

Bombardier Aerospace, Belfast



Visit of Financial Analysts

17 June 2009

David Hendron, Vice-president, Finance,
Customer Services, Programmes & Business
Services

BOMBARDIER

The Short brothers – a heritage of innovation



Wright Flyer

Centenary Year 2008

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Bombardier Aerospace history

Acquisition of *Short Brothers* in 1989



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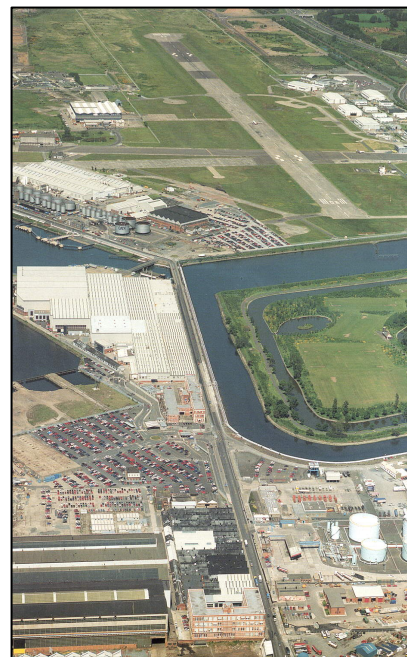
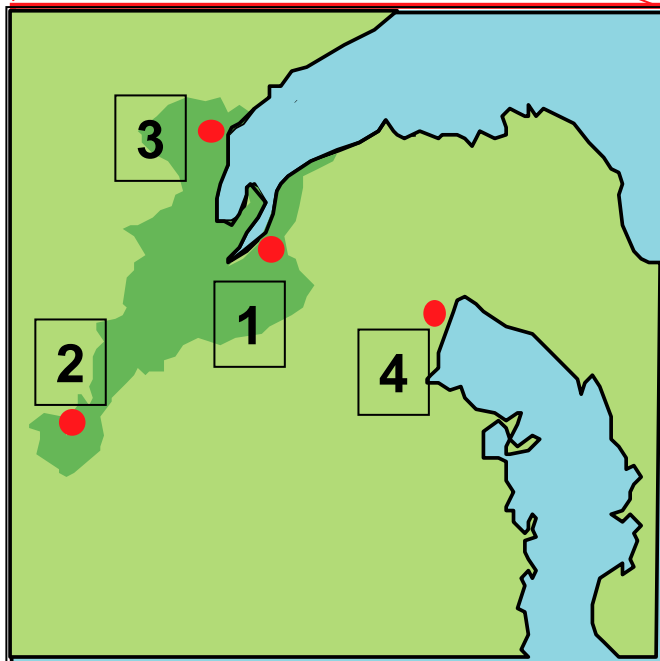


Bombardier Aerospace, Belfast - Manufacturing Sites



- 1 Queen's Island
- 2 Dunmurry
- 3 Newtownabbey
- 4 Hawlmark

*Assembly Facilities (fuselage & nacelle)
Composites Fabrication and Assembly
Composites Fabrication and Assembly
Metal Component Fabrication Facility*



*Queen's Island
Belfast
Main Assembly
Facility*



Facilities in Belfast – Northern Ireland





Main Factory, Queen's Island

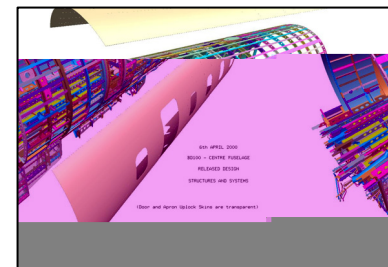
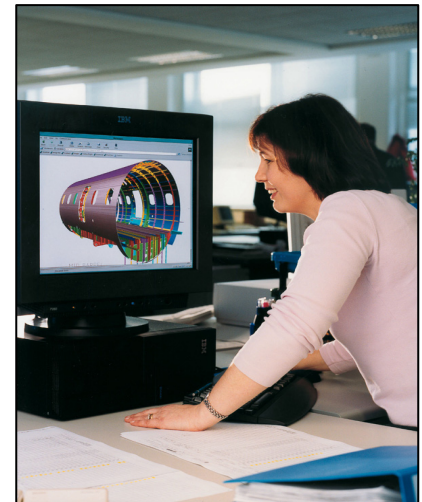
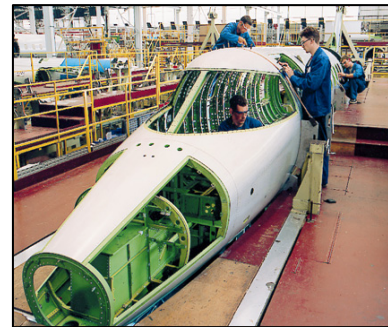


