



# Digital Technologies for the Maintenance of Rail Vehicles

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Lecture at MIT University

24th November 2015

# Bombardier Transportation (1 of 2)

## Overview



**BT - A LEADER IN THE  
RAIL INDUSTRY**

### Bombardier Transportation [Fiscal Year ended December 31, 2014]

REVENUES

**\$9.6Mrd.**

EBIT before  
special items

**\$486Mrd.**

EBIT  
Margin<sup>1)</sup>

**5.1%**

CUSTOMERS  
IN

**>60  
countries**

PRESENCE  
IN

**41  
countries<sup>2)</sup>**

ORDER  
BACKLOG<sup>3)</sup>

**\$32.5Mrd.**

EMPLOYEES<sup>4)</sup>: **39,700**  
HEADQUARTERS  
IN BERLIN, GERMANY

1. EBIT margin before special items
2. Defined as countries with BT employees
3. As at December 31, 2014
4. Including inactive and contractual employees

# Bombardier Transportation (2 of 2)

## Range of Products and Services

### ROLLING STOCK



INTERCITY, HIGH SPEED TRAINS, AND VERY HIGH SPEED TRAINS



COMMUTER AND REGIONAL TRAINS



ELECTRIC AND DIESEL LOCOMOTIVES



LIGHT RAIL VEHICLES



METROS

### SYSTEMS & SIGNALLING



MASS TRANSIT AND AIRPORT SYSTEMS



TURNKEY MAINLINE SYSTEMS & OPERATIONS



MASS TRANSIT, MAINLINE & INDUSTRIAL SIGNALLING

### SERVICES



MATERIAL SOLUTIONS



FLEET MANAGEMENT

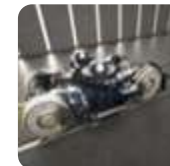


ASSET LIFE MANAGEMENT, COMPONENT RE-ENGINEERING AND OVERHAUL

### ROLLING STOCK COMPONENTS



PROPULSION AND CONTROLS



BOGIES

# BT is an established player in Russia

## Today

- **SER for passenger coaches and locomotives**

- TSG WLAB coaches converter overhaul
- TSG spare parts supply
- TMH-Service EP10 locomotive modernization



- **RCS opportunities through Elteza JV**

- 50% minus 1 share in “Elteza”, a subsidiary of RZD
- Largest Russian producer of electro-mechanical products



- **LOC opportunities**

- Product development of double locomotive
- Factory setup support



## Focus

- Grow existing business with signaling, services and locomotives
- Capture key LOC projects with RZD and private operators
- Monitor and evaluate new business opportunities

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# Digital Technologies

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# Digital technologies for the maintenance of rail vehicles

## BACKGROUND

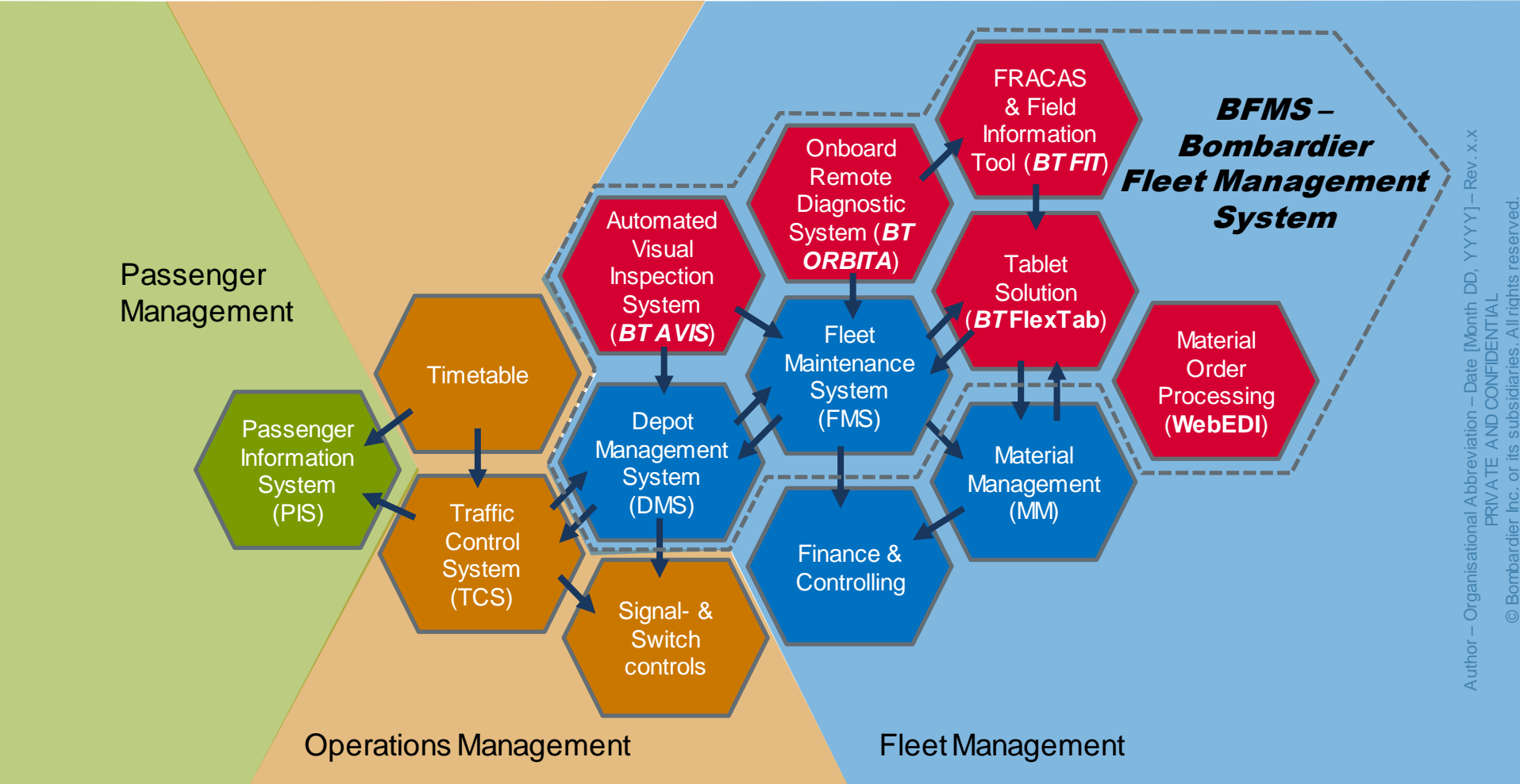
- More than 100,000 rail vehicles made by Bombardier in operation worldwide
- Bombardier provides its customers with comprehensive support for the maintenance of their fleets:
  - Material supply solutions
  - Technical support, repairs and modernizations
  - Full maintenance solutions
- Bombardier provides full maintenance for more than 5,000 vehicles worldwide with contract periods of up to 30 years

