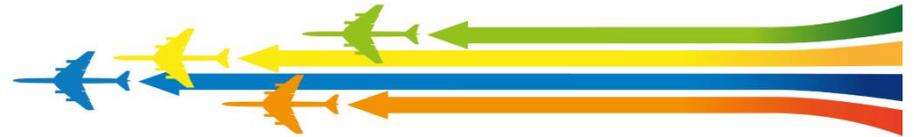




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ICAO Global Aviation Partnerships on  
Emissions Reductions (E-GAP)

# Environmental Benefits of Advanced Manufacturing Processes

Kahina Oudjehani

Ecodesign Lead

Product Development Engineering, Aerospace,  
Bombardier



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## FORWARD-LOOKING STATEMENTS

This presentation includes forward-looking statements, which may involve, but are not limited to: statements with respect to the Corporation's objectives, guidance, targets, goals, priorities, market and strategies, financial position, beliefs, prospects, plans, expectations, anticipations, estimates and intentions; general economic and business outlook, prospects and trends of an industry; expected growth in demand for products and services; product development, including projected design, characteristics, capacity or performance; expected or scheduled entry-into-service of products and services, orders, deliveries, testing, lead times, certifications and project execution in general; competitive position; and the expected impact of the legislative and regulatory environment and legal proceedings on the Corporation's business and operations. Forward-looking statements generally can be identified by the use of forward-looking terminology such as "may", "will", "expect", "intend", "anticipate", "plan", "foresee", "believe", "continue", "maintain" or "align", the negative of these terms, variations of them or similar terminology. By their nature, forward-looking statements require management to make assumptions and are subject to important known and unknown risks and uncertainties, which may cause actual results in future periods to differ materially from those forecasted. While management considers these assumptions to be reasonable and appropriate based on information currently available, there is 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 Guidance and forward-looking statements sections in BA and in BT of the Dec. 31, 2014 MD&A.

Certain factors that could cause actual results to differ materially from those anticipated in the forward-looking statements include risks associated with general economic conditions, risks associated with the Corporation's business environment (such as risks associated with the financial condition of the airline industry and major rail operators), operational risks (such as risks related to developing new products and services; doing business with partners; product performance warranty and casualty claim losses; regulatory and legal proceedings; the environment; dependence on certain customers and suppliers; human resources; fixed-price commitments and production and project execution), financing risks (such as risks related to liquidity and access to capital markets, exposure to credit risk, certain restrictive debt covenants, financing support provided for the benefit of certain customers and reliance on government support) and market risks (such as risks related to foreign currency fluctuations, changing interest rates, decreases in residual values and increases in commodity prices). For more details, see the Risks and uncertainties section in Other of the Dec. 31, 2014 MD&A. Readers are cautioned that the foregoing list of factors that may affect future growth, results and performance is not exhaustive and undue reliance should not be placed on forward-looking statements. The forward looking statements set forth herein reflect management's expectations as at the date of this report and are subject to change after such date. Unless otherwise required by applicable securities laws, the Corporation expressly disclaims any intention, and assumes no obligation to update or revise any forward-looking statements, whether as a result of new information, future events or otherwise. The forward-looking statements contained in this presentation are expressly qualified by this cautionary statement.



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# AEROSPACE INDUSTRY COMMITMENTS TO THE ENVIRONMENT

*Targets are at the global level*



## 2010

**Fuel efficiency improvement :**

**1.5%** (commercial A/C, per year)

**2%** (business A/C, per year)

*Working towards carbon-neutral growth*

## 2020

**Carbon-neutral growth**

*Implementation of global sectoral approach*

## 2050

**-50% CO<sub>2</sub>**

*Half the net aviation CO<sub>2</sub> of 2005*

*Invest in new*  
**TECHNOLOGY**

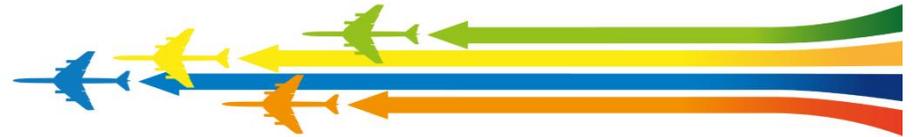
*(including sustainable aviation biofuels)*