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Bombardier Aerospace, Belfast

- Largest manufacturer in Northern Ireland – over 5,000 employees
- Bombardier investment of over US\$2bn since 1989
- World-class centre of excellence for design and manufacture of fuselages, wings, nacelles, and advanced composites, as well as after-market support
- Major role in all of Bombardier's families of aircraft



Belfast Plant's role in Bombardier aircraft

<u>Aircraft</u>
CRJ100/200
Learjet 60
Bombardier 415
Q200
Challenger 604
Learjet 45
Global Express
Q400
CRJ700
Challenger 300
CRJ900
Learjet 45XR
Learjet 40
Global 5000
Global Express XRS
Learjet 40XR
Challenger 605
Learjet 60XR
CRJ900 NextGen
CRJ700 NextGen
CRJ1000 NextGen
Global Vision cockpit
Learjet 85
CSeries

<u>Entry into Service</u>
1992
1993
1994
1995
1996
1997
1998
1999
2001
2002
2003
2003
2004
2004
2005
2006
2007
2007
2007
2008
2010
2011
2013
2013

<u>Design</u>
Essentially new design
Major change derivative
Major change derivative
Significant change derivative
Significant change derivative
All new
All new
Major change derivative
Major change derivative
All new
Significant change derivative
Significant change derivative
Significant change derivative
All new
Major enhancement
Major enhancement
Major enhancement
Major enhancement
Major enhancement
Major enhancement
Significant change derivative
Major enhancement
All New
All New