## „Seamless digitalization“

of maintenance processes is one of the main levers Bombardier is using to achieve best performance levels in fleet maintenance:

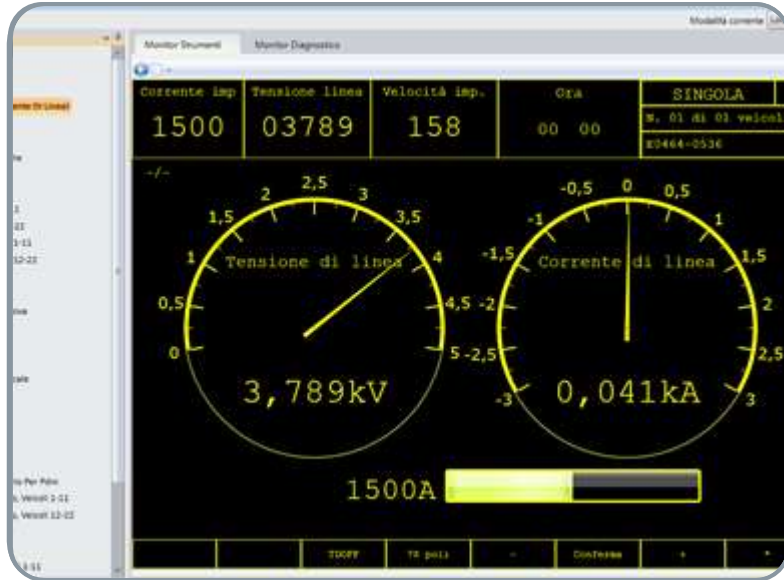
- Safety 
- Fleet availability 
- Maintenance costs 
- Energy and operating costs 
- Commercial risk 

# Maintenance of rail vehicles is often relying on complex IT structures



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# Bombardier's *ORBITA* remote diagnostics system offers powerful support for fleet maintenance ...



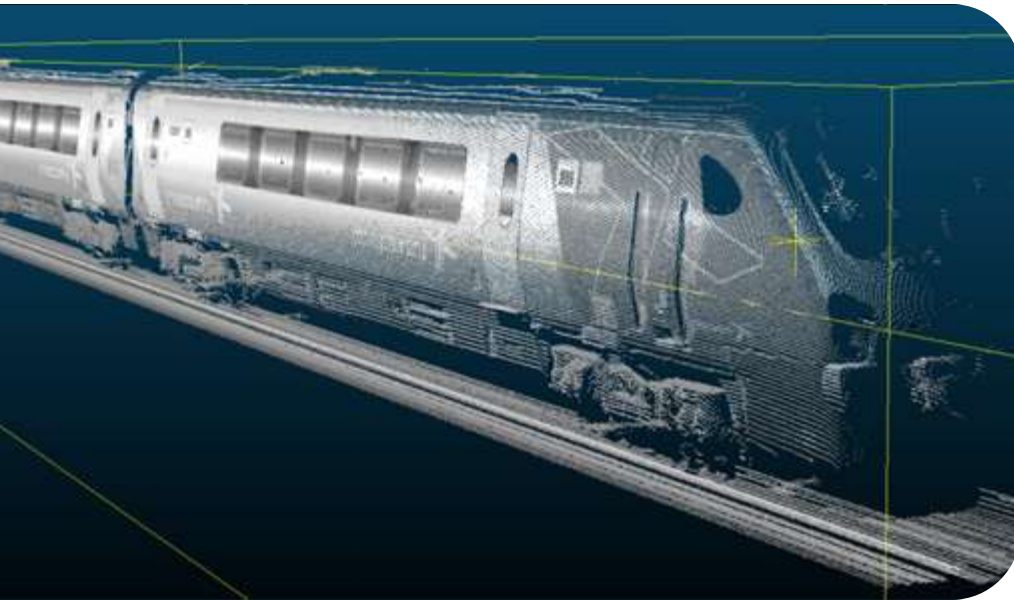
## The ORBITA remote diagnostic system offers:

- Control of technical vehicle parameters
- Fault analysis on system level and prognosis of maintenance relevant events
- Vehicle localization and geographical mapping
- Rule based decision support for operating and maintenance items (incl. creation of work orders)
- Implementation of an HMI-Display at the drivers desk for support of experts during operation

- Improved reliability and reduced maintenance costs
- In use for several fleets in the UK as well as the Swiss and French railways (SBB and SNCF)