*Fly using more efficient*  
**OPERATIONS**

*Build and use efficient*  
**INFRASTRUCTURE**

*Use effective, global,*  
**MARKET-BASED MEASURES**

Source: ATAG – Air Transport Action Group



# BOMBARDIER ADVANCED TECHNOLOGY AIRCRAFT

C SERIES CLEAN SHEET A MAJOR STEP FORWARD FOR THE ENVIRONMENT



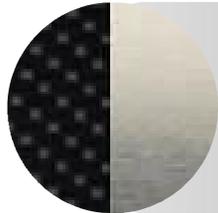
Advanced Flight Deck FBW with Side Sticks



Best-In-Class Cabin Comfort and Flexibility



Pratt & Whitney PurePower® PW1500G Engine



Advanced Materials > 2,000 lb. weight savings



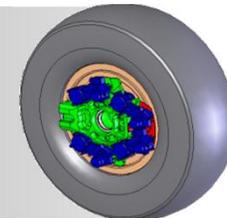
Superior Field Performance & Range Flexibility

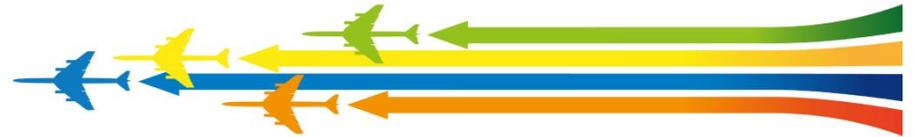