Recent Investments

Machine Shop in Main Factory



Customer Services





Recent Investments

Composites Unit, Dunmurry



Newtownabbey



Bombardier Aerospace, Belfast

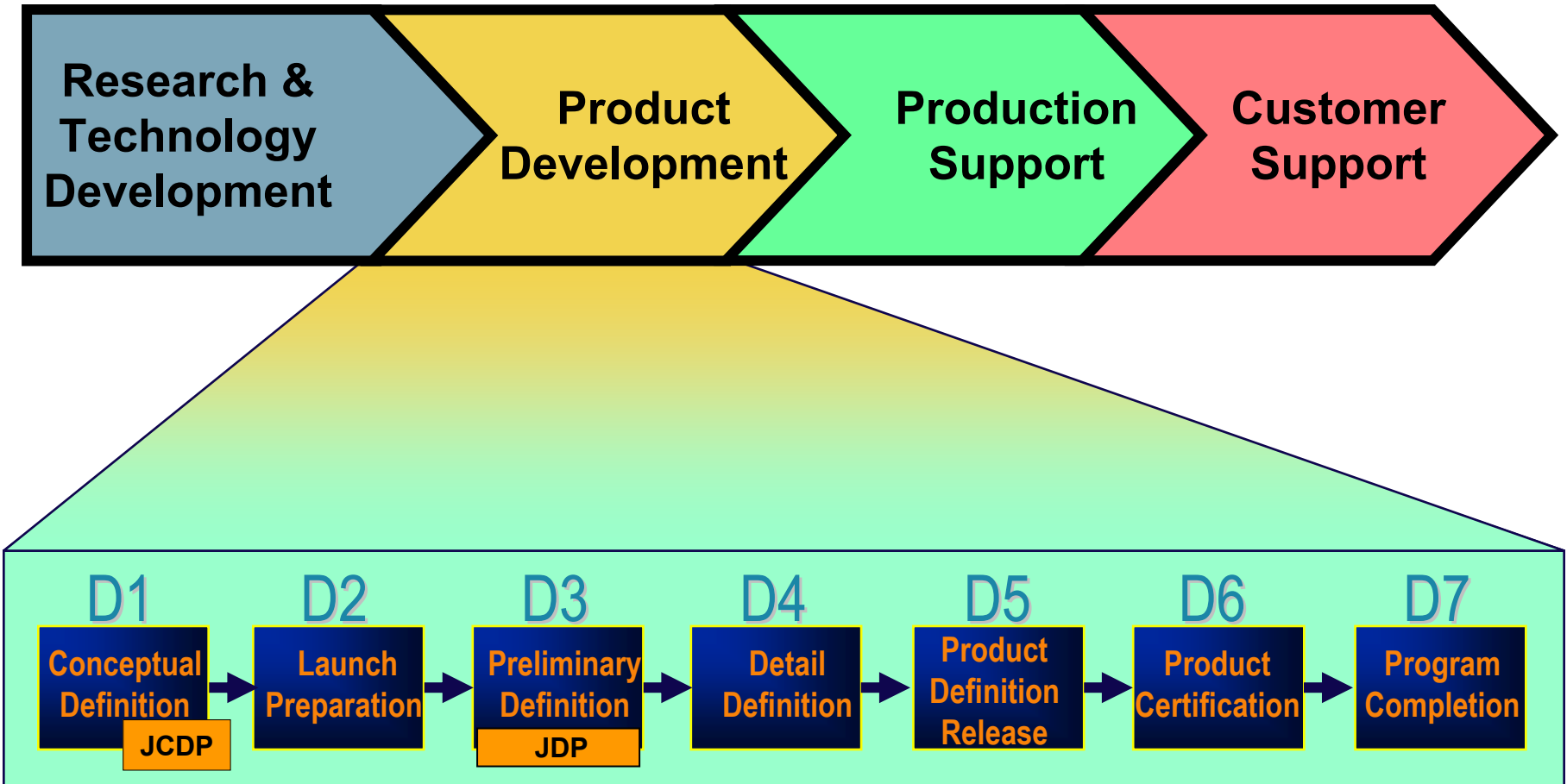


**Engineering, Research and
Technology**

**Gavin Campbell, Director, Design
Engineering and Technology Development**

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Bombardier Engineering System: Scope of Belfast Engineering





Role of Design Engineering at Bombardier Aerospace

- **The Northern Ireland business is an integrated design and manufacturing operation which:**
 - Conducts R&T for both local and group business needs
 - Designs the products which are manufactured in Belfast
 - Supports current programmes in development and in production
 - Develops innovative design and manufacturing solutions which meet the changing trends in the global aerospace industry especially in the move towards more composite aircraft and next generation Powerplant solutions
- **What are our differentiators?**
 - Our People! - innovation, manufacturing excellence, integrated product development, project management & supply chain management



Research & Technology Investments

R&D focus in Belfast is on:

Design Engineering (product technology)

- Composites
- Advanced metals
- Materials & Processes (incl. environmental)

Manufacturing Engineering (fabrication and assembly)

- Automation
- Digital simulation



Research & Technology Investments

Technology specialists in:

- **Secondary and Primary Composite Structures using a range of manufacturing technologies from pre-preg to resin infusion:**
 - Nacelle structural components (core cowls, fan cowl doors)
 - Fairing panels (Global Express)
 - Horizontal Stabiliser (Global Express)
 - Wings (C Series)
- **Metallic Structures**
 - Fuselages
 - Nacelle structural components
- **Nacelle Systems**
 - Acoustic technologies, aero thermal analysis & design, thrust reversers, EBU, etc.