## ... which can be complemented by *Bombardier's AVIS* vehicle inspection system

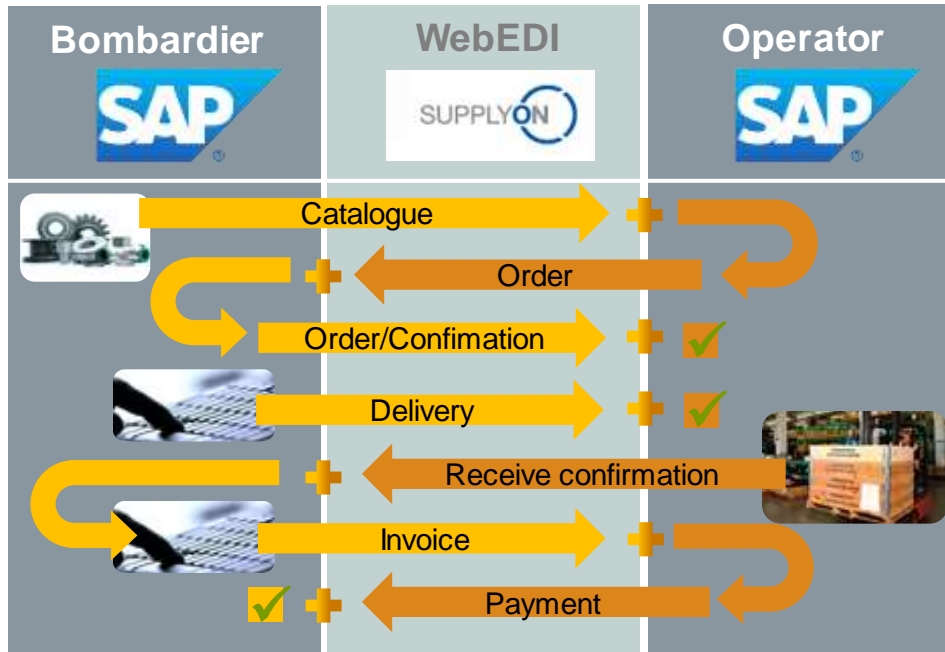


**AVIS is a fully automatic wayside inspection system made for:**

- Measuring the condition of critical components like:
  - Brakes
  - Pantographs
  - Wheel sets
- Visual inspection of the vehicle via lasers and video-scan when the vehicle is running through the AVIS station

- Improved Product Safety through higher frequency of inspections and consistency of data collection
- Enhanced vehicle component usage data and trend analysis: leading to improved maintenance decisions

# The workshop can order materials via the internet easily and fast directly from the vehicle manufacturer

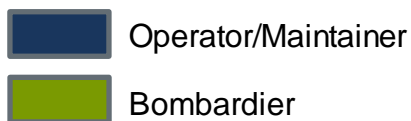
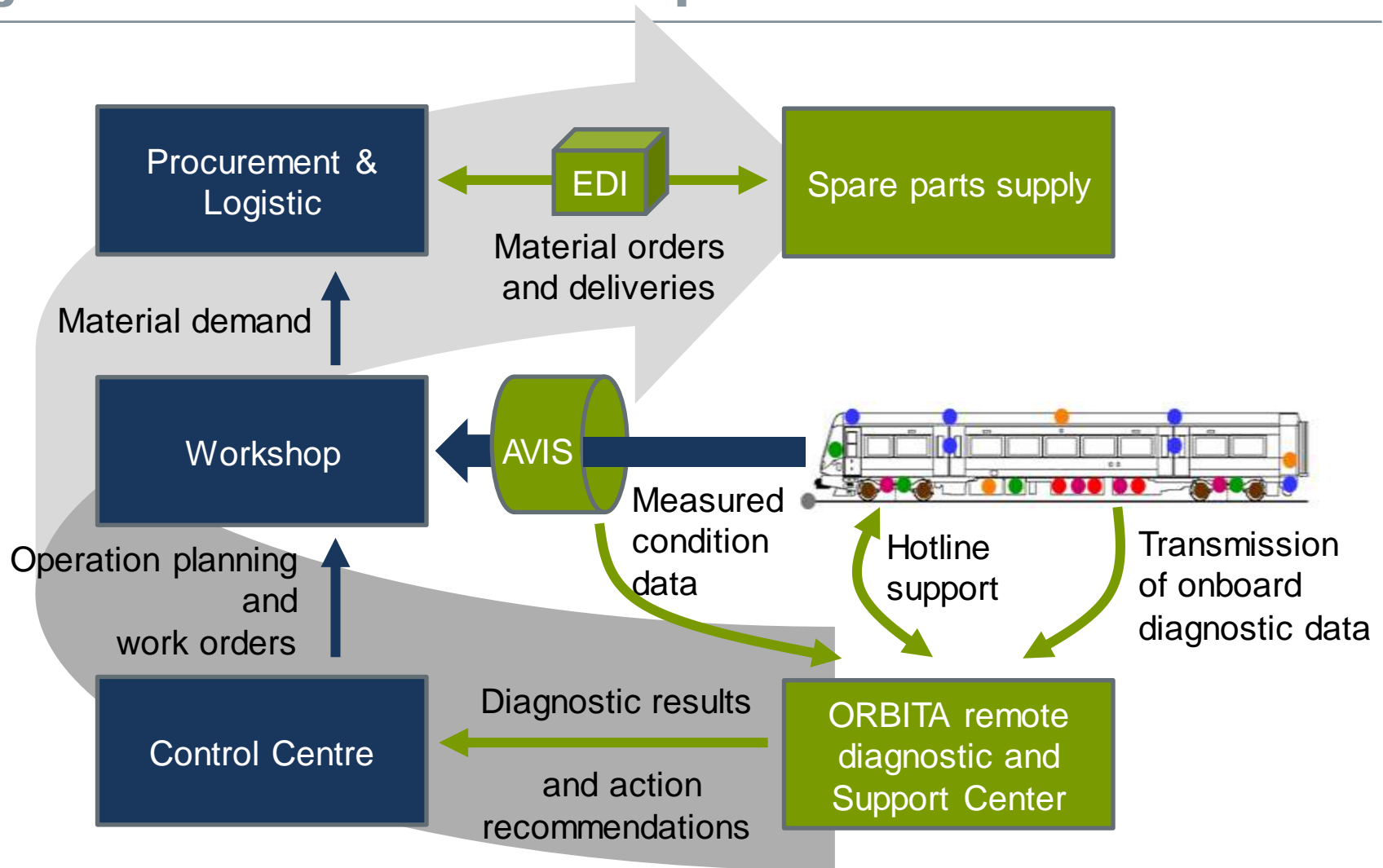


- Electronic processing of material orders
- Seamless connection of ERP\* systems on both sides via a powerful and web-based EDI\*\* interface
- Integration of IT solutions from leading 3<sup>rd</sup> party suppliers
- Short implementation period with reduced risk due to experiences from several customer projects

- Simplified and accelerated material orders and deliveries
- Increased material availability
- Decreased transactional costs

