



Digital Technologies for the Maintenance of Rail Vehicles

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Lecture at MIIT 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
Margin¹⁾

5.1%

CUSTOMERS
IN
**>60
countries**

PRESENCE
IN
**41
countries²⁾**

ORDER
BACKLOG³⁾
\$32.5Mrd.

EMPLOYEES⁴⁾: **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

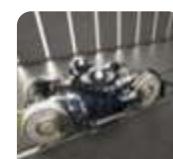


ASSET LIFE MANAGEMENT, COMPONENT RE-ENGINEERING AND OVERHAUL

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

Digital Technologies

Digital technologies for the maintenance of rail vehicles

BACKGROUND

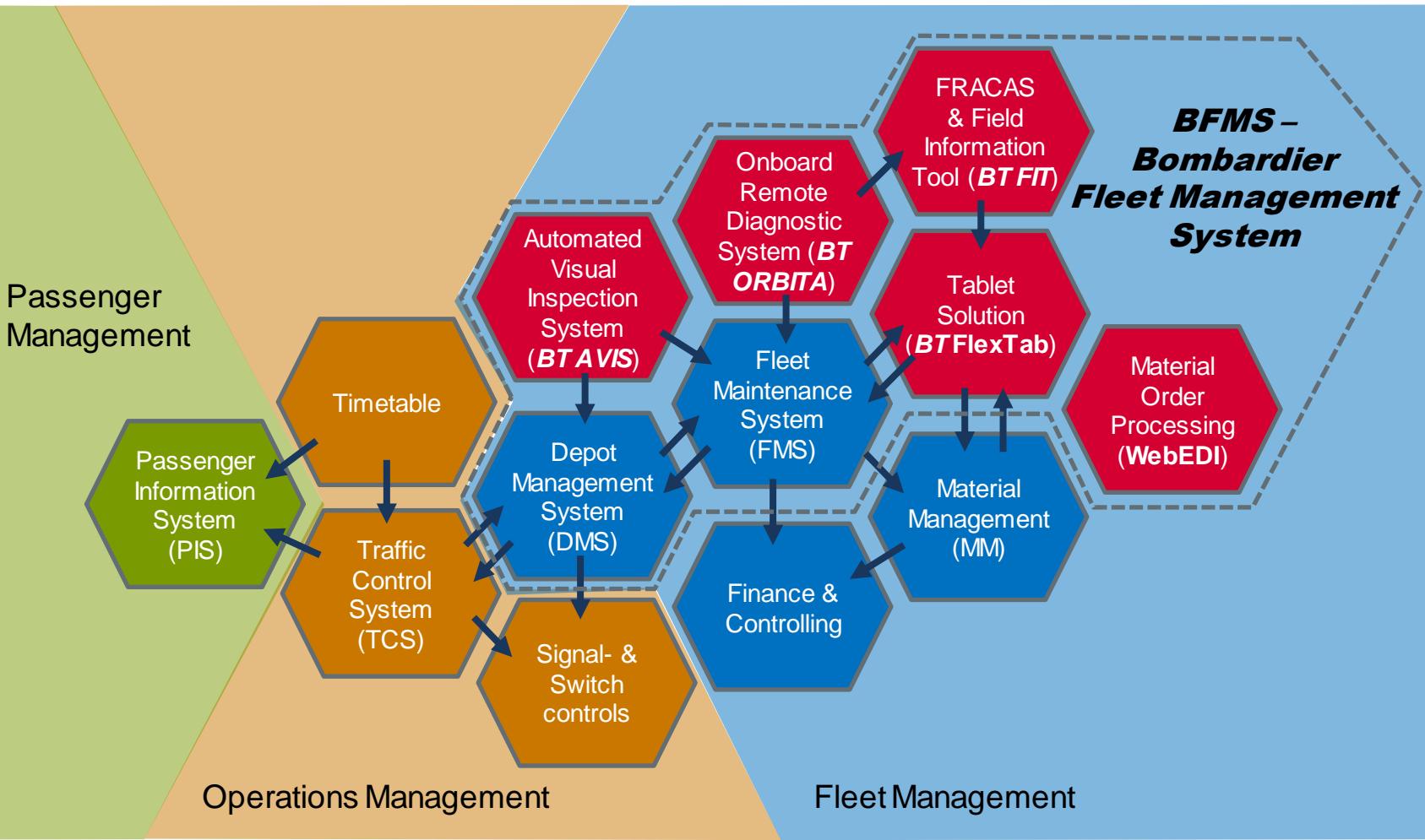
- More than 100,000 rail vehicles made by Bombardier in operation worldwide
- Bombardier provides its customers with comprehensive support for the maintenance of their fleets:
 - Material supply solutions
 - Technical support, repairs and modernizations
 - Full maintenance solutions
- Bombardier provides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

„Seamless digitalization“

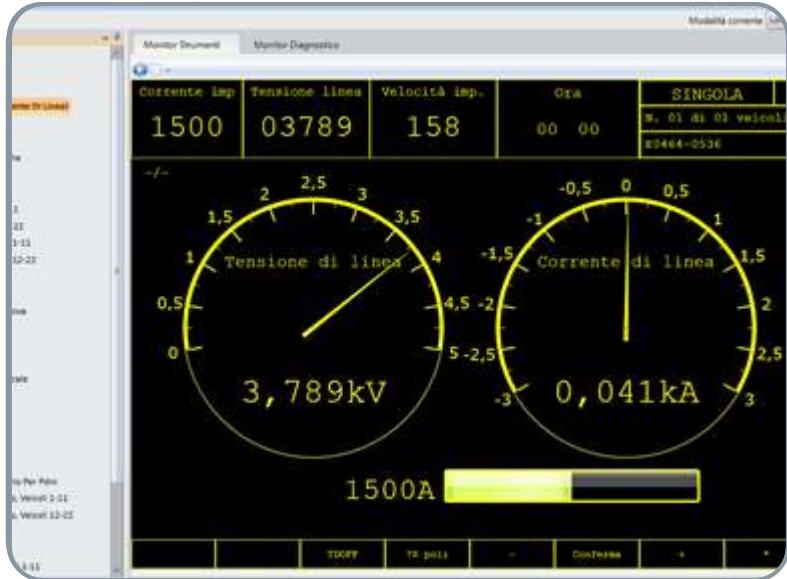
of maintenance processes is one of the main levers Bombardier is using to achieve best performance levels in fleet maintenance:

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

Maintenance of rail vehicles is often relying on complex IT structures



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

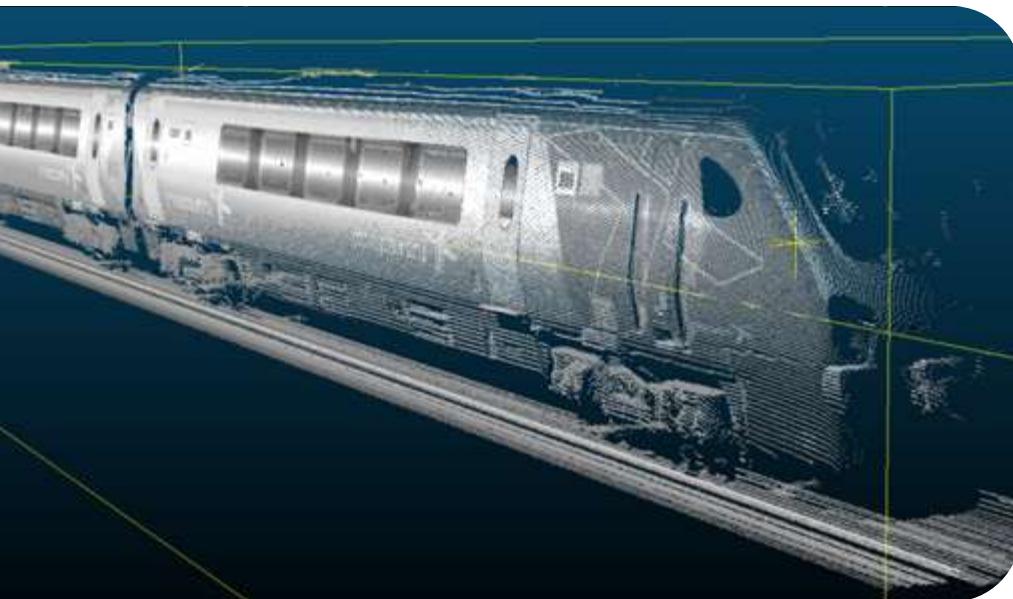


The ORBITA remote diagnostic system offers:

- 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)

- 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)
- Implementation of an HMI-Display at the drivers desk for support of experts during operation

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

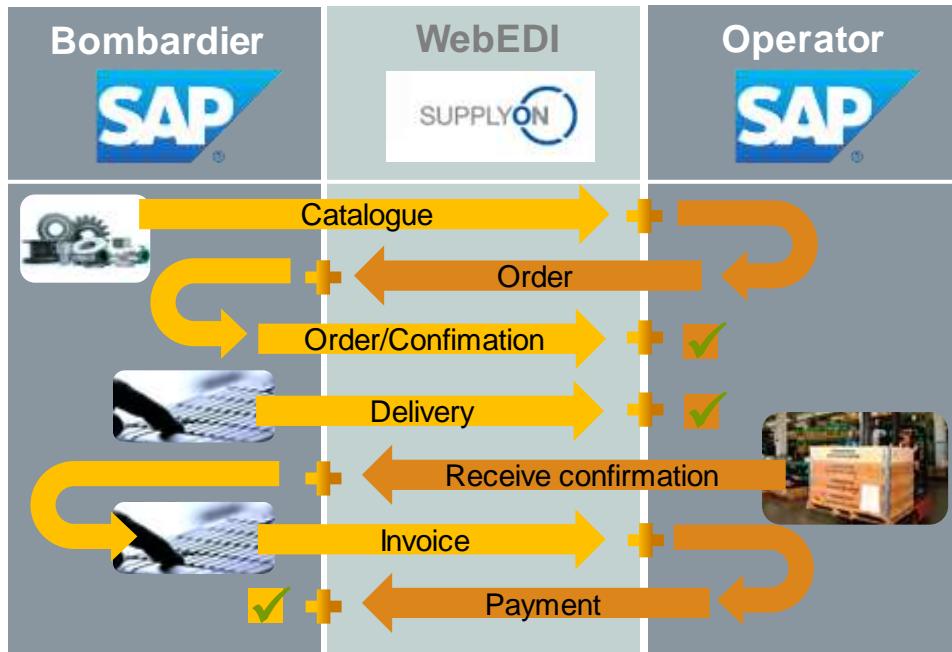


AVIS is a fully automatic wayside inspection system made for:

- 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



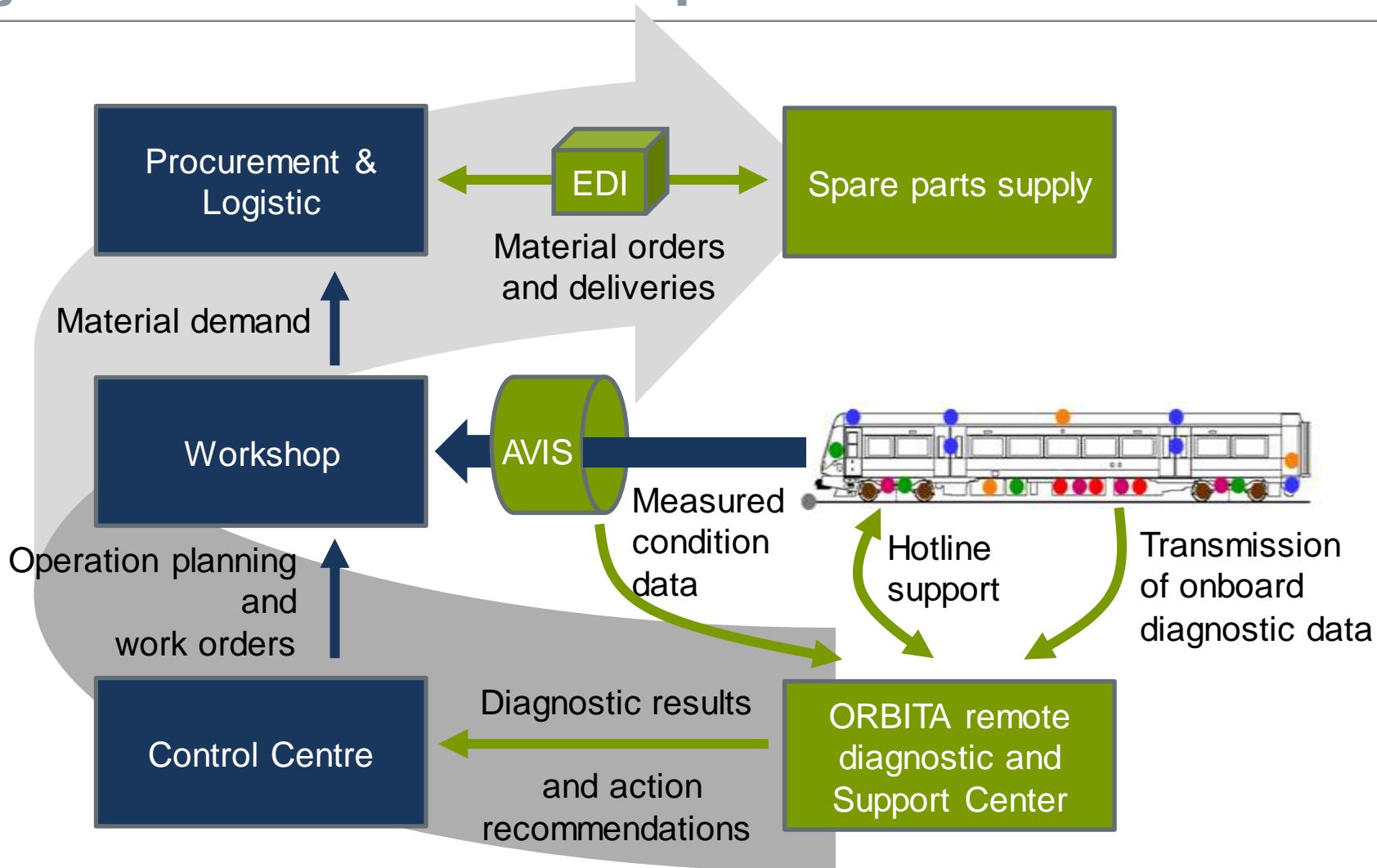
- Electronic processing of material orders
- Seamless connection of ERP* systems on both sides via a powerful and web-based EDI** interface
- Integration of IT solutions from leading 3rd party suppliers
- Short implementation period with reduced risk due to experiences from several customer projects