Integration (Technology & Supply Chain)

- Business processes and IT tools (e.g. CATIA)

Strategic Technology

Selection of Current Projects



SILENCE(R) 2001-2006



ALCAS 2005-2009

European



ANDANTE 2005-2008

Technology
Strategy
Board



Environmentally Friendly Engine ATPV 2006-2011



Integrated Wing ATPV 2006-2009

UK



CEIAT¹ CAST Projects (Queen's University Belfast)



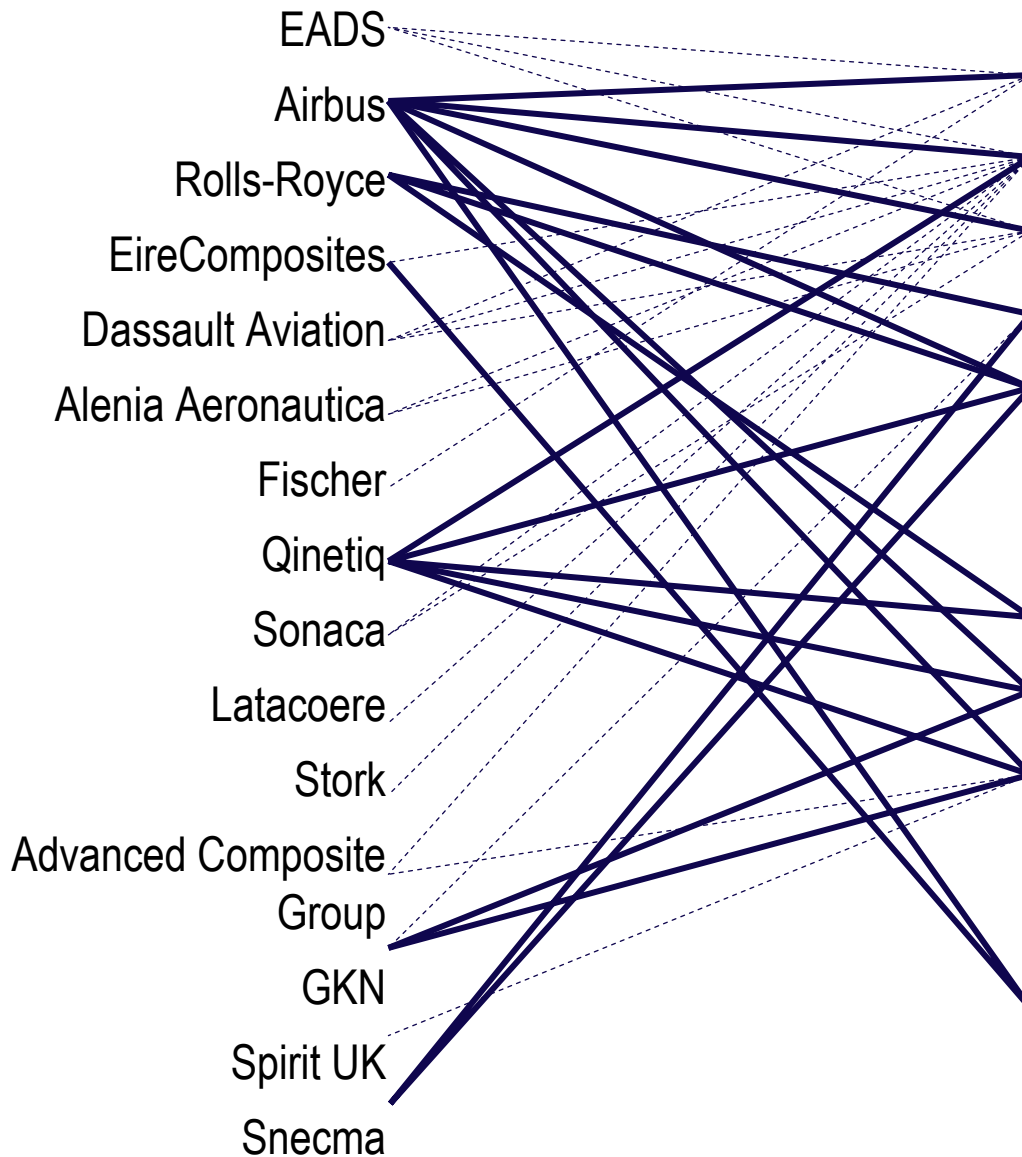
Advanced Nacelle Intake 2005-2007

NI

Invest
Northern
Ireland

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Industrial R&D Linkages



EUROPEAN PROJECTS

- TANGO (37 Partners)