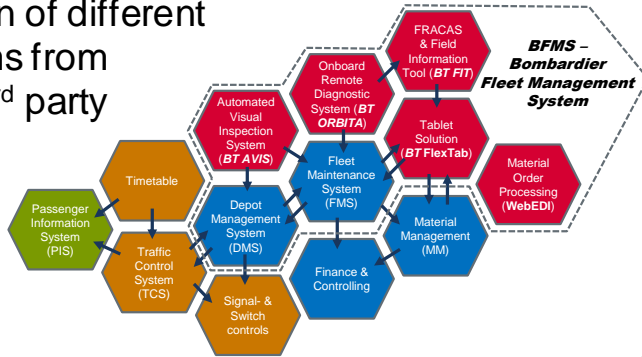
\*ERP - Enterprise resource planning  
\*\*EDI - Electronic Data Interchange

# Optimal results can only be realized through „seamless digitalization“ of maintenance processes

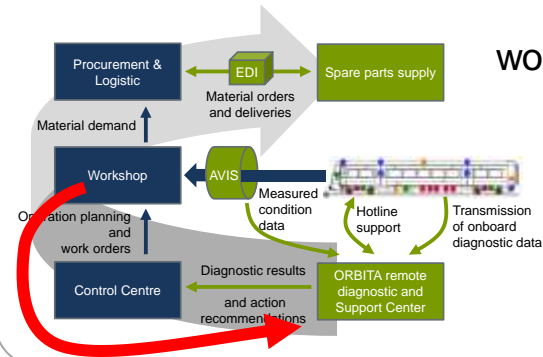


# Bombardier's future-proof integration of processes and systems ensures best possible results

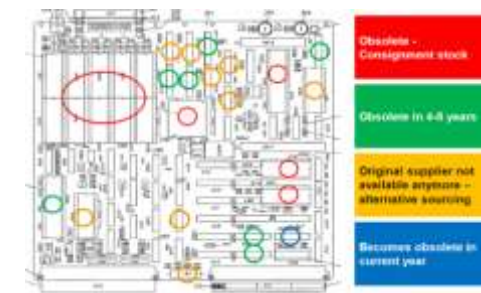
Connection and integration of different IT systems from leading 3<sup>rd</sup> party suppliers



Effective „Cyber Security“ mechanism

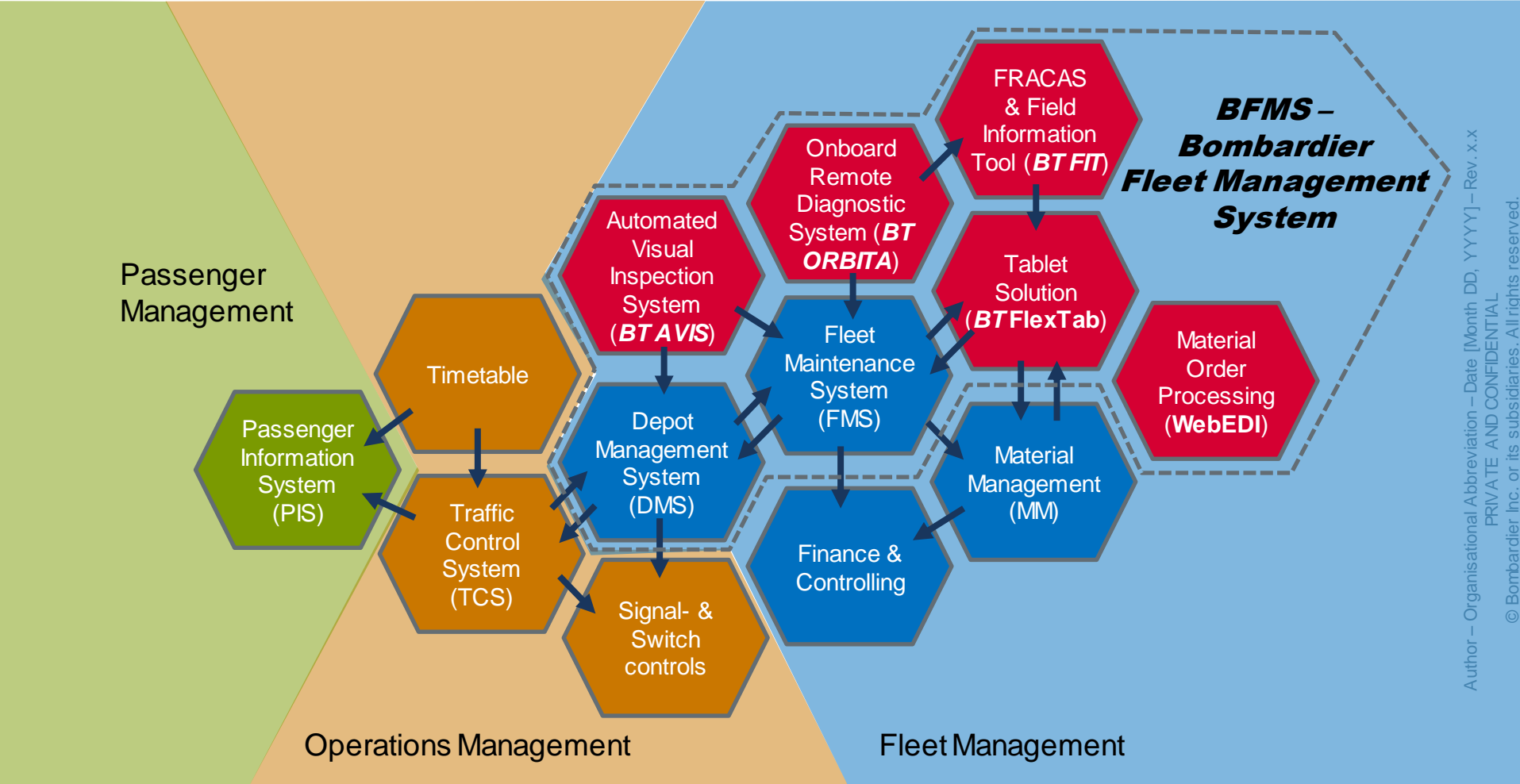


Information feedback loop between workshop software and diagnostic system for improved data verification and analysis



