



Bombardier- The Evolution of Mobility

HBM User Group Meeting

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Test Engineer

24th April 2013

BOMBARDIER
the evolution of mobility

Agenda



BOMBARDIER'S EVOLUTION



BOMBARDIER AEROSPACE



BOMBARDIER TRANSPORTATION



ENGINEERING DEVELOPMENT LABORATORY, DERBY



GLYPHWORKS IN 'THE LAB'

BOMBARDIER

Our evolution

1942-1973



- Company start-up
- Development of passenger and personal snowmobiles
- Vertical integration
- Energy crisis provoked market collapse

1974-1985



- Diversification into mass transit market
- Learning of new industry
- 1982 New York metro contract secured strong position in American market

1986-1993



- Entry into aerospace through Canadair acquisition
- Consolidation of North American mass transit position and reinforcement of presence in Europe

Strategic Acquisitions



- Aerospace: Short Brothers (UK), Learjet (US), de Havilland (CA)
- Transportation: BN (BE), ANF (FR), Deutsche Waggonbau (DE), Concarril (MX), Talbot (DE), Adtranz (DE)

1993-2003

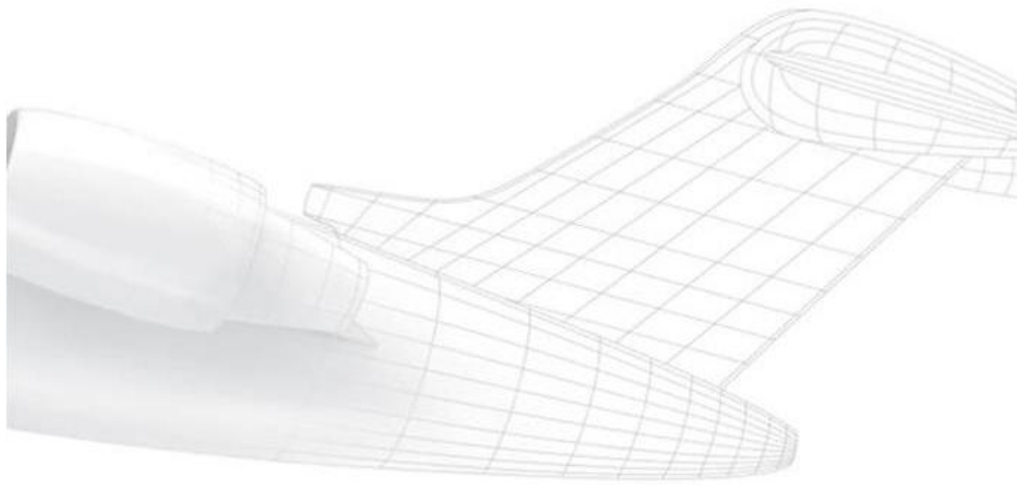


- CRJ Series, Global Express, Challenger 300
- Tilting train, AGC (Autorail Grande Capacité)
- Sale of Recreational products business unit

2003-



- CRJ NextGen family, Learjet 85, Q400 NextGen, CSeries, Global 7000, Global 8000
- Hybrid AGC, ZEFIRO, ECO4
- Transportation's expansion into emerging markets



BOMBARDIER AEROSPACE

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BOMBARDIER AEROSPACE

Overview



Bombardier Aerospace is a world leader in the design and manufacture of innovative aviation products and related services for the business, commercial, amphibious and specialized aircraft markets.

It also offers *Flexjet* fractional ownership, *Skyjet* aircraft charter and management, technical services, aircraft maintenance and pilot training.

