



**The challenge of improving cost effectiveness
AND performance of rail operations**

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Innotrans 24-09-10

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Bombardier, a full spectrum of railway solutions

Rail Vehicles



- Metros
- Light Rail Vehicles
- Commuter Trains
- Regional Trains
- Interregional Trains
- Intercity Trains
- High-speed Trains
- Locomotives
- Freight Wagons

Total Transit Systems



- Advanced Rapid Transit
- Automated Monorail
- Automated People Movers
- Guided Light Transit
- Light Rapid Transit
- Metros

Services



- Fleet Management
- Operations & Maintenance
- Material Solutions
- Vehicle Refurbishment & Overhaul
- Component Refurbishment & Overhaul

Rail Control Solutions



- Integrated Control Systems
- Onboard Computer Systems
- Automatic Train Protection and Operation
- Wayside Interlocking
- Wayside Equipment

Propulsion & Controls



- Traction Converters
- Auxiliary Converters
- Traction Drives
- Control and Communication

Bogies



- Portfolio to match entire range of rail vehicles



Set the scene :

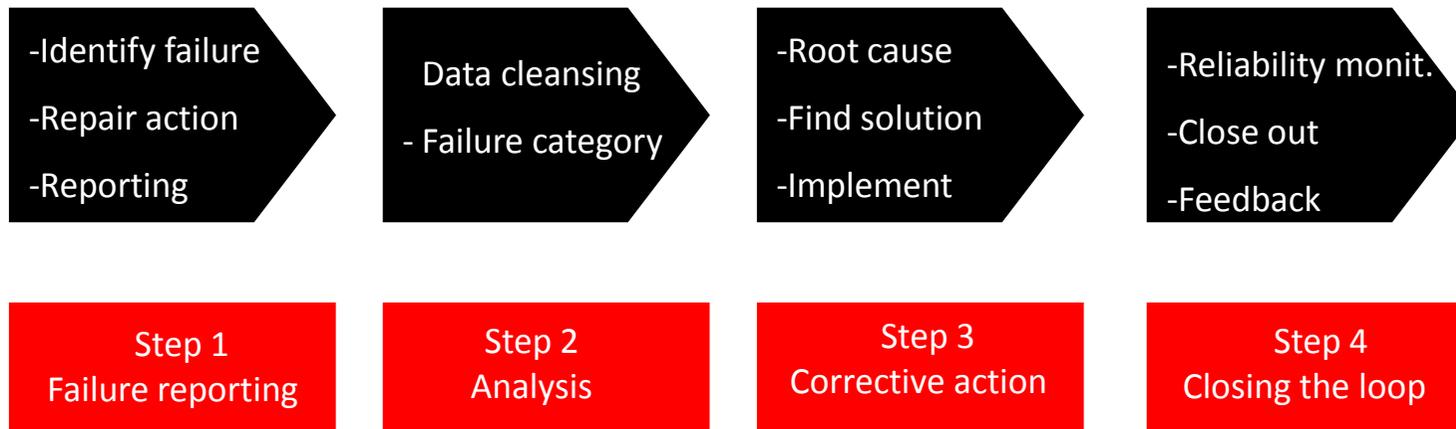
- **Challenge between cost effectiveness and performance is a given and will not go away**
- **Bombardier Transportation have developed a series of processes and techniques to optimize efficiency and effectiveness of rail maintenance**
- **Two generic themes**
 - Reliability management
 - Stabilize and increase in-service reliability
 - Maintenance optimization
 - Reducing the duration and frequency of maintenance interventions
- **Uniqueness lies in :**
 - Proven results : significant reduction in life cycle maintenance cost
 - Disciplined approach
 - Enablers for Condition Based Maintenance as another stepchange



Improving Train reliability is at the heart of optimising whole life maintenance costs