- ALCAS (61 Partners)
- MAAXIMUS (70 Partners)
- VITAL (53 Partners)
- SILENCER (51 Partners)

UK PROJECTS

- ENVIRONMENTALLY FRIENDLY ENGINE
- INTEGRATED WING (17 Partners)
- NEXT GENERATION COMPOSITE WING

BOMBARDIER PROJECTS

- COMPOSITE WING DEVELOPMENT

Strong link: technical info exchange, visits, regular contact, joint tasks
 Informal link: less frequent, high level info, some technical contacts

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CSERIES
Belfast Programme Update

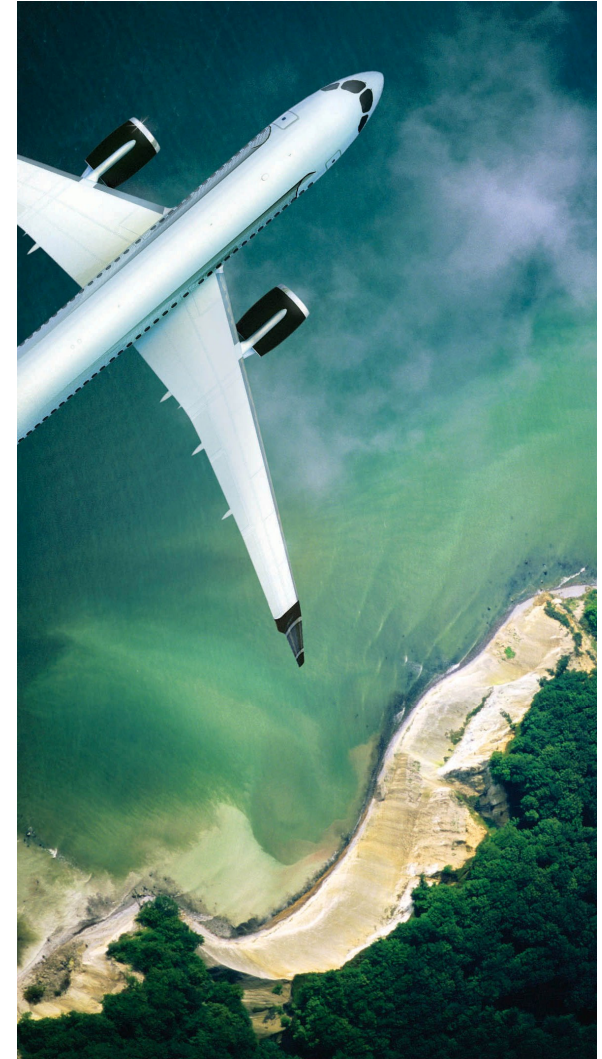
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*C*Series scope of work