BOMBARDIER AEROSPACE

Business aircrafts

LEARJET FAMILY



LEARJET 60 XR



LEARJET 70



LEARJET 75



LEARJET 85

CHALLENGER FAMILY



CHALLENGER 300



CHALLENGER 605



CHALLENGER 850



CHALLENGER 870

GLOBAL FAMILY



GLOBAL 5000



GLOBAL 6000



GLOBAL 7000



GLOBAL 8000

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Commercial aircrafts

Q-SERIES FAMILY



Optimized
short-haul
solution

C-SERIES FAMILY



Optimized
100- to 149-seat
market segment
solution

CRJ SERIES FAMILY



Optimized
regional
network
solution



BOMBARDIER TRANSPORTATION

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BOMBARDIER TRANSPORTATION

Overview

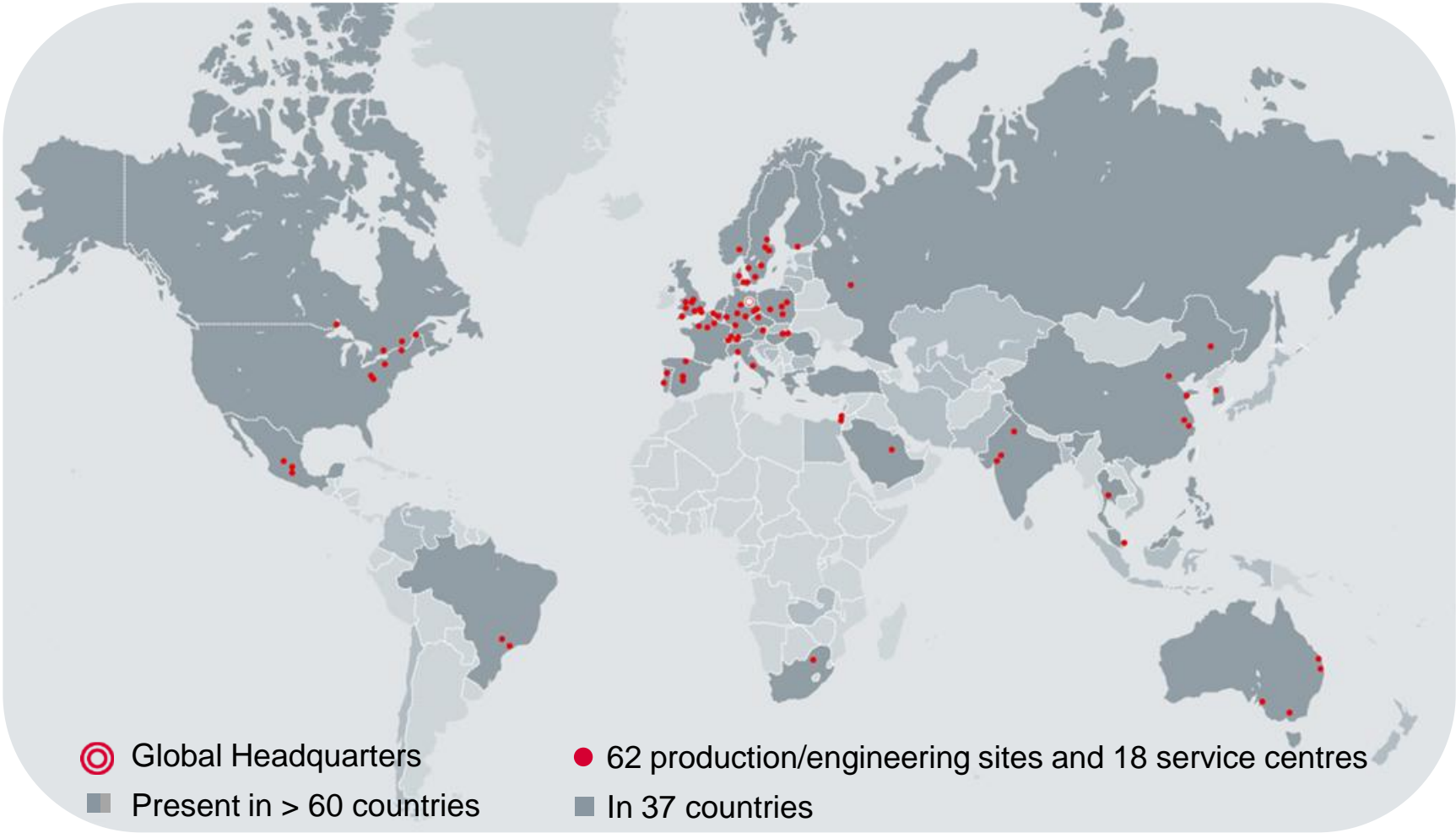


Bombardier Transportation, a global leader in rail technology, offers the broadest portfolio in the rail industry and delivers innovative products and services that set new standards in sustainable mobility.

***BOMBARDIER ECO4* technologies – built on the four cornerstones of energy, efficiency, economy and ecology – conserve energy, protect the environment and help to improve total train performance. Bombardier Transportation is headquartered in Berlin, Germany with products or services in more than 60 countries. It has an installed base of over 100,000 vehicles worldwide.**