- 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



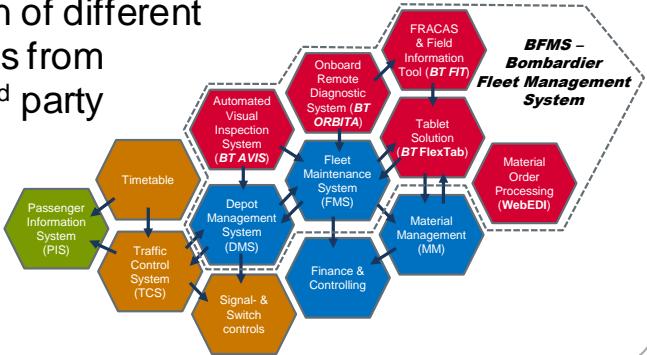
Operator/Maintainer



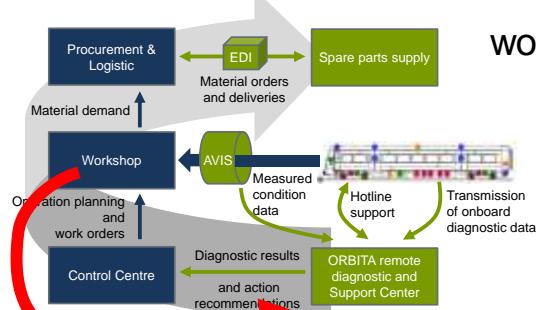
Bombardier

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

Connection and integration of different IT systems from leading 3rd party suppliers



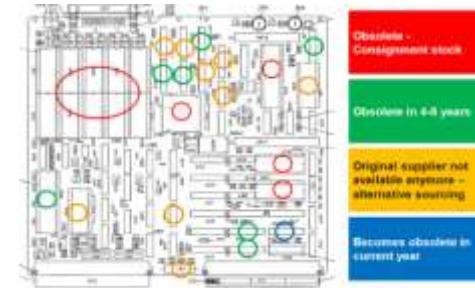
Information feedback loop between workshop software and diagnostic system for improved data verification and analysis



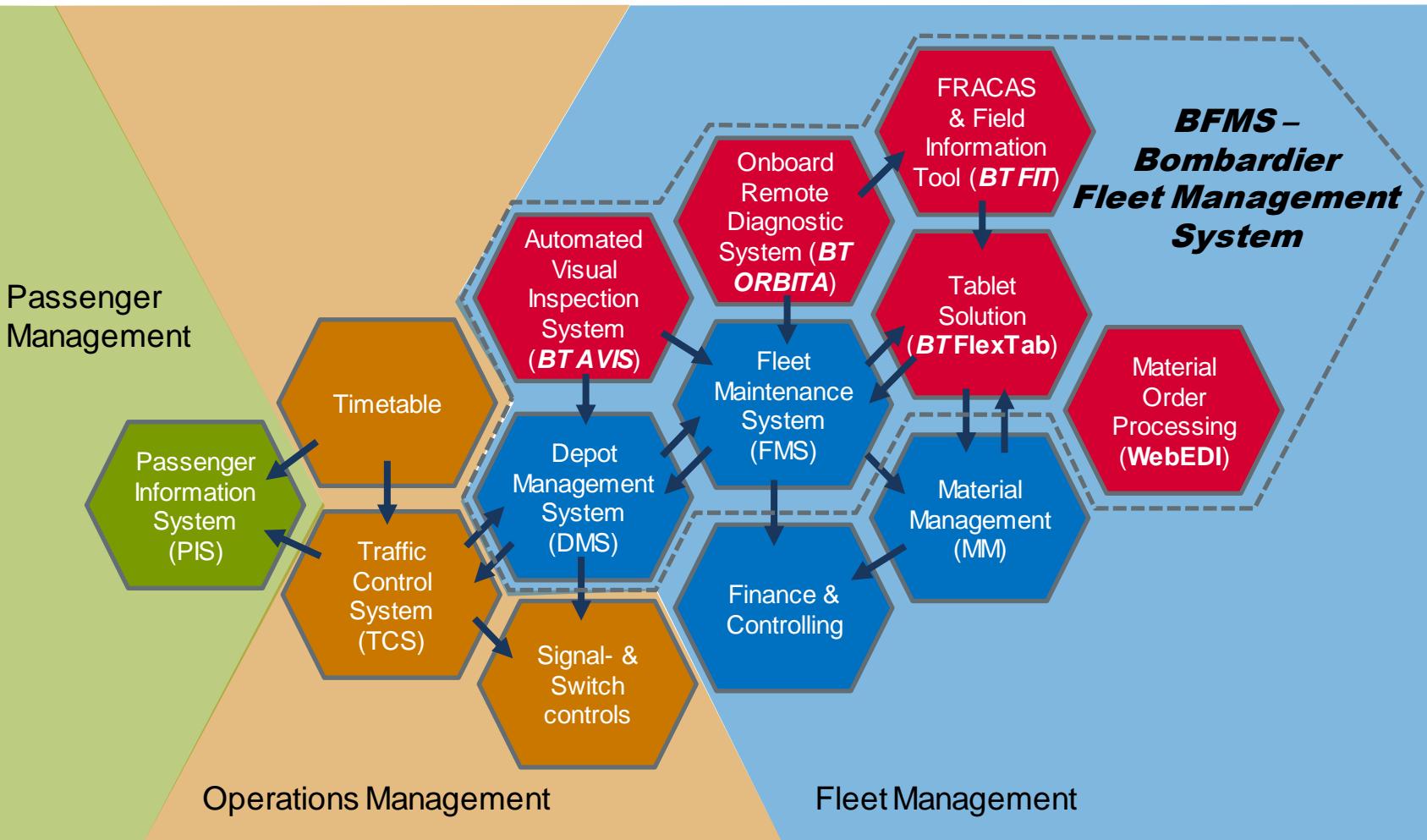
Effective „Cyber Security“ mechanism



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



Maintenance of rail vehicles is often relying on complex IT structures



Digital Technologies

„The Tool“



MyBTfleet

Новые технологии управления парком локомотивов от **Bombardier** в России

Александр Шутко
Святослав Прохоров
Алексей Муливенко

02-05 сентября 2015,
ЭКСПО 2015, Щербинка

BOMBARDIER
the evolution of mobility

MyBTfleet – новые технологии управления парком локомотивов от Bombardier www.mybtfleet.bombardier.com

Краткая история развития и совершенствования

MITRAC® Remote – технология, впервые примененная для локомотивов

1997



Diagnostic Data View : Vehicle 12X_Sim

View Onboard Database | Upload Onboard Database |

Diagnostic Information for Database 1 (Vehicle: 12X_Sim, train: 12X, Host: L0C_1Host)