Integrated Avionics & Optimized Systems



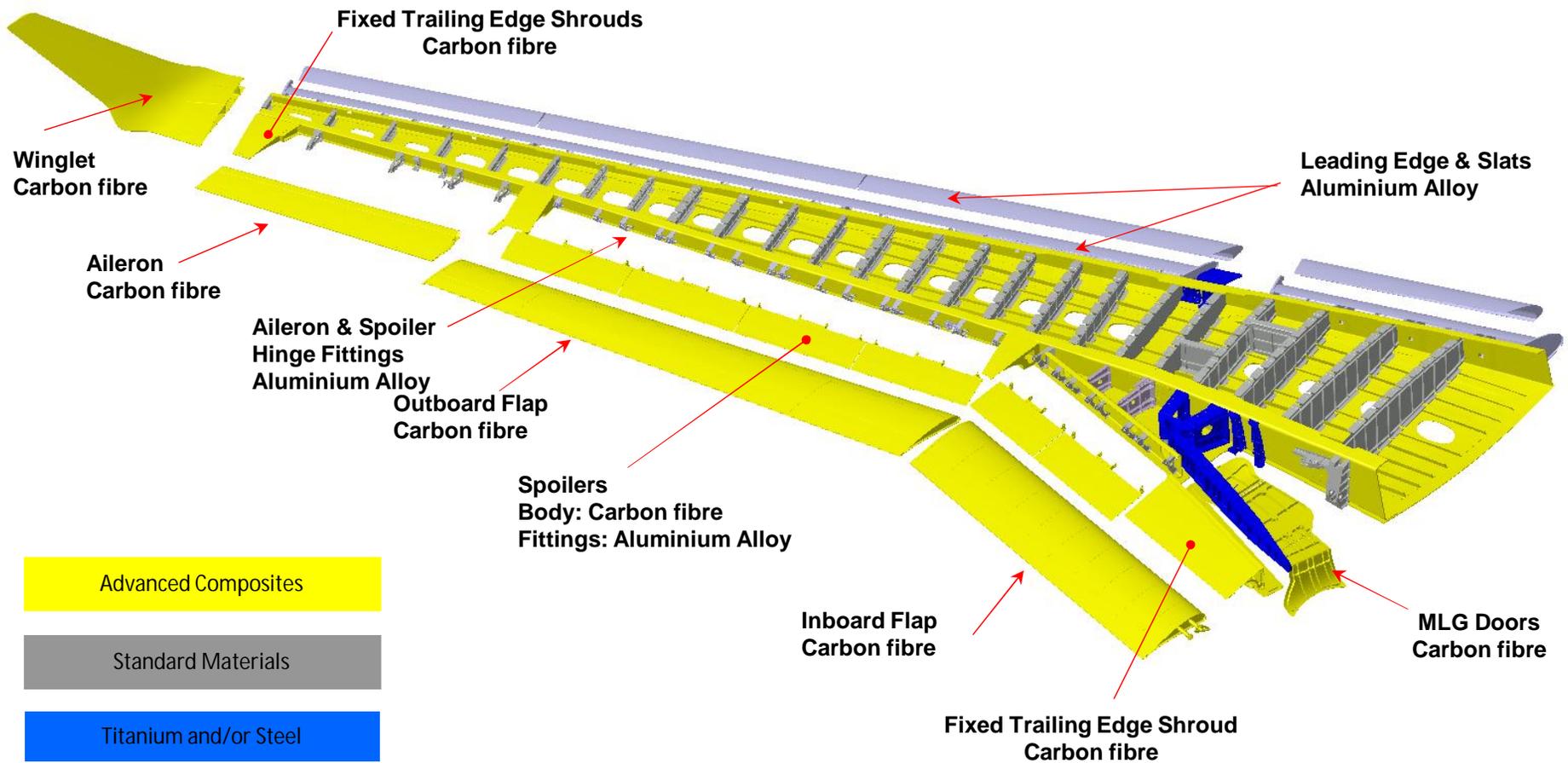
Electric Brakes





# C SERIES ADVANCED COMPOSITE WING

DELIVERS SIGNIFICANT WEIGHT SAVINGS AND AERODYNAMIC EFFICIENCY

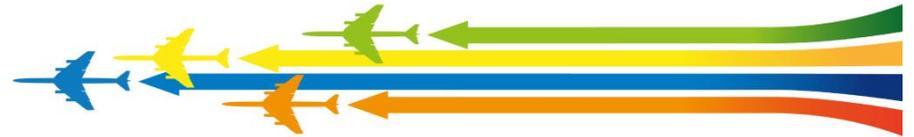




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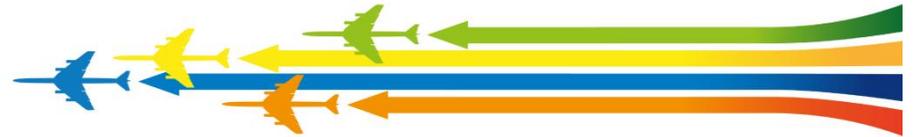
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# C SERIES AIRCRAFT WING PRODUCTION

RESIN TRANSFER INFUSION TECHNOLOGY (RTI)

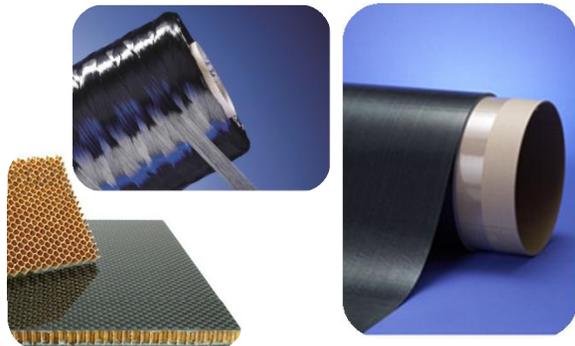




## BOMBARDIER IS ACTIVELY DEVELOPING SOLUTIONS TO RECYCLE CARBON FIBERS



New aircraft, like the C Series, are made from advanced materials such as carbon fiber composites