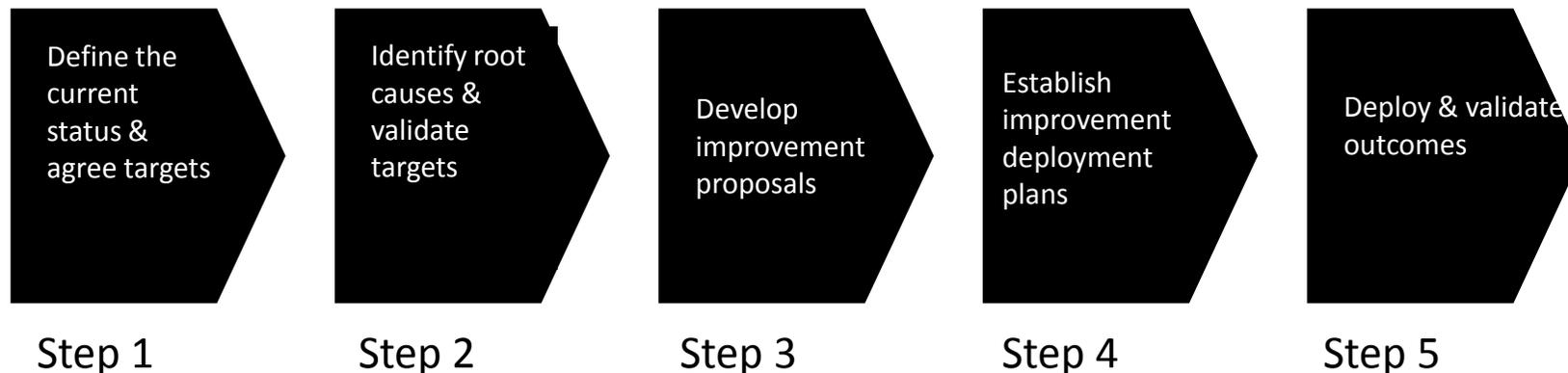
Knowing, predicting, monitoring and controlling reliability growth is essential for operational success

- Active management of reliability growth = top of the agenda
- As a response to this challenge Bombardier Transportation have developed **FRACAS (Failure Reporting And Corrective Actions)**
- A systematic process that supports the achievement of the targeted MDBF as quickly and predictably as possible



Reliability Optimisation then enables Maintenance Optimisation

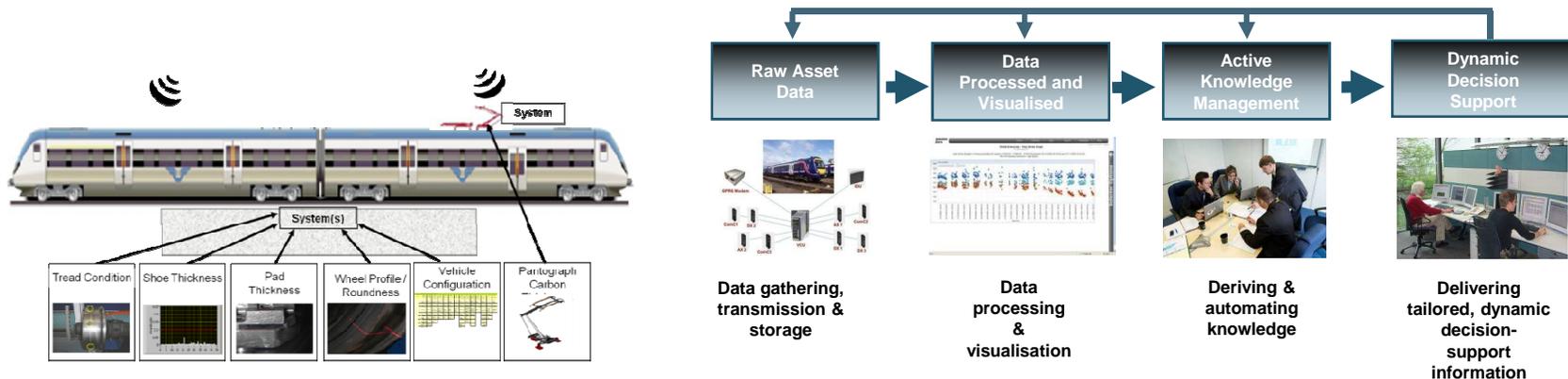
- Bombardier Transportation developed process based on Six Sigma methodology
- Objective is the streamlining of the maintenance activities by eliminating waste and increasing efficiency of the maintenance tasks through periodicity extensions.
- Process takes a holistic view of the current maintenance regime and generates improvements without compromising the safety, availability or reliability of the fleet
- Designed to develop component/system maintenance extensions
 - by undertaking a detailed analysis of the current maintenance regime, vehicle mileage and recent historic systems performance.
- The safe movement from one regime to another is also to be supported by quantitative assessments of in service component wear.