Flexibility and strong obsolescence management over 25-40 years fleet life cycle

# Maintenance of rail vehicles is often relying on complex IT structures



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# Digital Technologies

## „The Tool“



# MyBTfleet

## Новые технологии управления парком локомотивов от Bombardier в России

Александр Шутко  
Святослав Прохоров  
Алексей Муливленко

02-05 сентября 2015,  
ЭКСПО 2015, Щербинка

**BOMBARDIER**  
the evolution of mobility

# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)

Краткая история развития и совершенствования

MITRAC® Remote – технология, впервые примененная для локомотивов

## 1997



ReFIS (Remote Fleet Information Services) следующий шаг развития технологии

## 2001



MyBTfleet – современные технологии удаленного доступа к диагностике локомотивов

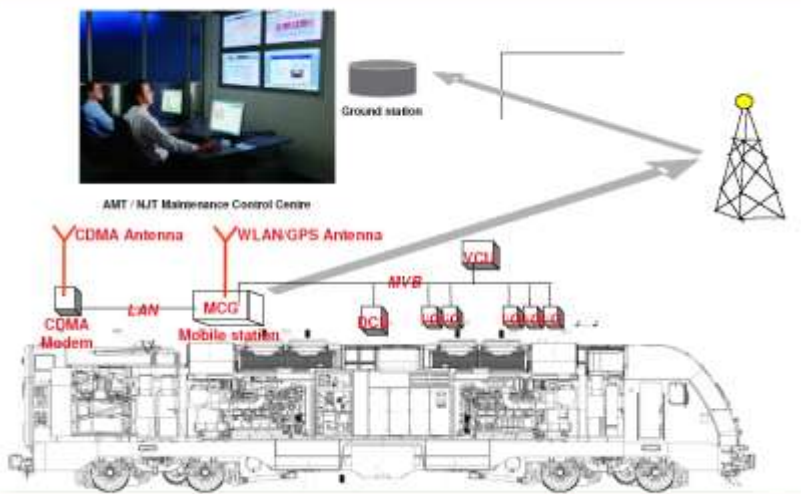




# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)

Результатом совершенствования системы **ReFIS** стали системы, применяемые в настоящее время компанией В для удалённого доступа к информации парка локомотивов для сервисного обслуживания.

## RDS – Remote Diagnostic System



BOMBARDIER

## MyBTfleet



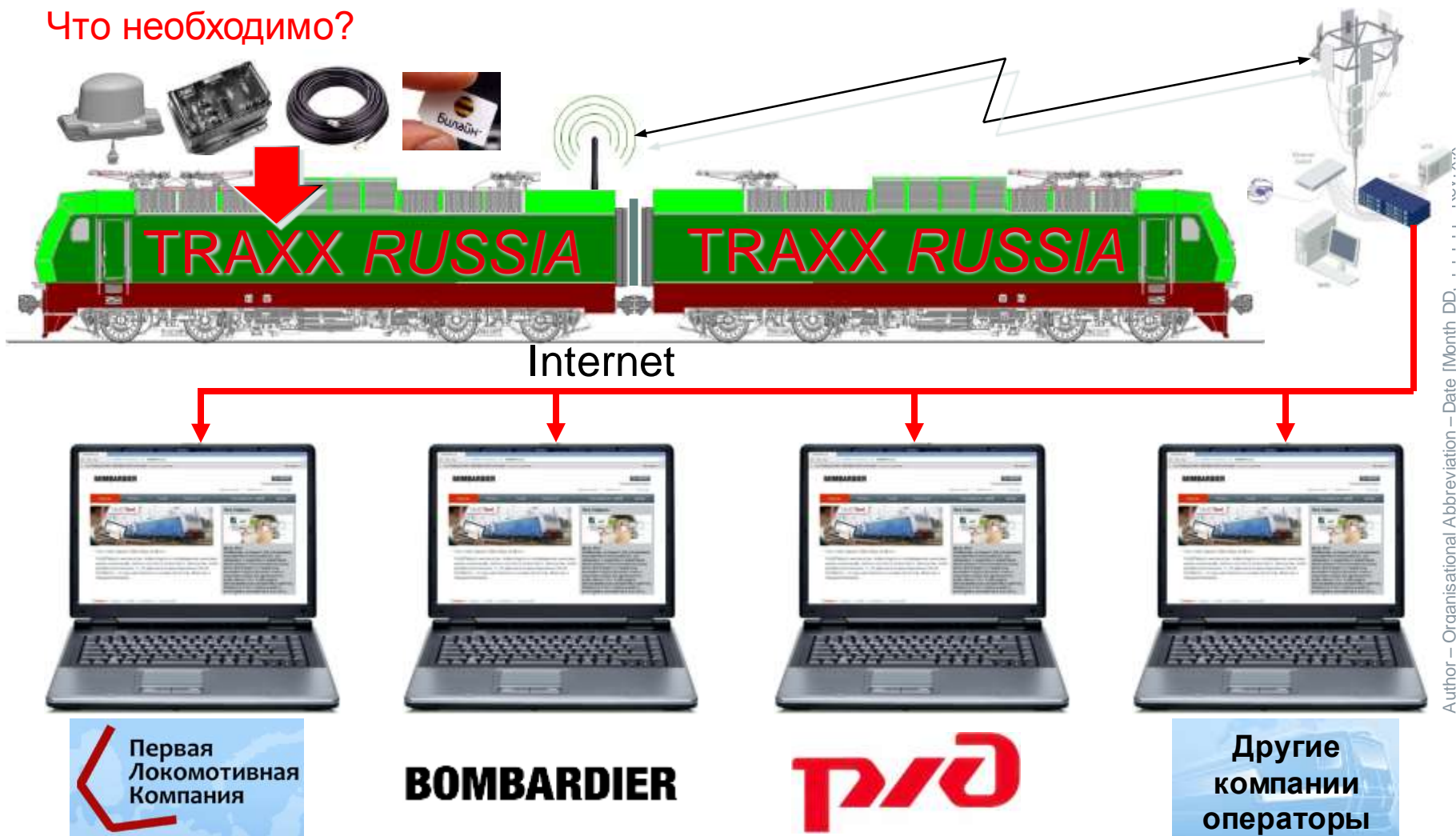
Real time access to the inner diagnostic of Your assets



BOMBARDIER

# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)

Что необходимо?



