Smart passenger transportation at airports

Airport Development Russia & CIS 2013
Detlef Derwenskus
Director Sales Europe, Russia and CIS
Systems Division
Bombardier Transportation
May 16, 2013
Agenda

1. Introduction to Bombardier
2. Turnkey systems
3. INNOVIA APM 300 automated people mover system
Bombardier is the world’s only manufacturer of both planes and trains, with a worldwide workforce of 71,700* people.

 Bombardier is headquartered in Montréal, Canada. Our shares are traded on the Toronto Stock Exchange (BBD) and we are listed on the Dow Jones Sustainability World and North America indexes. In the fiscal year ended December 31, 2012, we posted revenues of $16.8 billion USD.

* as at December 31, 2012 (includes 200 employees at our corporate office in Canada)
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.
### Our products and services

THE BROADEST PORTFOLIO IN THE RAIL INDUSTRY

<table>
<thead>
<tr>
<th>Rail Vehicles</th>
<th>Transportation Systems</th>
<th>Services</th>
<th>Rail Control Solutions</th>
<th>Propulsion &amp; Controls</th>
<th>Bogies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light rail vehicles</td>
<td></td>
<td></td>
<td>Fleet Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metros</td>
<td></td>
<td></td>
<td>Asset Life Management</td>
<td></td>
<td>Portfolio to match entire range of rail vehicles</td>
</tr>
<tr>
<td>Commuter trains</td>
<td></td>
<td></td>
<td>Material Solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional trains</td>
<td></td>
<td></td>
<td>Component re-engineering and overhaul</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercity trains</td>
<td></td>
<td></td>
<td>Integrated control systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High speed trains</td>
<td></td>
<td></td>
<td>Automatic train protection and operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locomotives</td>
<td>Driverless Systems: Monorails, Metros, People Movers</td>
<td></td>
<td>Interlocking systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Light rail systems</td>
<td></td>
<td>Wayside equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metro Systems</td>
<td></td>
<td>Services</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intercity Systems</td>
<td></td>
<td>Traction converters</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>E-mobility Solutions</td>
<td></td>
<td>Auxiliary converters</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operations and Maintenance</td>
<td></td>
<td>Traction drives</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Control and communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Services</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

- **Transportation Systems**
  - Driverless Systems: Monorails, Metros, People Movers
  - Light rail systems
  - Metro Systems
  - Intercity Systems
  - E-mobility Solutions
  - Operations and Maintenance

- **Services**
  - Fleet Management
  - Asset Life Management
  - Material Solutions
  - Component re-engineering and overhaul

- **Rail Control Solutions**
  - Integrated control systems
  - Automatic train protection and operation
  - Interlocking systems
  - Wayside equipment
  - Services

- **Propulsion & Controls**
  - Traction converters
  - Auxiliary converters
  - Traction drives
  - Control and communication

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

1. Introduction to Bombardier
2. Turnkey systems
3. INNOVIA APM 300 automated people mover system
Bombardier’s approach to turnkey projects

CUSTOMER BENEFITS

Turnkey projects...

- create clarity by having **one party responsible** for system delivery
- mitigate against scope and budget creep; one **fixed price** for the system
- have a shorter implementation time than “sum of the parts” procurement and a **more reliable project delivery schedule**
- focus on optimisation of the complete system rather than reducing costs over the whole lifetime of the system
- use a **“one stop shop” approach** to source skilled people
A world of experience and innovation
GLOBAL LEADER IN DELIVERING TURNKEY TRANSPORTATION SYSTEMS

Figures and statistics for systems sold as at January 2012

1 Total double lane track
2 As of October 2012
Provider and integrator for all system elements
TAILOR-MADE SOLUTIONS

System Elements

Operation and Maintenance

Civil
Fare collection
Vehicle
Signaling
Power Supply
Communications
Depot
Guideway
Radio
Stations

Vehicles
Signalling
Power Supply and Distribution
Communications
Automatic Fare Collection
Components (Bogies)
Switches
Platform Screen Doors
Operation and Maintenance
Transit Security

BOMBARDIER
the evolution of mobility
Why choose Bombardier for turnkey systems?