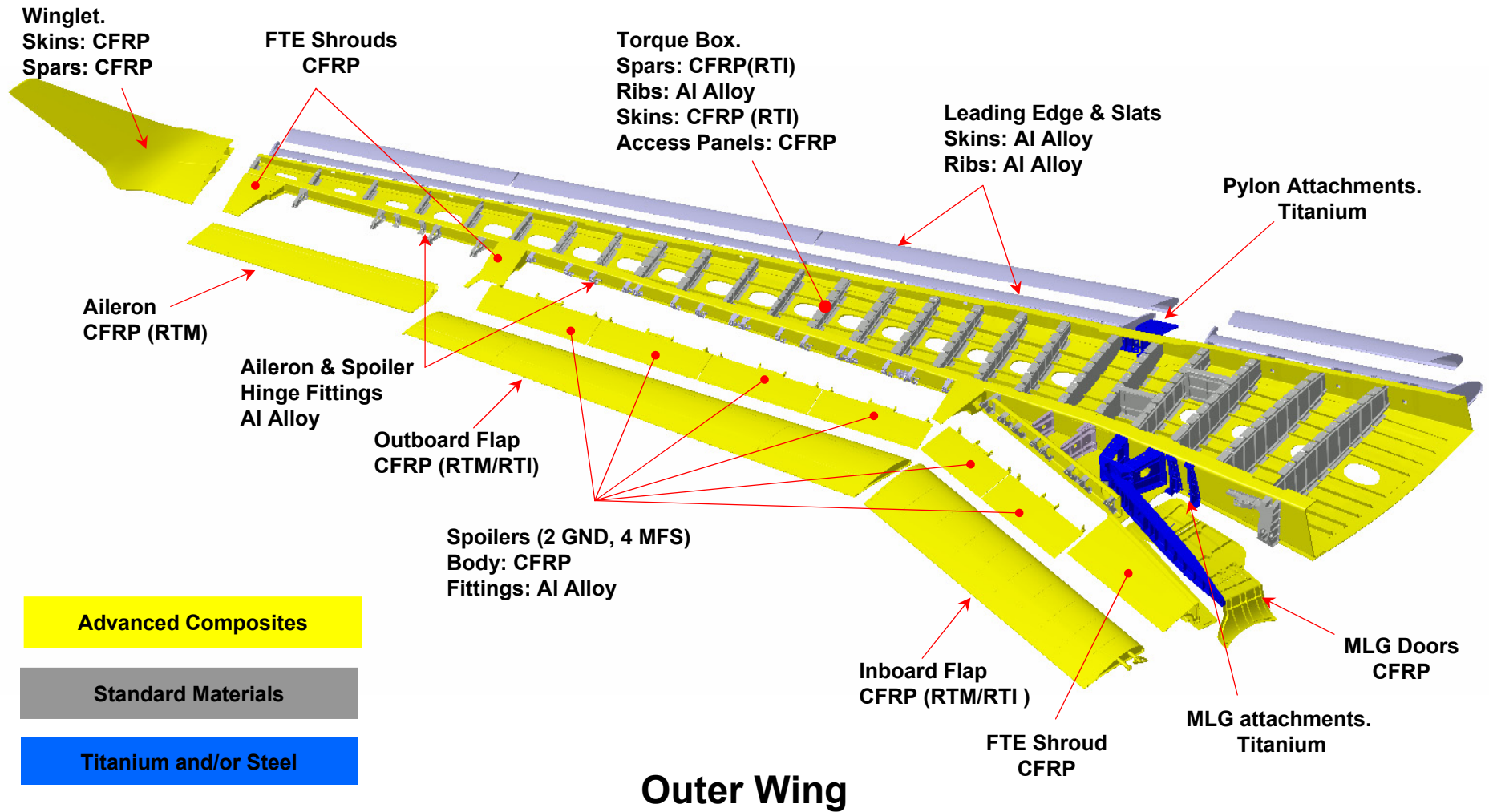
Belfast is responsible for the outer wing airframe comprising structural wing boxes, leading edges, trailing edges, slats, flaps and spoilers, ailerons, aerodynamic fairings, winglets, and main landing gear doors

Belfast is also responsible for the installation and physical integration of the systems (to the system supplier's requirements) within its work package



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CSeries Wing - Structural Definition



C Series Composite wing development programme

- Design layouts agreed and Joint Concept Definition Phase exit achieved
- Material Evaluation programme progressing to schedule with thousands of small parts being tested
- Testing of several hundred larger scale detail features and sub-components under way to prove out design
- Pre-production demonstrator programme well under way to prove out RTI design, manufacturing and assembly processes