New Generation Maintenance

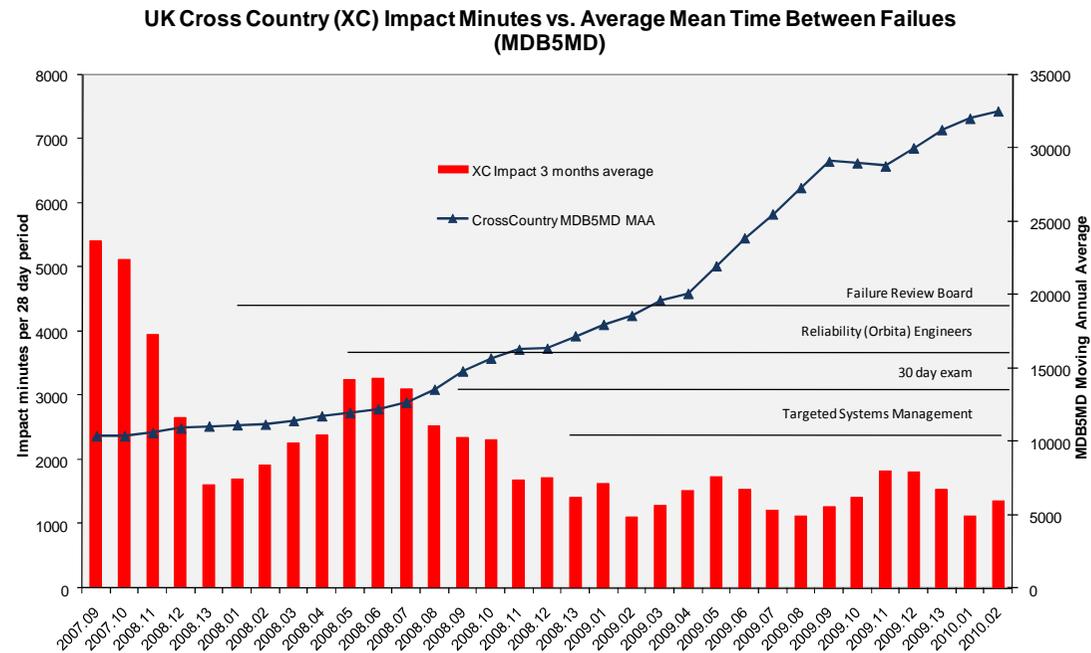
Condition Based Maintenance Becomes a Reality

- Development of condition monitoring and automatic vehicle inspection tools and processes
- Bombardier Orbita and AVI (Automatic Vehicle Inspection) are moving the technology and processes to the next generation maintenance
- Enables the real time management of train reliability and also evolution of the core maintenance regime
 - Moving away from traditional time and distance based regimes to cycle or condition.
- Proof of the pudding : over 2700 vehicles now being monitored