TOP SIX REASONS

PRODUCTS:
1. Broader portfolio in the industry and a dedicated Systems division
2. World leader in delivering Design-Build-Operate-Maintain (DBOM) turnkey systems

PEOPLE:
3. Experienced and expert people in-house to project manage the entire scope and integrate all system elements
4. Actively integrates all parties of the project, cultivating close relationships with customers, suppliers and partners

PARTNER:
5. Provides the full system package and capabilities including financing and services, to build partnerships for life
6. Most competitive whole life cost solution provider
Broaderest portfolio in the industry

OUR PRODUCTS

Complete range of services packages to maintain system safety, availability and reliability, providing total care 24/7

- People Mover
  - Airport Circulator
  - Urban Circulator

- Mid-size Metro
  - Feeder
  - Mass Transit
  - Airport Link
  - Commuter

- Monorail
  - Mass Transit
  - Airport Link
  - Feeder
  - Urban Circulator

- Tram/Light Rail
  - Urban Transit
  - Feeder
  - Road Operation

- Heavy Metro
  - Mass Transit
  - Commuter

- High Speed
  - Intercity
  - Regional
Game changing urban transportation solution
INNOVIA MONORAIL 300 SYSTEM

- Fully automated and driverless mass transit solution
- Futuristic aerodynamic design
- Speeds up to 80 km/h
- Minimised headways for highest frequency of service
- Energy efficient technologies
- High passenger capacity
- Superb comfort and ride quality
Driverless metro for efficient transportation systems
INNOVIA METRO 300 SYSTEM

- Fully automated medium capacity metro solution
- Consistent and dependable service
- Short station dwell times and rapid journey times
- Quick local vehicle construction
- Unobtrusive guideways blend into the landscape
- Low wayside noise
- Easily adapted for system expansion
- Wayside energy storage for even lower energy consumption
Agenda

1. Introduction to Bombardier
2. Turnkey systems
3. INNOVIA APM 300 automated people mover system
The INNOVIA APM 300 system incorporates 40 years of experience in automated transit operations in some of the world’s busiest airports and cities

- Fully automated, driverless transit system
- State-of-the-art lightweight aluminium carshell
- Modern interior and exterior finishing
- Easily navigates steep grades and tight horizontal curves
- Low-profile guideways
- High passenger capacity
- Superior reliability and ride quality
## Optimised system for airport and urban transit applications

### TECHNICAL OVERVIEW OF INNOVIA APM 300 SYSTEM

<table>
<thead>
<tr>
<th>Train configuration</th>
<th>1- to 6- car trains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car empty weight</td>
<td>15,200 kg</td>
</tr>
<tr>
<td>Maximum gradient</td>
<td>10%</td>
</tr>
<tr>
<td>Optimal operational</td>
<td>6%</td>
</tr>
<tr>
<td>gradient</td>
<td></td>
</tr>
<tr>
<td>Minimum horizontal</td>
<td>22 m</td>
</tr>
<tr>
<td>curve radius</td>
<td></td>
</tr>
<tr>
<td>Maximum speed</td>
<td>80 km/h</td>
</tr>
<tr>
<td>Power distribution</td>
<td>+/- 350 Vdc</td>
</tr>
<tr>
<td>Propulsion system</td>
<td>AC traction motor</td>
</tr>
<tr>
<td>Design capacity</td>
<td></td>
</tr>
<tr>
<td>- 2-car trains</td>
<td>14,500 pphpd(^1)</td>
</tr>
<tr>
<td>- 4-car trains</td>
<td>29,000 pphpd</td>
</tr>
<tr>
<td>- 6-car trains</td>
<td>43,500 pphpd</td>
</tr>
</tbody>
</table>

\(^1\)pphpd: passengers per hour per direction

INNOVIA is a trademark of Bombardier Inc. or its subsidiaries.
High flexibility and customisation
TAILOR-MADE VEHICLES

- Customisable exterior design
  - Sloped or blunt end caps
  - Paint and wrap combinations
- Immense choice of colors and materials for the interior
- Optional static and dynamic signage
- Expansive windows flush with car body
- Energy efficient design features such as LED lighting available
- Single-vehicle configuration or trains of up to six cars
Focus on passengers

VEHICLE INTERIOR

- High passenger capacity (nominal capacity of 103 per car)
- Customisable seating options
- Large windows at vehicle sides and ends
- Reduced noise and vibrations
- Bi-parting doors on each side of the car (wide door opening of 1981 mm)
- Stanchions and handrails throughout the car
- Easily accessible for passengers with disabilities (ADA compliant)
Exceptional route flexibility
GUIDEWAY CONFIGURATION

- Operates on dedicated elevated guideway, at grade, in underground tunnel, or any in combination
- Navigates steep 10 per cent grades\(^1\) and curves as tight as 22 metres
- Superstructure and running surfaces built to standard highway tolerances
- Stations can be located anywhere along the route and even integrated directly into buildings
- System expansions, including guideway extensions, stations and additional trains, can be completed with little to no disruptions to passenger service

\(^1\) Bombardier recommends a maximum six per cent grade based on ride comfort
Enhanced safety without compromised aesthetics