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# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)

## Как подключиться?

Для подключения к серверу **MyBTfleet** необходим персональный компьютер, планшет или мобильный телефон



Необходима точка доступа в **Internet**



# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)

Главное меню MyBTfleet и язык

Для выбора языка общения необходимо подтвердить ► **Русский**

**Июль 2012 Секвенсор**, инструмент для планирования мероприятий по обслуживанию, уже завершена, и оказались в оперативном использовании! Все пользователи будут иметь приложения со стандартным мониторинга флота kilometers. Users с кредитами полную функциональность может вместо того, чтобы видеть планирование всех регламентных работ на ближайшие 5 лет и забронировать в необходимых мероприятий в доступных базах. Календарь показывает текущей деятельности и предоставлять связь между депо и операторов.

**Может 2012**  
Визуализация **Диагностика** теперь интегрирован в MyBTfleet портал. Новые возможности были добавлены, давая теперь пользователи возможность увидеть диагностических сообщений по времени, так и над картами.

# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)

## Панель инструментов MyBTfleet

The screenshot displays the MyBTfleet web interface. At the top, the BOMBARDIER logo is on the left, and the MyBTfleet logo with the tagline "Your web-based fleet data toolbox" is on the right. Below the logo is a navigation bar with links for "Карта сайта", "Связаться", and "Russian". A user profile section shows "Пользователь: ep10" and a "Выход" button.

The main content area is divided into three columns representing different user roles:

- ОПЕРАТОР (Operator):**
  - Карты:** Местонахождение по GPS. Приложение активно.
  - Запрос:** История запросов. Приложение не активно.
  - Планирование:** Планировка тех обслуживания. Приложение не активно.
- ТО и РЕМОНТ (Maintenance and Repair):**
  - Каталог:** Каталог зап частей. Приложение не активно.
  - Отчет:** Отчет о проведении ТО. Приложение не активно.
  - Документация:** Чертежи и документация. Приложение не активно.
- ИНЖЕНЕР (Engineer):**
  - Диагностика:** Актуальное состояние. Приложение активно.
  - Удаленный доступ:** Эксплуатационные данные. Приложение не активно.
  - Orbita:** Контрольный центр БТ. Приложение не активно.

# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)

## Место нахождения локомотива

Для просмотра необходимо выбрать меню **Карта** или **Спутник**

The screenshot displays the MyBTfleet web application interface. At the top, the BOMBARDIER logo is on the left, and the MyBTfleet logo with the tagline "Your web-based fleet data toolbox" is on the right. A navigation bar contains links for "Домой", "Панель", "Помощь", "Контакт", "Копия сайта", "Контакт", "Актуальный", "Пользователь: ep10", and "Logout".

The main content area is titled "Пластиковые" and "EP10\_012". On the left, there is a "Карты" (Maps) section with a sub-section "Все локомотивы" (All locomotives). A list of locomotives is shown, with "EP10\_012 - 19.02.2013" selected. Details for this locomotive are displayed:

- Время: 07:03:32
- Номер Поезда: N/A
- км: 769309
- SW Loco: 20900
- SW ID: 001.001.001.017
- Страна: RU

The main part of the interface is a map. The left map shows Belarus and surrounding regions with several blue location markers. A red arrow points from the "Карта" menu to this map. The right map is a satellite view of a railway yard in Moscow, with a red arrow pointing from the "Спутник" menu to it. A tooltip over the satellite map provides the following data:

EP10\_012 - 19.02.2013 07:09:01 - 769309 Km  
- 0 km/h - 3350 V - 110 V

At the top right of the interface, there are three locomotive icons: a green one, a grey one, and a red one.

# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)

## Отчеты диагностики состояния локомотива

Для просмотра Отчетов диагностики состояния локомотива необходимо выбрать один из вариантов

The screenshot displays the MyBTfleet web application interface. At the top left is the BOMBARDIER logo. At the top right is the MyBTfleet logo and the tagline "Your web-based fleet data toolbox". Below the logo is a navigation bar with links: "Домой", "панель", "Помогите", "Контакт", "Карта Сайта", "Контакт", "Русский", "Пользователь: ep10", and "Logout".

The main content area is titled "Диагностика" (Diagnosis) and "Отчеты" (Reports). On the left, there is a sidebar menu with three items: "Диагностика", "Отчет" (highlighted in red), and "Поиск".