Seq.	Proc.	Datas.	Pin	Event	State	User	Time	End Time	Text
1	45	-5	32	0	0	Sum	Fein	Sum Fein	L0C_1Host: Zugfein 119V
138	45	150	48	0	0	Sum	Fein	Sum Fein	L0C_1Host: Zugfein 119V
138	45	150	48	0	0	Sum	Fein	Sum Fein	L0C_1Host: Schutzschalter Zugfein 119V
138	45	150	48	0	0	Sum	Fein	Sum Fein	L0C_1Host: Schutzschalter Zugfein 119V
13	45	123	32	0	0	Sum	Fein	Sum Fein	L0C_1Host: Schutzschalter Zugfein 119V



ReFIS (Remote Fleet Information Services) следующий шаг развития технологии

2001



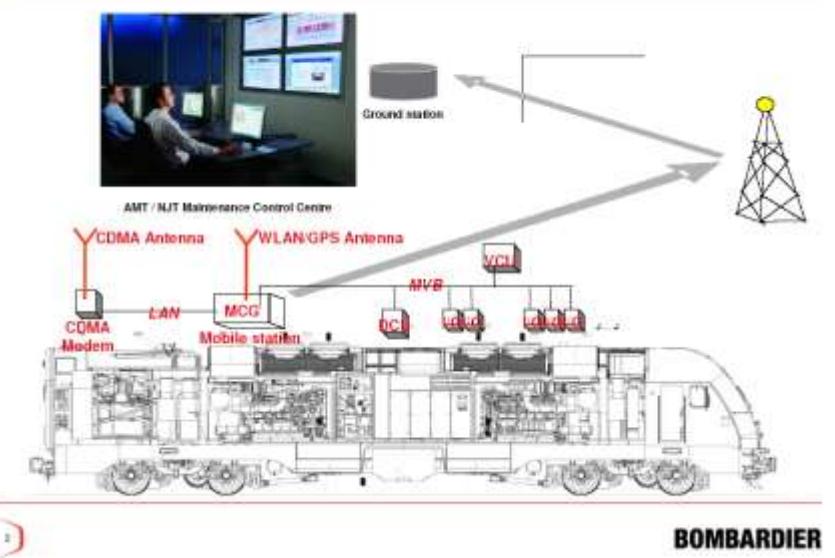
MyBTfleet – современные технологии удаленного доступа к диагностике локомотивов



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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

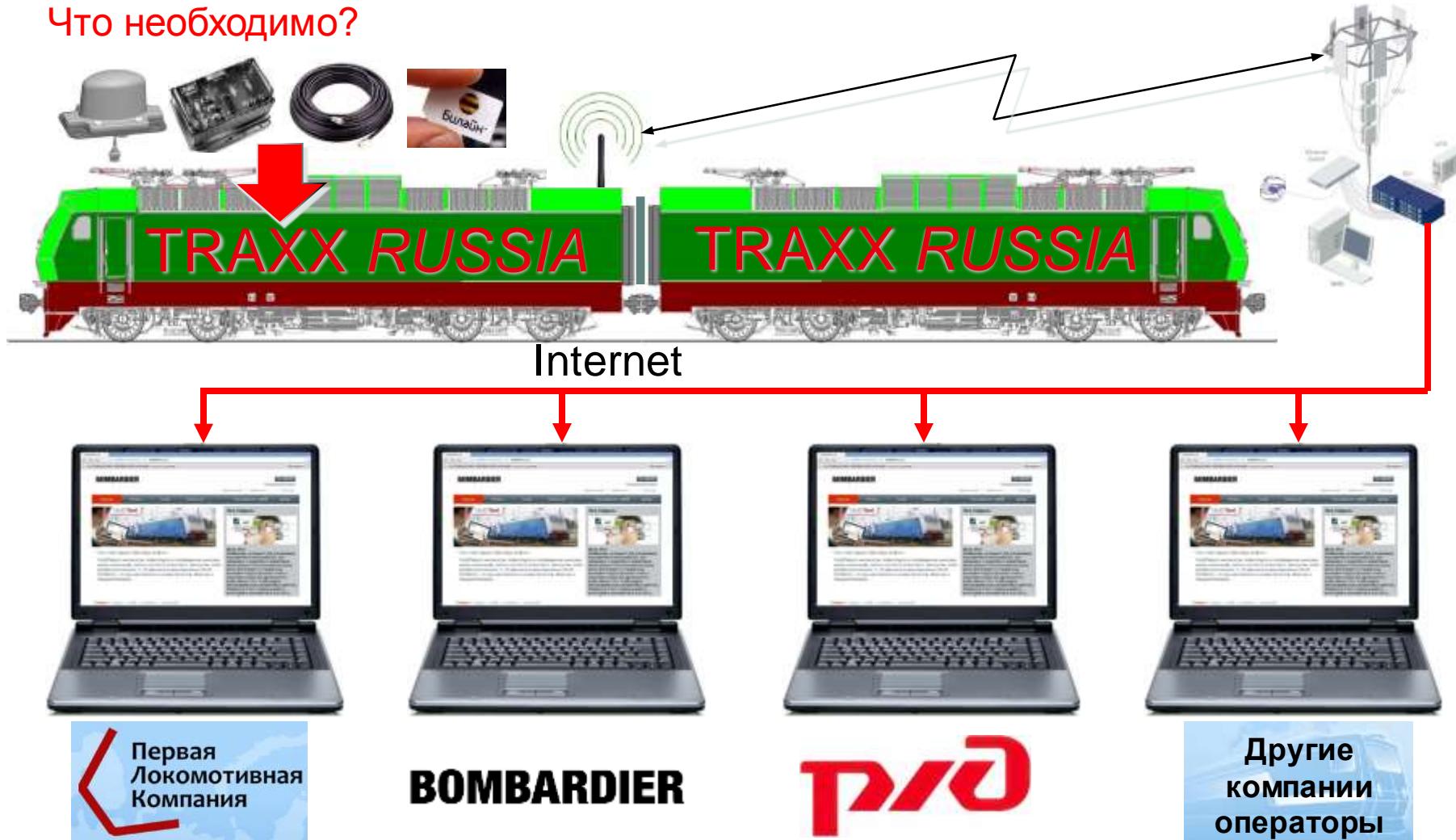


MyBTfleet

The screenshot shows the MyBTfleet web interface. At the top, there is a navigation bar with links for 'HOME', 'ABOUT', 'SERVICES', 'CASE STUDIES', 'CONTACT', and 'LOG IN'. Below the navigation bar, there is a large red circular icon with a white train silhouette and a heart rate monitor line. To the right of the icon, the text 'Diagnostic' and 'Health Status of vehicles' is displayed. Below this, there is a grid of icons representing different diagnostic and monitoring services: 'New', 'Existing', 'Diagnostic', 'TIA', 'Train Driver', 'Pass / Break', 'Data & Images', 'Data', and 'Control'. The 'Diagnostic' icon is highlighted with a red border. At the bottom of the interface, the URL 'www.mybtfleet.bombardier.com' is shown, followed by the text 'Real time access to the inner diagnostic of Your assets'. Below this text, there are two images: one of a green and white locomotive and another of a close-up of a digital display screen showing data.