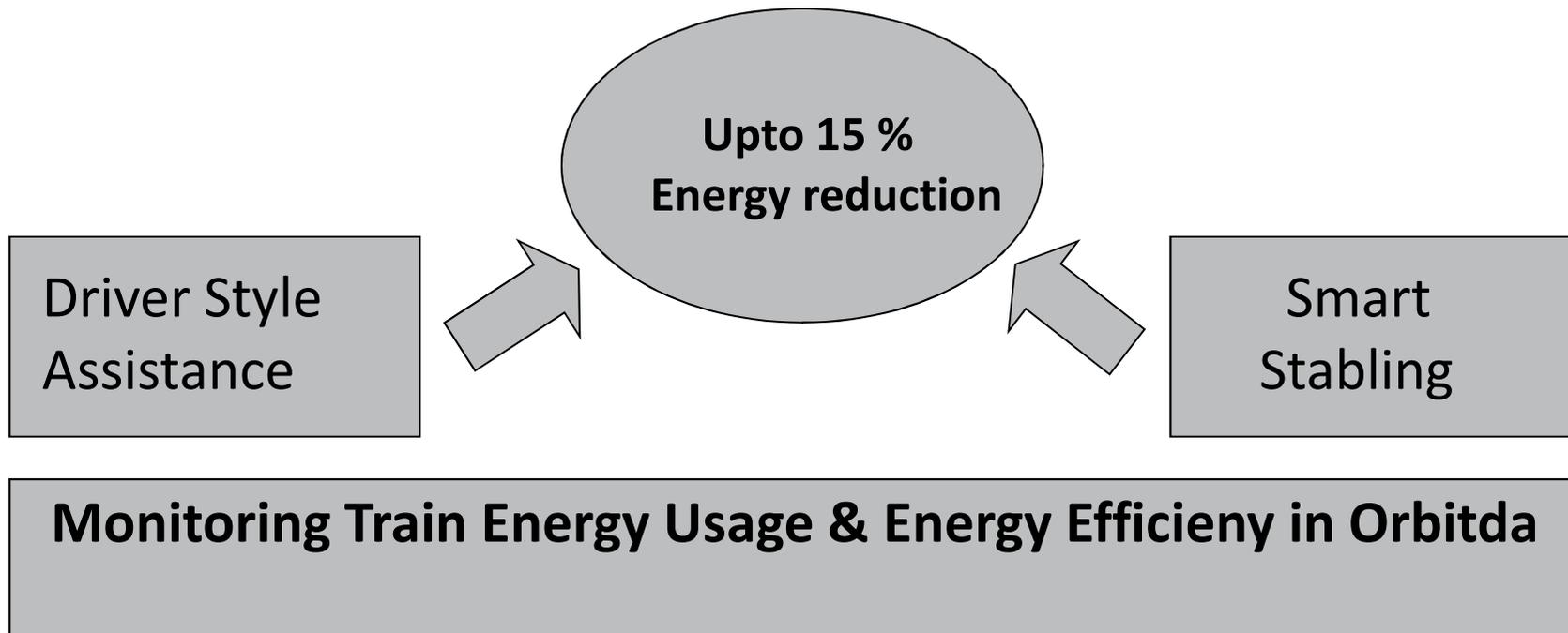
Reference application: Bombardier built and maintained UK Cross Country High Speed Voyager DEMU's

- Using the Bombardier FRACAS together with the Maintenance Optimisation Process and Orbita the performance has been dramatically improved over an 30 month period 07-10
- 300% improvement in reliability from 10,000 Mean Distance Between 5 Minute Delay (MDB5MD) to 33,000MDB5MD
- 70% reduction in operational impact minutes from 5,500 per 28 days to 1,800
- 20% reduction in material consumption over the same period



Energy Consumption reduction

- Impending regulation
- Increasing cost of energy
- Corporate responsibility



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Summary :

- **Cost effectiveness and performance not or**
- **New tools and processes based on Global Benchmarking exercise**
- **Energy is the focus of the future**
- **Proven concepts**