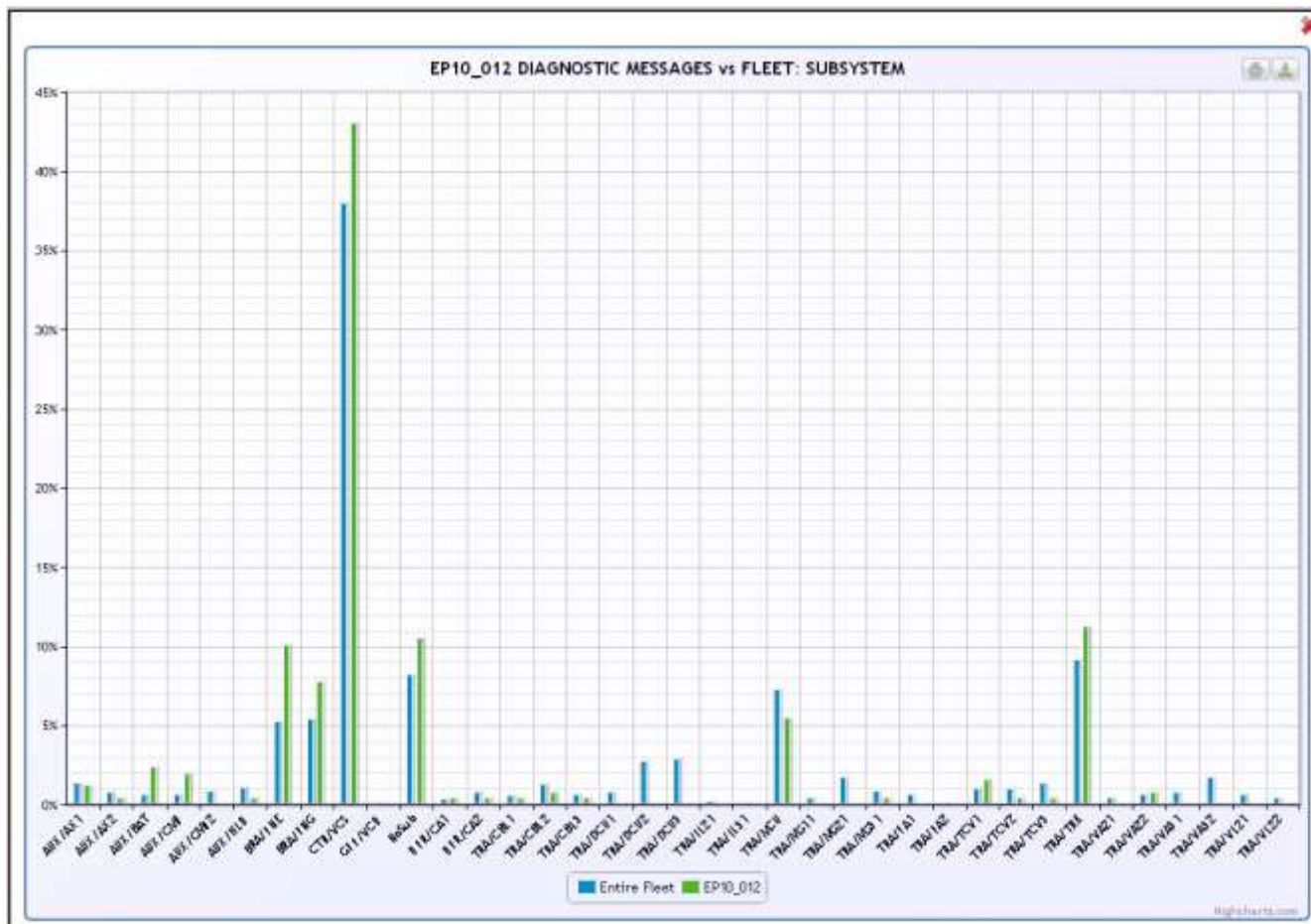
The main content area displays three report options:

- ЛОКО ДИАГНОСТИЧЕСКИХ СООБЩЕНИЙ vs ПОДСИСТЕМЫ**  
Выберите Локомотив вы хотите получить отчет (данные фильтруются в последний месяц случай).  
LOKO: EP10\_012  
Excel, Рисовать
- ФЛОТ ДОСТУПНОСТИ (с помощью диагностики)**  
Отчет показывает количество имеющихся диагностических данных в базе отсутствуют.  
Период: 02/2013  
Excel, Рисовать
- ЛОКО ДИАГНОСТИЧЕСКИХ СООБЩЕНИЙ vs ФЛОТА**  
Выберите Локомотив вы хотите получить отчет (данные фильтруются в последний месяц случай).  
LOKO: EP10\_012  
Excel, Рисовать

On the right side of the page, there is a vertical blue scrollbar.

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Графическое отображение информации диагностики состояния локомотива





# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)