MyBTfleet – новые технологии управления парком локомотивов от Bombardier www.mybtfleet.bombardier.com

Что необходимо?



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MyBT^{fleet} – новые технологии управления парком локомотивов от Bombardier www.mybtfleet.bombardier.com

Как подключиться?

Для подключения к серверу MyBT^{fleet} необходим персональный компьютер, планшет или мобильный телефон



Необходима точка доступа в *Internet*



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Главное меню MyBTfleet и язык

Для выбора языка общения необходимо подтвердить ► Русский

BOMBARDIER

The screenshot shows the MyBTfleet website interface. At the top, there is a navigation bar with links for 'Домой' (Home), 'О Нас' (About Us), and 'Контакт' (Contact). Below the navigation bar, the 'BOMBARDIER the evolution of mobility' logo is displayed. The main content area features a large image of a train and several smaller images related to transportation and aerospace. On the right side of the page, there is a sidebar titled 'Что Нового' (What's New) featuring a hand interacting with various mobile devices. A red arrow points from the 'Russian' confirmation link in the contact form to the 'Russian' option in the language dropdown menu.

Search

Расширенный Поиск

Карта Сайта | Контакт | Английский

Домой | О Нас | Контакт

EP10

MyBTfleet

BOMBARDIER the evolution of mobility

Домой | О Нас | Отделение Системами | Управление | Корпоративная Отчетность | Медиа-Центр | Карта Сайта

Транспорт | Аэрокосмический | Продукты И Технологии | Авиационный | Контакт | Контакт

Бомбардьеर | Аэрокосмический | Транспорт

МойБТфлот

Приступите к MyBTfleet

Английский | Контакт | Контакт | Контакт

Английский | Italiano | Deutsch | Français | Español | Польский | Русский

Что Нового

Связаться с Нами

Имя:

Запись:

Телефон:

Тема:

Текст:

237

Оставить | Задать

Help Windows Internet Explorer

Help@bt.com

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

Может 2012

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

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Панель инструментов MyBTfleet

The screenshot shows the MyBTfleet web-based fleet data toolbox interface. At the top, there's a header bar with the Bombardier logo, the title "MyBTfleet | Your web-based fleet data toolbox", and navigation links for "Карта сайта", "Связаться", and "Russian". Below the header is a menu bar with "Главная", "Панель" (highlighted in red), "Помощь", "Связаться", "Пользователь: erp10", and "Выход". The main content area is divided into three columns: "ОПЕРАТОР", "ТО И РЕМОНТ", and "ИНЖЕНЕР". Each column contains three application cards with icons and status indicators.

Категория	Приложение	Статус
ОПЕРАТОР	Карты	Местонахождение по GPS Приложение активно
	Запрос	История запросов Приложение не активно
	Планирование	Планировщик тех. обслуживания Приложение не активно
ТО И РЕМОНТ	Каталог	Каталог запчастей Приложение не активно
	Отчет	Отчет о проведении ТО Приложение не активно
	Документация	Чертежи и документация Приложение не активно
ИНЖЕНЕР	Диагностика	Актуальное состояние Приложение активно
	Удаленный доступ	Эксплуатационные данные Приложение не активно
	Orbita	Контрольный центр БТ Приложение не активно

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Место нахождения локомотива

Для просмотра необходимо выбрать меню Карта или Спутник

BOMBARDIER

The screenshot displays the MyBTfleet interface. At the top, there is a navigation bar with links for 'Домой' (Home), 'Панель' (Panel), 'Помощь' (Help), and 'Контакт' (Contact). The main title 'MyBTfleet | Your web-based fleet data toolbox' is followed by a user login 'Пользователь ep10' and a 'Logout' button. Below the title, there are three icons representing different types of locomotives: a green one, a grey one, and a red one.

The left side of the screen shows a map of Eastern Europe, specifically focusing on Belarus and Russia. A blue dot marks the location of the locomotive 'EP10_012'. The right side shows a detailed satellite view of a railway station in Moscow, with several tracks and buildings visible. A green dot on the map corresponds to the satellite view. A red arrow points from the map to the satellite view, indicating the transition between the two modes.

On the left, a sidebar titled 'Пластиковые' (Plastic) shows details for the locomotive 'EP10_012' last updated on 19.02.2013 at 07:03:32. The data includes:

- Бриз: 07:03:32
- Номер Поезда: N/A
- Нм: 769309
- SW Loco: 20800
- SW ID: 001.001.001.017
- Сервис: RU

At the bottom of the map, there is a scale bar from 0 to 100 km and 0 to 100 miles, and a note: 'Данные карты ©2013 Basemap, GIS InfraMap'.

A callout box in the bottom right corner of the satellite view provides specific information about the locomotive's location: 'EP10_012 - 19.02.2013 07:09:01 - 769309 Km - 0 Km/h - 3350 V - 110 V'.

TRAXX RUSSIA F120 MS

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Отчеты диагностики состояния локомотива

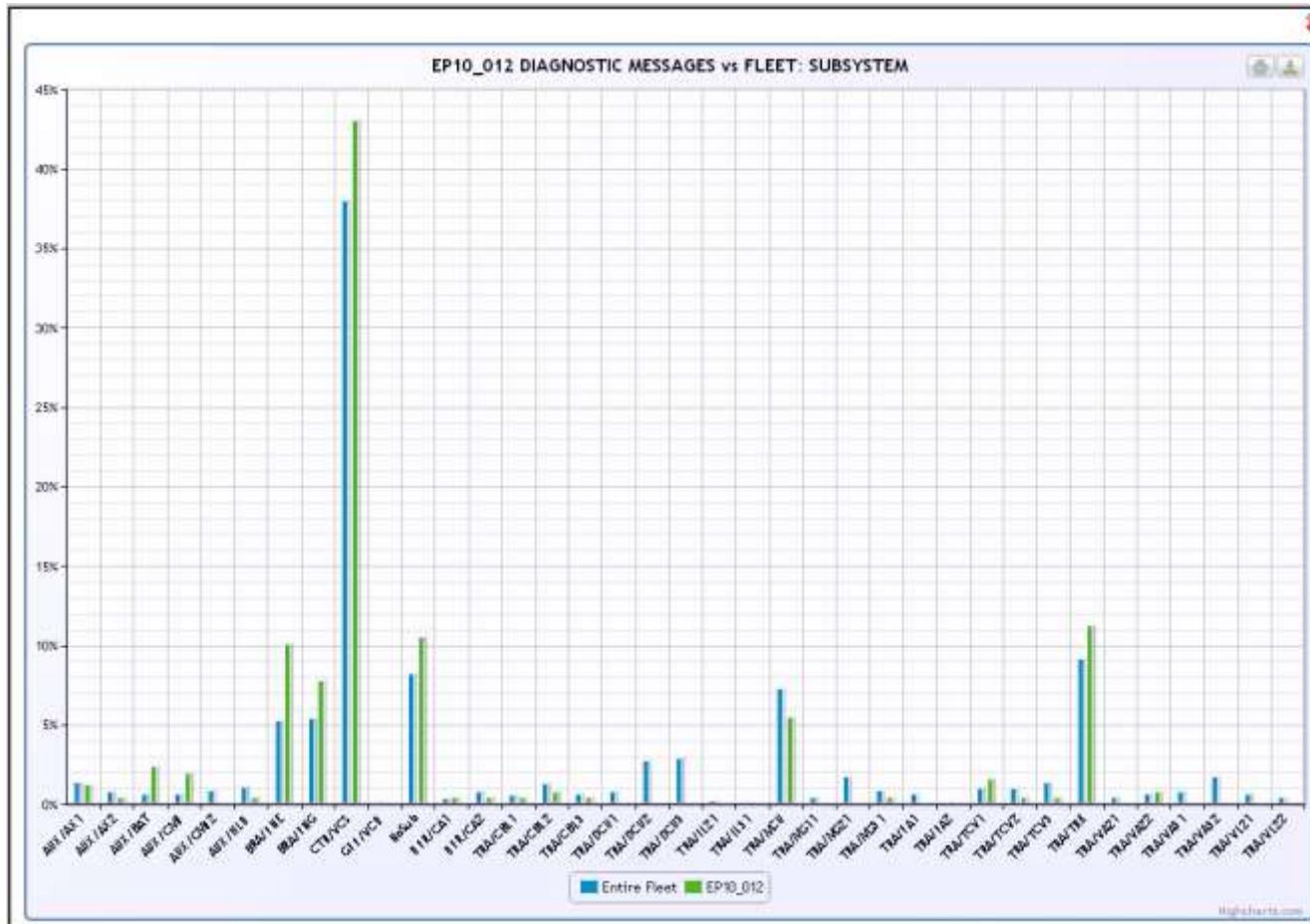
Для просмотра Отчетов диагностики состояния локомотива необходимо выбрать один из вариантов