BOMBARDIER TRANSPORTATION

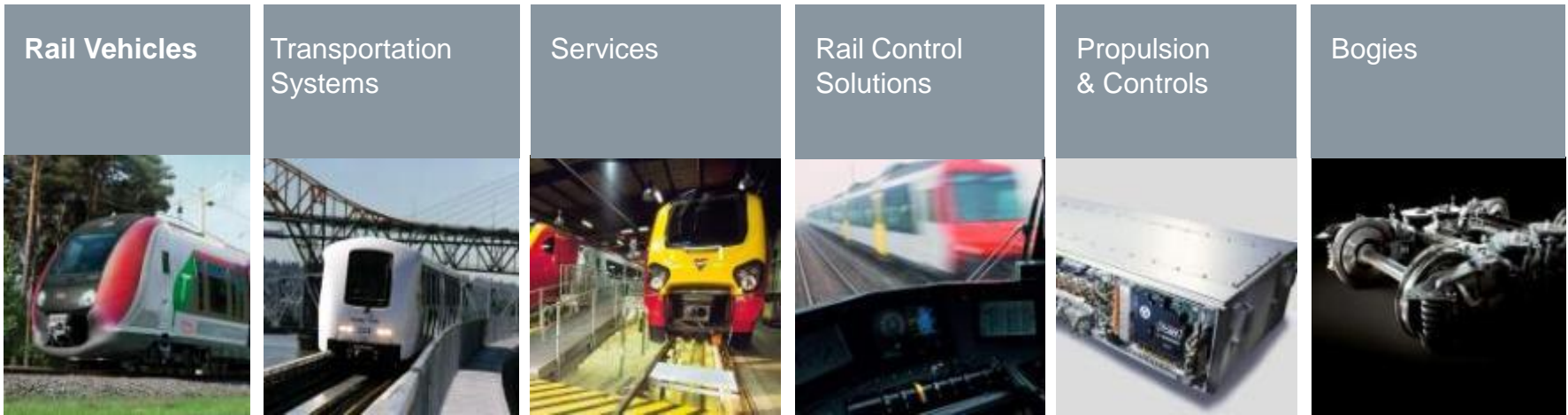
Global expertise – local presence



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BOMBARDIER TRANSPORTATION

A Full Spectrum of Railway Solutions



- Light rail vehicles
- Metros
- Commuter trains
- Regional trains
- Intercity trains
- High speed trains
- Locomotives

- Monorail systems
- APM systems
- Light rail systems
- ART systems
- Metro systems
- Intercity systems
- Transit Security

- Fleet management
- Operations & maintenance
- Material solutions
- Vehicle refurbishment
- Component reengineering

- Integrated control systems
- Automatic train protection and operation
- Interlocking systems
- Wayside equipment
- Services

- Traction converters
- Auxiliary converters
- Traction drives
- Control and communication

- Portfolio to match entire range of rail vehicles
- Full scope of service over the lifetime of a bogie



ENGINEERING DEVELOPMENT LABORATORY, DERBY

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ENGINEERING DEVELOPMENT LABORATORY

Overview

The Engineering Development Laboratory is a flexible test facility with the capability to carry out a range of static and dynamic tests, from individual components to complete rail vehicles.

For Bombardier :

- testing enables validation of new products.
- Aids product development.
- Promotes product innovation through test.

We have facilities for:

Static Tests – Complete vehicle Railway Group Standard tests – weigh, kinematic gauging, wheel unloading and bogie rotational resistance. UIC bogie frame tests.
Individual component tests

Dynamic Tests – Complete unit Group Standard Safety tests – including braking, ride and bogie stability. Investigative tests allowing problem identification and validation of re-design or modification solutions.

ENGINEERING DEVELOPMENT LABORATORY

Overview

Our Skills:

- Mechanical and electrical test rigs to suit customer requirements
- Test management, instrumentation and data analysis specialists
- British Society of Strain Measurement qualified staff for strain gauge applications

Our Capabilities:

- Measurement of stress, acceleration, pressure, torque, displacement, temperature, electrical current and other measurements from a variety of transducers.
- Data acquisition for static tests – HBM MGC+ Rack and Canhead system data logger, 300 channel capability
- Data acquisition for dynamic tests : Dewetron dataloggers, up to 300 channels. Dewesoft 7.0.5 software
- Data Analysis Software: Glyphworks 9.0.
- Main types of analysis : time domain, frequency domain, fatigue

- Glyphworks easy to use scripting tools have enabled us to develop processes to carry out data analysis to BS EN14363 *Railway Applications – Testing for the acceptance of running characteristics of railway vehicles – Testing of running behaviour and stationary tests (simplified method)*
- Why we did it: Irish Rail requested testing of a modified freight wagon, to validate compliance to BS EN 14363.
- Requirements : BS EN14363 requires compliance of the vehicle on straight and curved track, and at various speeds. The standard requires that data from straight and curved track, and vehicle body and bogie transducers be processed differently.
- How: Extraction of 14km of suitable data, comprising 40 sections of straight track and 40 sections of curved track.
Low pass filtering of each section of data in accordance with the standard, with different filters for body and bogie data.
Cumulative frequency analysis provides results for further statistical processing in Microsoft Excel to determine compliance with the standard.

ENGINEERING DEVELOPMENT LABORATORY

Analysis

Benefits :

The processes developed are locked down to ensure quality of data, and strict compliance with the requirements of the standard.

It increases speed of analysis as the processes can be shared with multiple users.

Time savings made because Glyphworks handles multiple data formats eliminating the need to convert data.

Capable of processing huge file sizes and quantities of data.

Eliminating data handling and checking at each step of the analysis process.

Visual approach and logical construction of processes eliminates the need to write code or learn a programming language.



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