Online - состояние парка локомотивов В в странах Европы

BOMBARDIER

MyBTfleet | Your web-based fleet data toolbox

Карта сайта | Справка | Russian

Главная | Панель | Помощь | Справка | TRAXX Tour

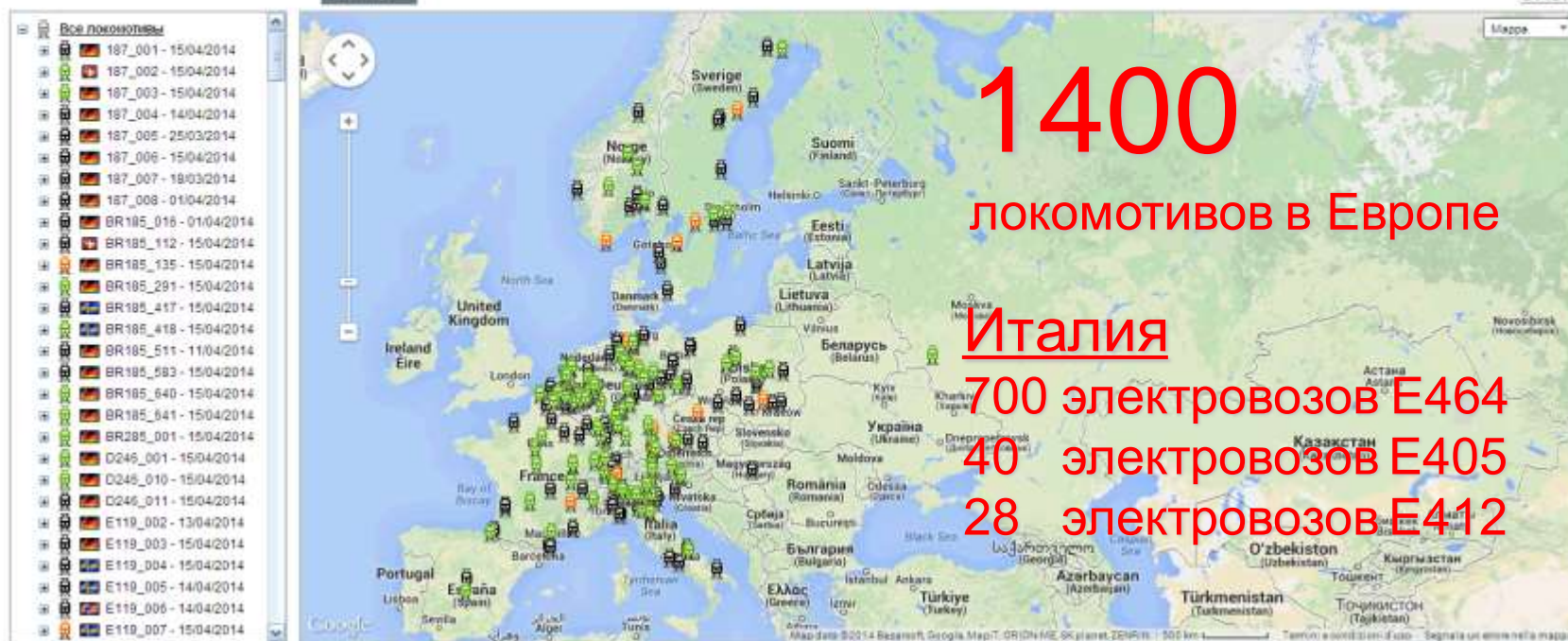
Пользователь: МохТест | Выйти

Maps

Все локомотивы

Адаптив

ОТЧЕТ



Главная | Панель | Помощь | Справка | Карта сайта

Powered by Adas Group

# MyBT fleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)

Ваша веб-база парка локомотивов. Пример – Италия



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The screenshot shows the MyBTfleet web interface. At the top, there are three main sections: OPERATORE, MANUTENTORE, and SOCIORE. The OPERATORE section is highlighted with a red box and contains three main menu items: Localizza, Prenota / Pianifica, and Contatta. The 'Localizza' item is further highlighted with a red border and contains the text 'Individua la posizione del rotabile via GPS' and 'Applicazione attivata'.



Отображает физическое местоположение вашего локомотива и для возможности планирования мероприятий по техническому обслуживанию

# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)



## OPERATORE



### Localizza

Individua la posizione del rotabile via GPS

Applicazione attivata



### Prenota / Pianifica

Programmazione delle manutenzioni

Applicazione attivata



### Contatta

Visualizza tutte le richieste effettuate

Applicazione attivata

# MyBTfleet



Отслеживает все Ваши запросы для нашей деятельности и сервисных услуг в настоящий момент и/или планируемые.

# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)



## MANUTENTORE



### Rapporto d'Intervento

Dettagli delle Manutenzioni effettuate

Applicazione attivata



### Catalogo

Informazioni sulle Parti di Ricambio

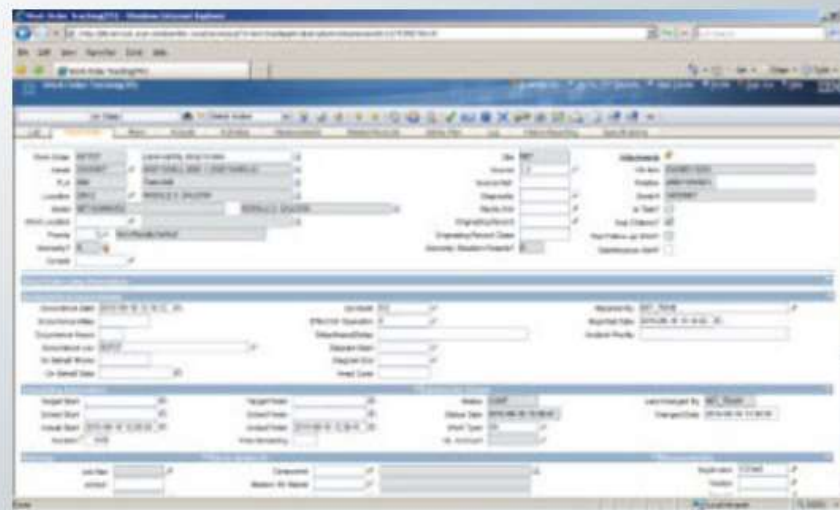
Applicazione attivata



### Archivio

Disegni tecnici e Documentazione del rotabile

Applicazione attivata



Отображает подробный отчет о выполненных обслуживающих и ремонтах вашего локомотива.

# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)



**MANUTENTORE**

- Rapporto d'Intervento**  
Dettagli delle Manutenzioni effettuate  
Applicazione attivata
- Catalogo**  
Informazioni sulle Parti di Ricambio  
Applicazione attivata
- Archivio**  
Disegni tecnici e Documentazione del rotabile  
Applicazione attivata



Отображает и позволяет скачать чертежи, документы и все технические характеристики подвижного состава.

# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)



INGEGNERE



**Diagnostica**

Stato di salute del rotabile in Tempo Reale

Applicazione attivata



**Campiona**

Dati operativi dei Rotabili in Servizio

Applicazione attivata



**Orbita**

Interfaccia Centri Gestione Flotta Bombardier

Applicazione in sviluppo



Предоставляет доступ в реальном времени к диагностике состояния вашего локомотива.

# MyBTfleet – новые технологии управления парком локомотивов от Bombardier [www.mybtfleet.bombardier.com](http://www.mybtfleet.bombardier.com)



INGEGNERE



**Diagnostica**

Stato di salute del rotabile in Tempo Reale

Applicazione attivata



**Campiona**

Dati operativi dei Rotabili in Servizio

Applicazione attivata



**Orbita**

Interfaccia Centri Gestione Flotta Bombardier

Applicazione in sviluppo



Возможность подключения локомотивов к  
Центрам по управлению парком подвижного  
состава





## Video on Fleet Management

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# Workshop/Homework

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# Workshop/Homework on Digital Technologies in the Railway Industry

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- Form teams of 10 members each and nominate one leader per team
- Each team to work on the following 4 tasks
  - written results to be handed in by 31st January 2016 (contact to follow)
- My second lecture in Q1/2016 will focus on reviewing and reflecting on your presentations

# Task # 1: Find and explain 3 best practises/showcases for digital technology success stories in the railway industry

Best Practise #	Detailed Description
1	
2	
3	

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# Task # 2: Possible Use of Digital Technologies in Railway Industry/Fleet Maintenance

Possible Area of Use	Target/Reason of Use	Expected Measurable Results	Remarks

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# Task # 3: Prepare a SWOT analysis of digital technology use in the railway industry/fleet maintenance

Best Practise #	Detailed Description
1	
2	
3	

Author – Organisational Abbreviation – Date [Month DD, YYYY] – Rev. x.x  
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# Task # 4: Digital technology in railway industry/fleet maintenance - what is MIT University already doing today?

Detailed Description of past or current projects


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Thank you very much for your attention!





# Q&A

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