The screenshot shows the MyBTfleet interface with the following elements:

- Header:** BOMBARDIER logo, MyBTfleet | Your web-based fleet data toolbox, Carta Saita, Kontakt, Русский, Пользователь: ep10, Logout.
- Left Sidebar:** Домой, панель, Помогите, Контакт. The "Диагностика" item is highlighted in red.
- Top Navigation:** Диагностика, Отчеты.
- Content Area:**
 - Локо диагностических сообщений vs подсистемы:** Choose Locomotive (EP10_012), Output formats: Excel, Рисовать.
 - Флот доступности (с помощью диагностики):** Choose Period (02/2013), Output formats: Excel, Рисовать.
 - Локо диагностических сообщений vs флота нормальности:** Choose Locomotive (EP10_012), Output formats: Excel, Рисовать.

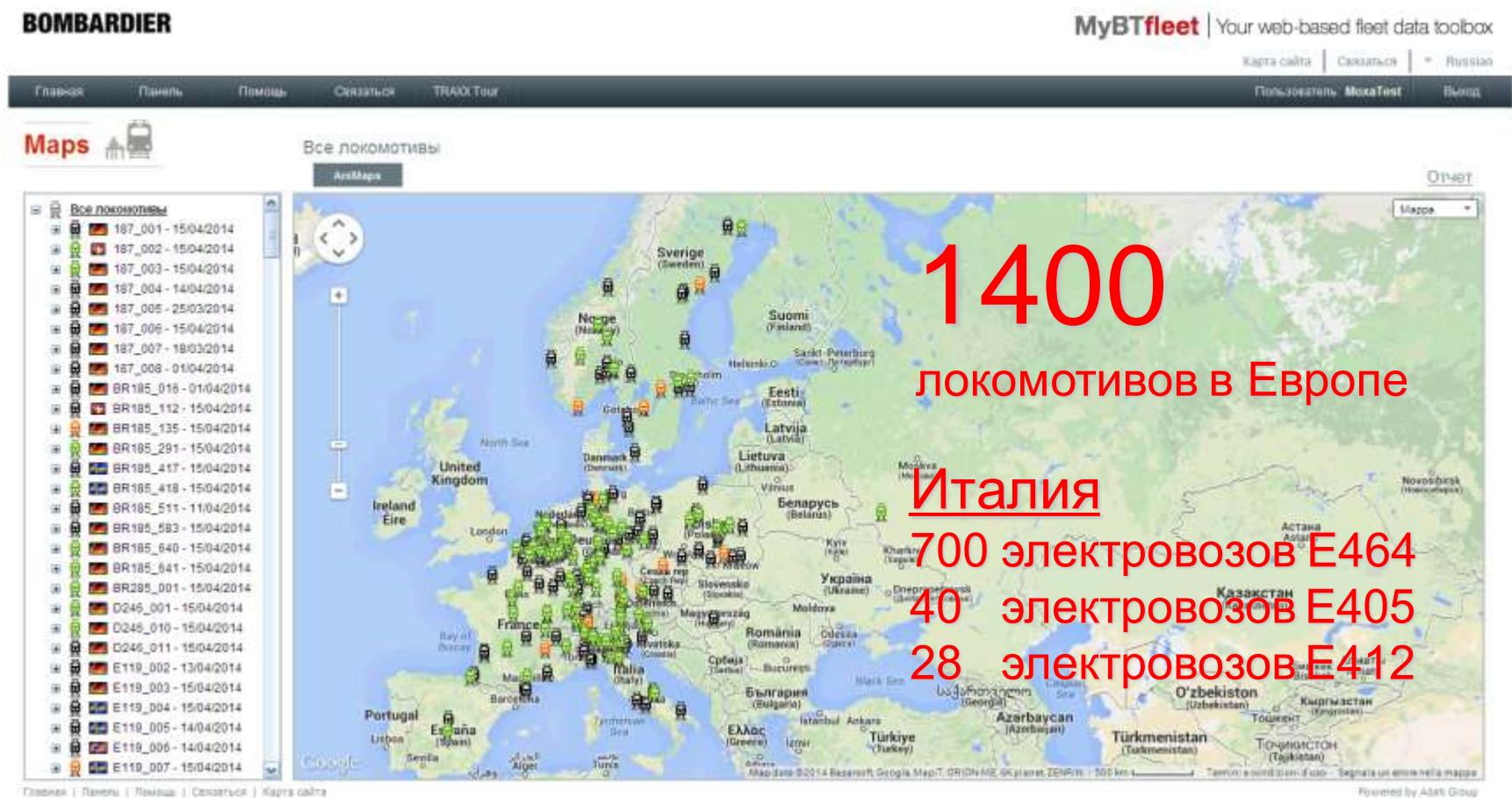
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Графическое отображение информации диагностики состояния локомотива



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Online - состояние парка локомотивов В в странах Европы

