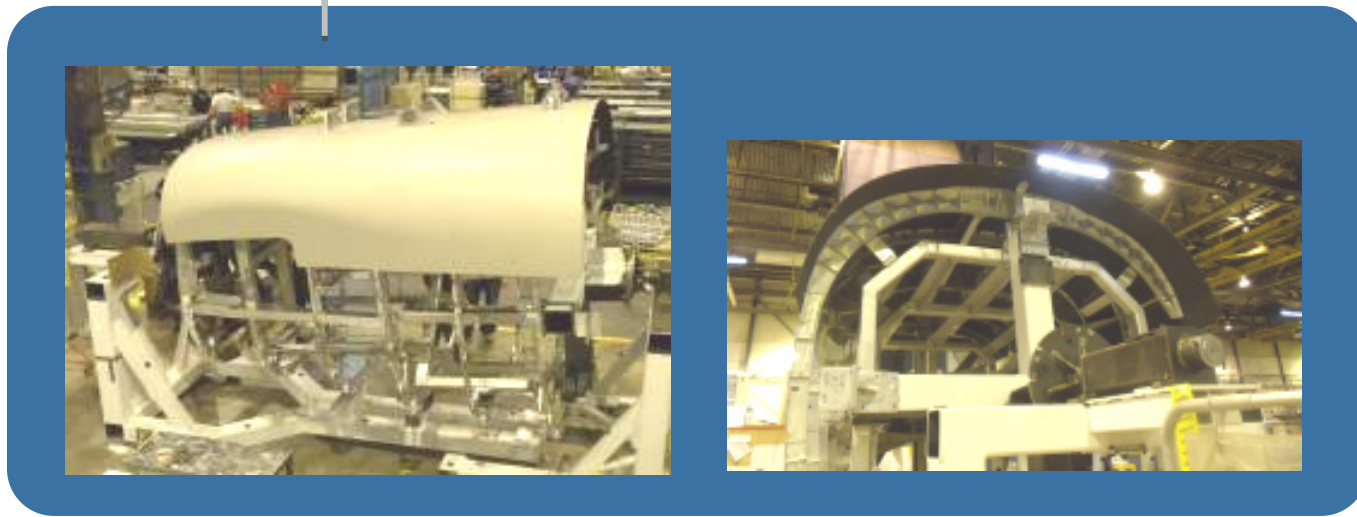


# Fuselage barrel demonstrator delivered ahead of schedule

- **Barrel delivered ahead-schedule**
- **Rigorous testing will simulate three aircraft design lives** through 180,000 test cycles
- An extra step to ensure the aircraft will meet **schedule and customer expectations**



# New materials require new manufacturing processes



# It Comes Down to Execution of 7 Fundamental Principles



- Family of Aircraft with Full Operational Commonality**
- Unmatched Reduction in Environmental Footprint**
- Total Life Cycle Cost Improvement**
- 15% Better Cash Operating Costs – 20% Fuel Burn Advantage**
- Widebody Comfort In A Single Aisle Aircraft**
- Mature 99% Reliability at Entry Into Service**
- Operational Flexibility – Short Field and Longer Range Performance**



# More than 30 organizations actively contributing through Working Groups & Advisory Councils

2008

**Airlines Advisory Council**  
Montréal, Nov. 20-22 ✓  
12 Organizations Represented

**JCDP Customer Event**  
Montréal, Apr. 2-3 ✓  
4 Organizations Represented

2009

**Airlines Advisory Council**  
Hong Kong, May 12-13 ✓  
21 Organizations Represented

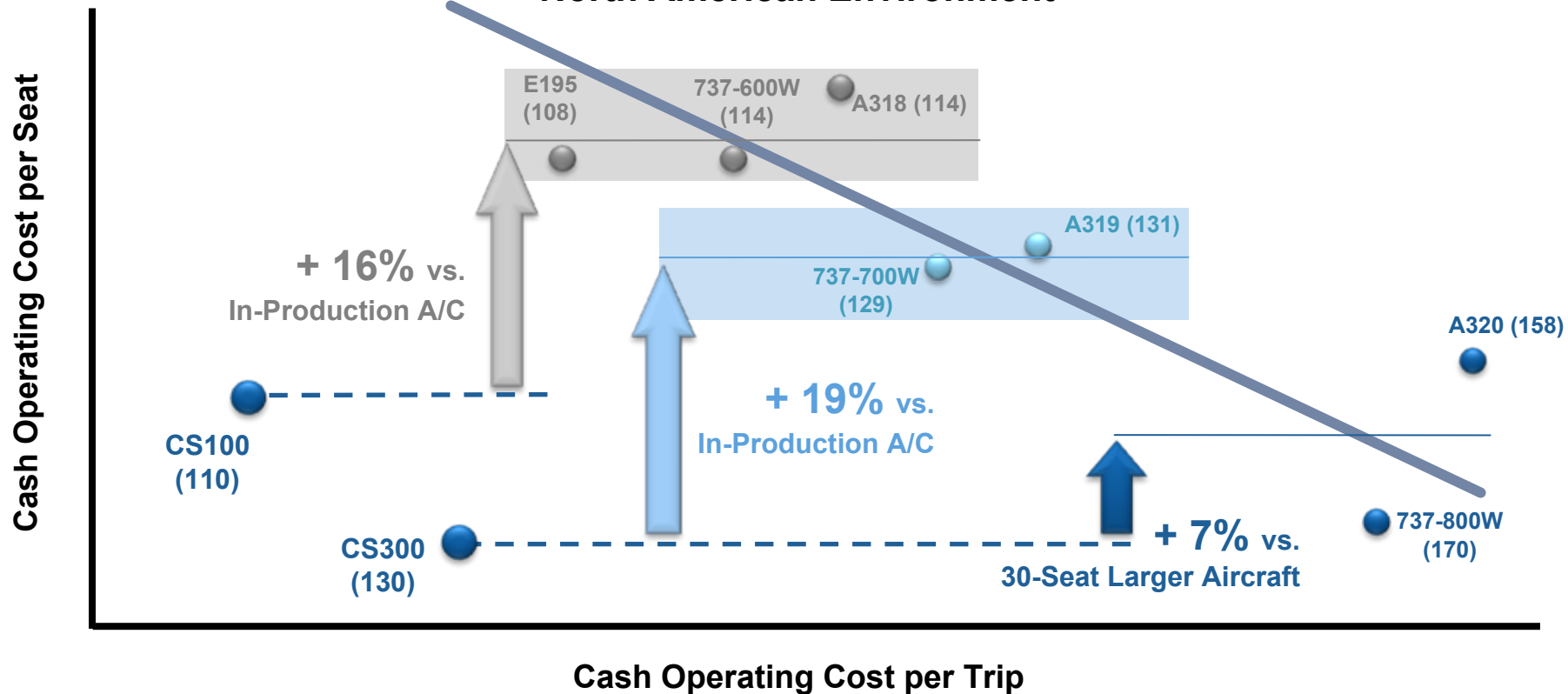
**Airline Working Groups**  
Jun. to Sept. 2009 ✓  
14 Organizations Represented

- Interiors
- Flight Deck
- Maintenance
- Structures



# Program Success = A Cost-effective Right-sized Aircraft

## Cash Operating Cost (COC) Comparison 500 nm Mission North American Environment



Jet Fuel at \$1.95 USD/USG [\$82 US\$/Jet Fuel barrel]

**GREAT MINDS THINK AHEAD**

REDUCED ENVIRONMENTAL FOOTPRINT

MORE COMFORT

REDUCED COST

MORE FLEXIBILITY



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