EMERGENCY WALKWAY

- Quick and safe passenger egress
- Easy access for system maintenance
- No need for active intervention in an emergency
Fully automated driverless operation
CITYFLO 650 TECHNOLOGY

- Capable of very short headways

- Reduced headway enables:
  - Maximised average train speed
  - Minimised train lengths
  - Minimised platform length and civil station costs
  - Optimised fleet size
  - Higher ridership

- Reduced operation and maintenance costs

- Minimised energy consumption

- Proven technology

*CITYFLO* is a trademark of Bombardier Inc. or its subsidiaries.
Minimising the environmental impact

POWER MANAGEMENT

- Intelligent power management system and sleep mode
- Dual AC traction motors provide redundancy for increased efficiency and operational flexibility
- DC Power Distribution System allows regenerative braking
- Equipped with the CITYFLO 650 ATC system for efficient driverless operation
Superior value for operators
OPERATION AND MAINTENANCE

- Highest levels of system performance
- 24/7 operation and maintenance services
- System-wide operations
  - Central control, security, fare collection, customer service and public relations
  - Manual and automatic (unattended) train operations
- System-wide maintenance
  - Vehicles
  - Wayside (track, power supply and distribution, HVAC, etc.)
  - Fixed facilities (stations, depot, stabling yards)
- Spares provision and capital asset replacement programs
- Quality, health, safety and environment controls
- Customer services
New developments in embedded diagnostic systems for vehicle subsystems and wayside systems

- Collect and analyse data
- Data trending and visualisation
- Deep visibility into performance
- Fast fault finding and resolution
## Selected O&M reference projects

**LONG TERM CONTRACTS AND HIGH AVAILABILITY TARGETS**

<table>
<thead>
<tr>
<th>System</th>
<th>Type</th>
<th>Number of Cars</th>
<th>Contract Availability</th>
<th>Contract Type</th>
<th>In Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dallas/Fort Worth International Airport, USA</td>
<td>APM</td>
<td>64</td>
<td>99.5%</td>
<td>Maintenance</td>
<td>2005</td>
</tr>
<tr>
<td>Madrid Barajas International Airport, Spain</td>
<td>APM</td>
<td>19</td>
<td>99.5%</td>
<td>Operations &amp; Maintenance</td>
<td>2005</td>
</tr>
<tr>
<td>Las Vegas Monorail, USA</td>
<td>Monorail</td>
<td>36</td>
<td>99.0%</td>
<td>Operations &amp; Maintenance</td>
<td>2004</td>
</tr>
<tr>
<td>AirTrain JFK, USA</td>
<td>ART</td>
<td>32</td>
<td>99.0%</td>
<td>Operations &amp; Maintenance</td>
<td>2003</td>
</tr>
<tr>
<td>Leonardo da Vinci International Airport, Italy</td>
<td>APM</td>
<td>4</td>
<td>98.5%</td>
<td>Operations &amp; Maintenance</td>
<td>1999</td>
</tr>
<tr>
<td>AirTrain Newark, USA</td>
<td>Monorail</td>
<td>108</td>
<td>99.02%</td>
<td>Operations &amp; Maintenance</td>
<td>1996</td>
</tr>
<tr>
<td>Frankfurt Main Airport, Germany</td>
<td>APM</td>
<td>18</td>
<td>99.65%</td>
<td>Operations &amp; Maintenance</td>
<td>1994</td>
</tr>
<tr>
<td>Tampa International Airport, USA</td>
<td>APM</td>
<td>16</td>
<td>98.5%</td>
<td>Maintenance</td>
<td>1971</td>
</tr>
</tbody>
</table>
**Why choose an INNOVIA APM 300 system?**

**SUMMARY OF BENEFITS**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Modern, attractive vehicles with customisable options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Suitable for both urban and airport circulator systems</td>
</tr>
<tr>
<td></td>
<td>Exceptional route flexibility</td>
</tr>
<tr>
<td></td>
<td>Low-profile guideways</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operation</th>
<th>Driverless system enhances overall efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easily navigates steep gradients and tight curves</td>
</tr>
<tr>
<td></td>
<td>Short headways for increased frequency</td>
</tr>
<tr>
<td></td>
<td>Unprecedented track record for safety, reliability and availability</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Passenger</th>
<th>Spacious vehicle interior</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy access</td>
</tr>
<tr>
<td></td>
<td>Comfortable ride</td>
</tr>
<tr>
<td></td>
<td>Large, bright windows</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environment</th>
<th>Low noise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zero emissions</td>
</tr>
<tr>
<td></td>
<td>Recyclable material</td>
</tr>
<tr>
<td></td>
<td>Energy saving equipment</td>
</tr>
</tbody>
</table>
Q&A
BOMBARDIER
the evolution of mobility