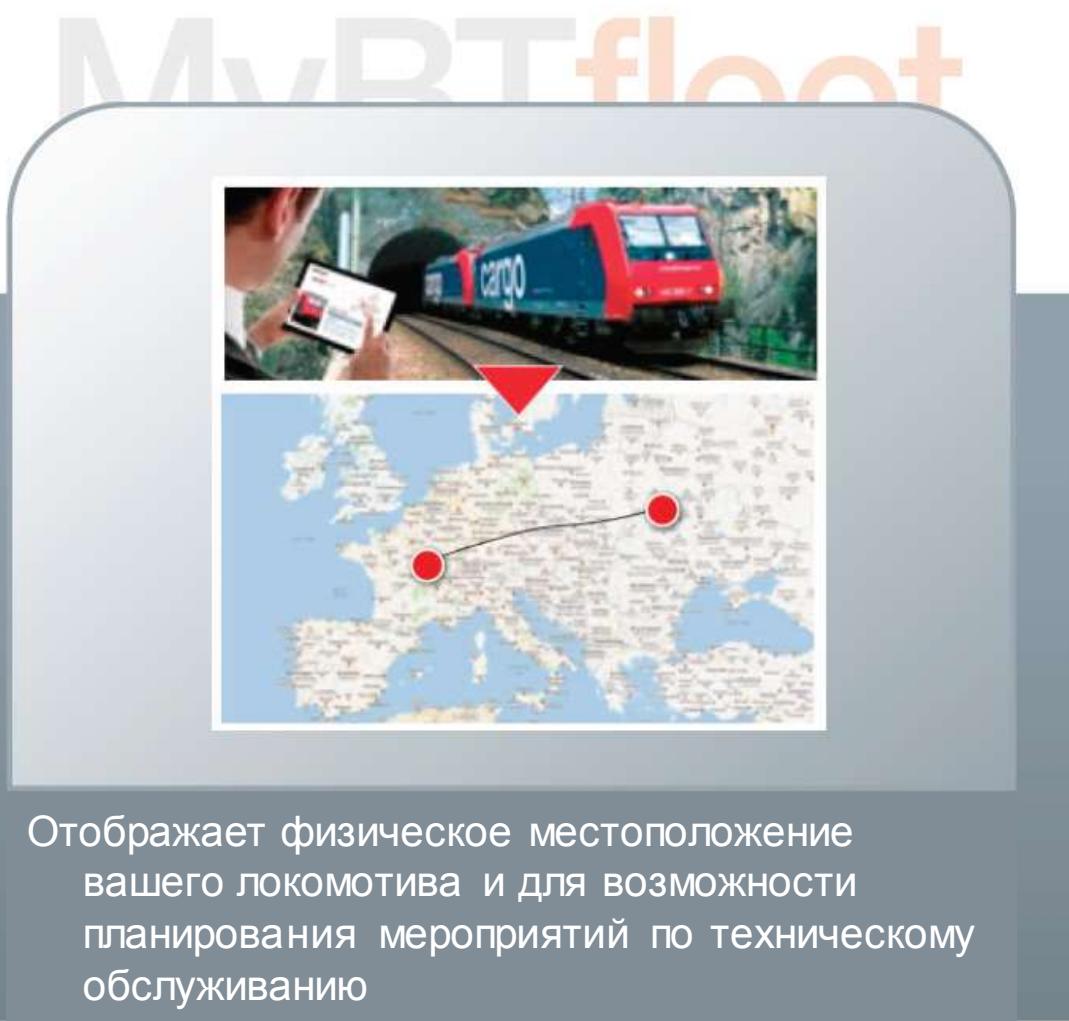


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Ваша веб-база парка локомотивов. Пример – Италия



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MyBTfleet | Your web-based fleet data toolbox
BOMBARDIER

Home | Operatore & Concessione | Help | Logout

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

Operatore | Manutentore | Indovinatore | Localizza | Prenota / Pianifica | Catalogo | Archivio | Rapporto d'intervento | Diagnistica | Campiona | Orbita

MyBTfleet – новые технологии управления парком локомотивов от Bombardier

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

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The screenshot shows the MyBTfleet web-based fleet data toolbox interface. At the top, there are three main sections: OPERATORE (Operator), MANUTENZIONE (Maintenance), and AVVISTAMENTO (Surveillance). Under each section are several sub-options: Localizza (Localization), Rapporto d'Intervento (Maintenance Report), Diagnosi (Diagnosis), Catalogo (Catalog), Cognizioni (Knowledge), and Orbite (Orbits). A large blue arrow points down from the top menu to the OPERATORE section. In the OPERATORE section, there are three buttons: Localizza (with a compass icon), Prenota / Pianifica (with a wrench and clock icon), and Contatta (with a phone icon). The Contatta button is highlighted with a red border.



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

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The image shows the MyBTfleet software interface. At the top, there is a navigation bar with links for Home, Profilo di Controllo, Help, and Logout. Below this is a main menu with three categories: OPERATORE (LocoLoca, Prenota / Planifica, Contatto), MANUTENTORE (Rapporto d'Intervento, Catalogo, DiagnosiVia), and ARCHIVIO (DiagnosiVia, Campagna, Ortafa). A large blue arrow points down from the main menu to a section labeled 'MANUTENTORE'. This section contains three applications: 'Rapporto d'Intervento' (highlighted with a red border), 'Catalogo', and 'Archivio'. Each application has a green icon and a brief description below it. The 'Rapporto d'Intervento' application is described as 'Dettagli delle Manutenzioni effettuate' and has a red button labeled 'Applicazione attivata'. To the right of this section is a large screenshot of the 'Rapporto d'Intervento' application window, which displays a detailed list of maintenance reports with various fields like Date, Type, and Description.

Отображает подробный отчет о выполненных обслуживаниях и ремонтах вашего локомотива.

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BOMBARDIER MyBTfleet | Your web-based fleet data toolbox User [LOGOUT](#) | [Logout](#)