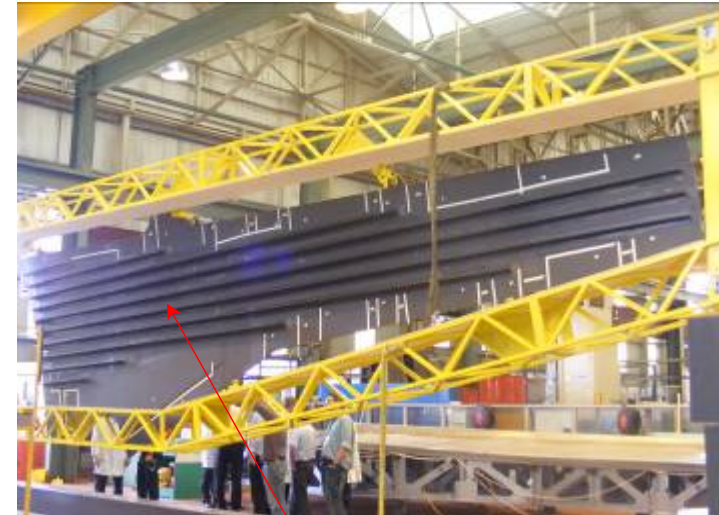
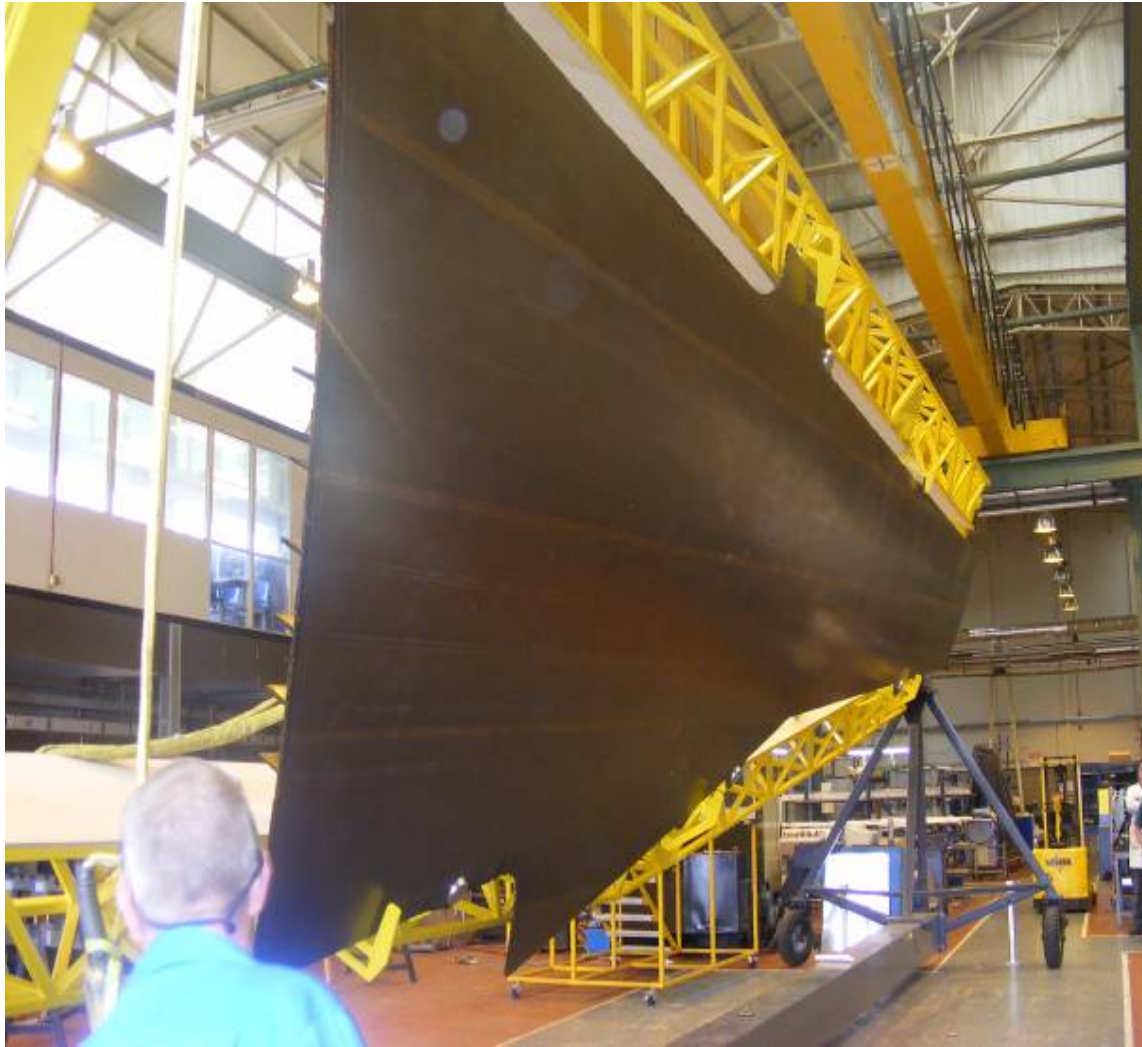