Powder

Short  
Fibre

Pellets

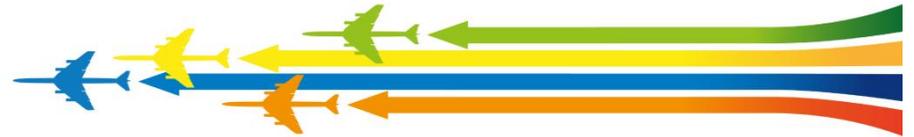
Today, manufacturing carbon fiber scraps can be recycled



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## BOMBARDIER IS LOOKING AT REINTEGRATING RECYCLED CARBON FIBER IN FUTURE DESIGN



**CRIAQ**

ENV 411

*R&D project to evaluate the economical and the technical benefits of recycled materials*

Results showed good technical properties, potentially leading to weight and cost reductions of materials

Next steps: **close the loop and reuse recycled carbon fibers in non-structural parts of aircraft** (brackets, interior panels,...)

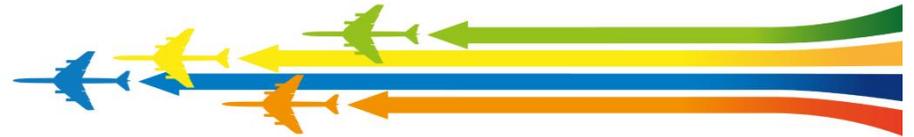




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# BOMBARDIER IS AN ACTIVE MEMBER OF THE AIRCRAFT FLEET RECYCLING ASSOCIATION (AFRA)

BOMBARDIER USED AFRA-ACCREDITED DISMANTLING OPERATION





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## VALORIZATION OF MATERIALS

LEATHER OF PASSENGER SEATS INTO A LADY'S JACKET

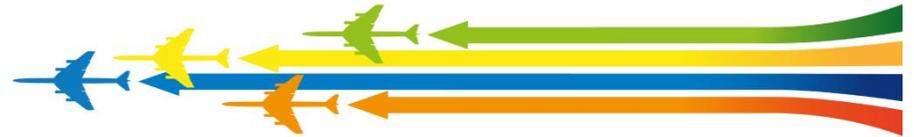




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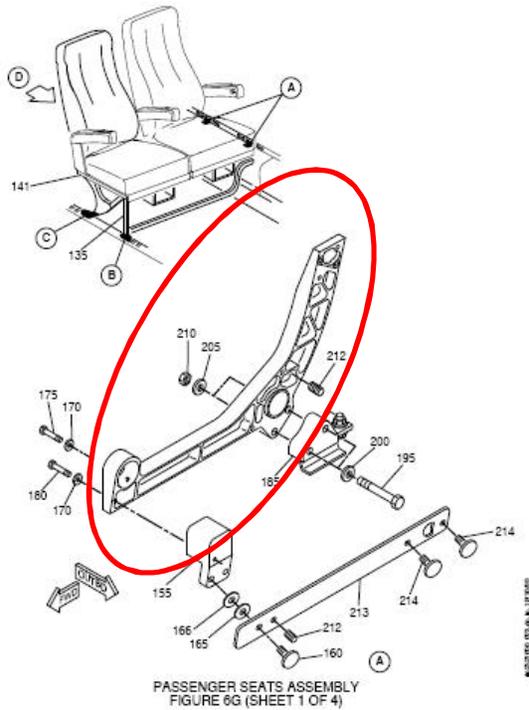
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# VALORIZATION OF MATERIALS

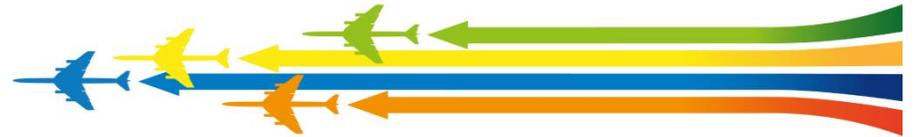
FROM AN AIRCRAFT SEAT STRUCTURE INTO A COMPLETE BICYCLE





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CRIAQ ENV 411 Project  
*Recycling of Thermoset Composites Wastes from Aerospace Industry: Feasibility Study and Proof of Concept*

CRIAQ ENV 412 Project  
*Process for Advanced Management and Technologies of Aircraft End of Life*