OPERATORE Localizza Prende / Pianifica Contatti

MANUTENTORE Rapporto d'Intervento Catalogo

SISTEMI DI DIAGNOSTICA Diagnosica Campioni Orbita

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



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BOMBARDIER

MyBTfleet | Your web-based fleet data toolbox

Home | Profilo di Gestione | Help | Logout

OPERATORE

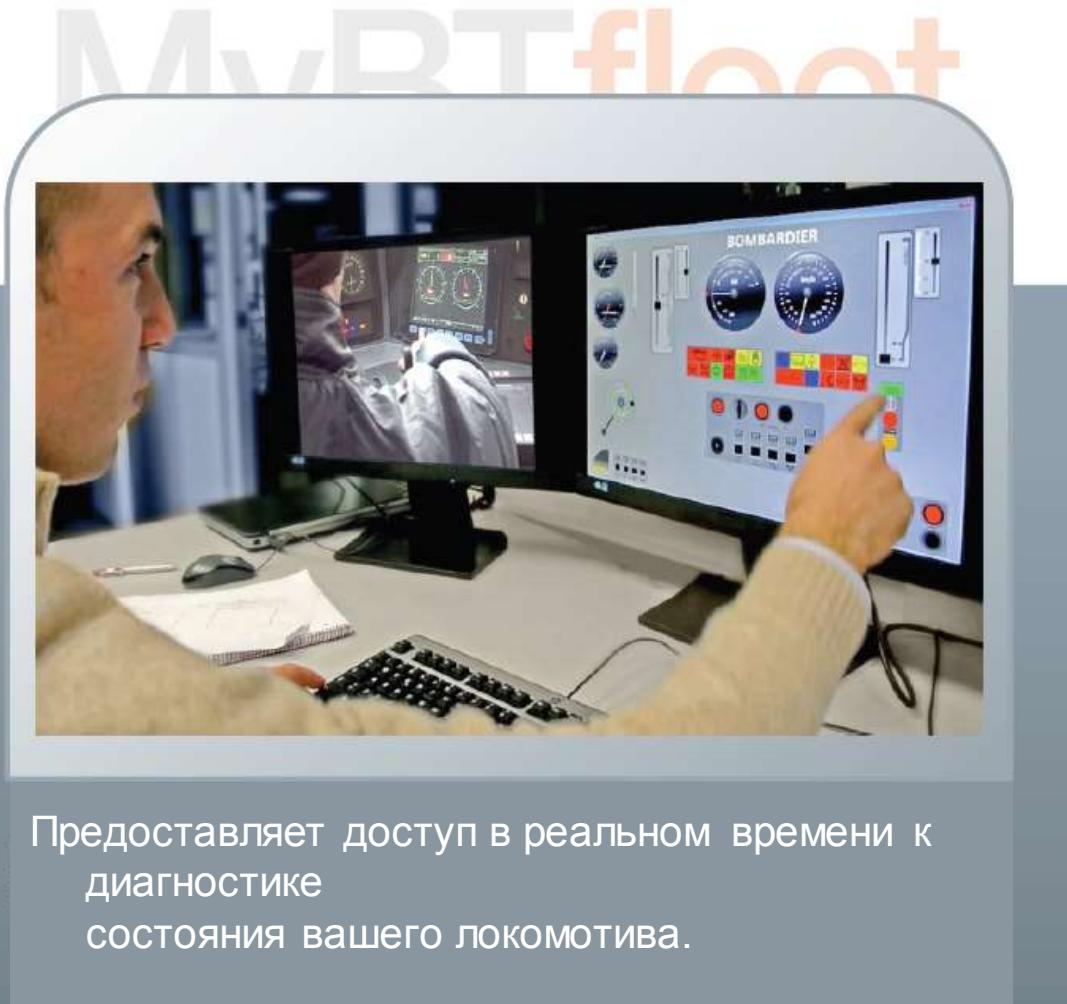
- Localizza
- Promoti / Planifica
- Contatti

MANUTENZIONE

- Rapporto d'Intervento
- Catalogo
- Archivio

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

BOMBARDIER

MyBTfleet | Your web-based fleet data toolbox

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OPERATORE

- Localizza
- Prende / Pianifica
- Contatta

MANUTENZIONE

- Rapporto d'Intervento
- Catalogo
- Archivio

INGEGNERE

Diagnostica

Stato di salute del rotabile in Tempo Reale

Applicazione attivata

Campiona

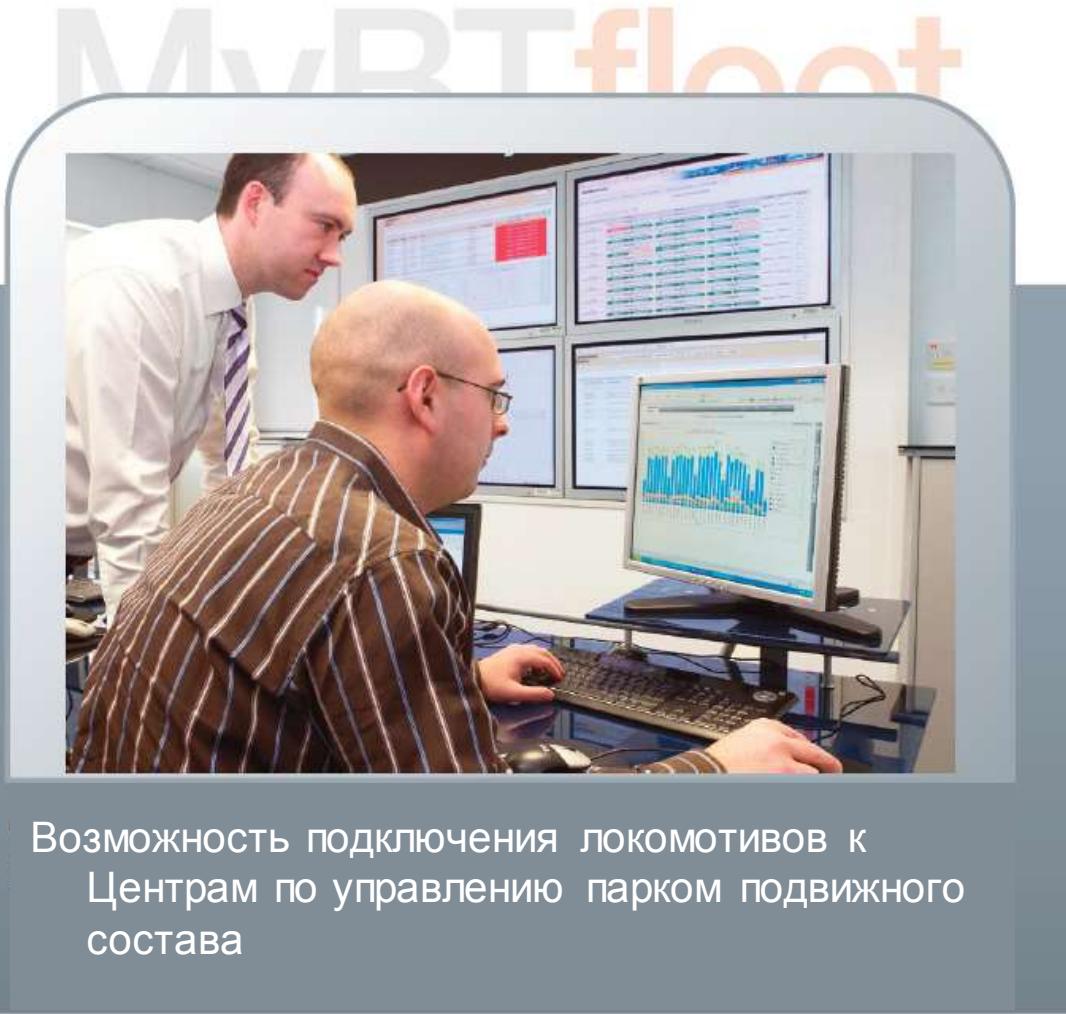
Dati operativi dei Rotabili in Servizio

Applicazione attivata

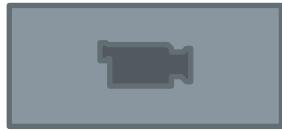
Orbita

Interfaccia Centri Gestione Flotta Bombardier

Applicazione in sviluppo



Возможность подключения локомотивов к Центрам по управлению парком подвижного состава



Video on Fleet Management

Workshop/Homework

Workshop/Homework on Digital Technologies in the Railway Industry

- **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	

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

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

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

Best Practise #	Detailed Description
1	
2	
3	

Task # 4: Digital technology in railway industry/fleet maintenance - what is MIIT University already doing today?

Detailed Description of past or current projects

Author – Organisational Abbreviation – Date [Month DD, YYYY] – Rev. x.x
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Thank you very much for your attention!



Q&A

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