C Series demonstrator wing assembly under way with major components – including the upper skin panel





First upper wing skin produced using RTI process



Stringers built in and cured as part of the one-piece skin



CSeries composite wing development programme

- Construction of new state-of-the-art CSeries factory due to begin later this summer. Ready for production in second half of 2010
- CSeries composite wing programme is progressing to schedule, with results to date meeting all expectations. On track to deliver first production wing in 2011



Bombardier Aerospace, Belfast



Customer Services, Belfast

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Customer Services : MRO Capability

- Approved repair centres in Dallas and Belfast
- Repair and overhaul including complete nacelles and flight components
- Production tooling and parts
- OEM engineering data
- Repair Field Support
- Re-engineering capabilities
- Thrust Reverser and QEC Training





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Customer Services : Repair Capability, Commercial Aircraft

COMMERCIAL AIRCRAFT	AIRBUS				BOEING			BOMBARDIER				
	A319 V2500	A320 V2500	A321 V2500	A330 Trent 700	737 CFM56-7	747 RB211 524	757 RB211 535	767 RB211 524	CRJ200 CF34-3	CRJ700 CF34-8	CRJ900 CF34-8	Q400 PW150A
Inlet Cowl	✈️	✈️	✈️	✈️	🔑	✈️	✈️	✈️	✈️	✈️	✈️	
Fan Cowl Doors	✈️	✈️	✈️			✈️		✈️	✈️	✈️	✈️	
Thrust Reverser							🔑		✈️	✈️	✈️	
EBU	✈️	✈️	✈️			✈️		✈️	✈️	✈️	✈️	
Tail Pipe Fairing									✈️	✈️	✈️	
Turboprop Nacelle												✈️
Flight Controls									✈️	✈️	✈️	✈️
Fuselage									⚙️	⚙️	⚙️	⚙️

- KEY
-  Design and Manufacture
 -  Component Repair
 -  Design and Manufacture and Component Repair



Customer Services : Repair Capability, Business Aircraft

BUSINESS AIRCRAFT	BOMBARDIER								GULFSTREAM	
	Learjet 40 XR TFE731	Learjet 45 XR TFE731	Challenger 300 HTF7000	Challenger 600 Series CF34-3	Challenger 850 CF34-3	Global 5000 BR710	Global Express XRS BR710	G500 BR710	G550 BR710	
Inlet Cowl										
Fan Cowl Doors										
Thrust Reverser										
EBU										
Tail Pipe Fairing										
Flight Controls										
Fuselage										

KEY

- Design and Manufacture
- Component Repair
- Design and Manufacture and Component Repair



Customer Services : Mobile Response Team (MRT)

- Provides round-the-clock support for Bombardier business aircraft
- Dedicated team of six EASA-licensed technical experts
- Located across Europe
- Performs on-site AOG maintenance
- Supports *Global* and *Challenger* jets, and shortly the *Learjet 60*
- MRT assistance covers Europe, Africa and Asia



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