AGV Plattform und italo Projekt für NTV

March 2013
Francois Lacote
Agenda

1. A new piece in the high speed range

2. AGV designed for operators

3. AGV designed for passengers

4. AGV “.italo” designed for NTV
A new piece in the high speed range

The origin
A new piece in the high speed range

What was considered the future of ground transportation
A new piece in the high speed range

The TGV system: a cultural revolution

New infrastructure optimised for high speed train only

Revolution for the maintenance of the train

Full compatibility with existing lines

New protection system: on-board signalling
A new piece in the high speed range

A new architecture for the train: articulated train-set
A new piece in the high speed range

A new architecture for the train: articulated train-set

Conceived for very high speed
A new piece in the high speed range

Very high speed technology

Constant evolution for already 30 years...

maturity and experience

...but still

new ways of improvement
A new piece in the high speed range

Very high speed records: Why?

SAFETY driven by sufficient margin between research & expertise and commercial operation

1st generation
TGV Sud Est
260 km/h
300 km/h

2nd generation
TGV Réseau
300 km/h

3rd generation
TGV Duplex
320 km/h

4th generation
AGV
360 km/h

Max. speed test
Feb. 81: 380 km/h
May 90: 515.3 km/h
April 07: 574.8 km/h

Max. commercial speed

Graph showing the evolution of maximum speed and commercial speed over time:
- 1960: 1st generation (TGV Sud Est) 260 km/h
- 1970: 2nd generation (TGV Réseau) 300 km/h
- 1980: 3rd generation (TGV Duplex) 320 km/h
- 1990: 4th generation (AGV) 360 km/h
- 2000: 500 km/h
- 2010: 574.8 km/h
A complete high speed range

A global world requires a wide portfolio

**Pendolino**

- 720 Very High Speed Trains
- 440 High Speed Trains
- 20 Countries
- 31 Years commercial service
- 15+ borders

**HST**

- **tilting**
  - 155 mph
  - 250 kph

- **non-tilting**
  - 155 mph
  - 250 kph

**Euroduplex**

- **double deck**
  - 200 mph
  - 320 kph

**VHST**

- **single deck**
  - 220 mph
  - 360 kph

**TGV**

- **VHST**
  - articulated
  - 200 mph
  - 320 kph

**AGV**

- New Pendolino

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AGV revolution: A new commercial approach

Single deck new generation faces international market evolution

**High speed rail is evolving:**

- Global market, different needs, different contexts
- Mature/New operators in new/existing networks
- Single operation / Open competition

→ AGV developed 100% by Alstom for the future market

High speed in operation

Source: UIC

* TGV is SNCF trademark
AGV revolution: Outstanding technology

The challenge: the optimal single deck for the international market

**Built on Alstom’s expertise...**
- Articulated train
- Weight optimisation
- Safety

**To offer more...**
- Modularity / Capacity
- Speed
- Comfort
- Availability

**...and less**
- Operating costs
- Power consumption
- Investment per seat
- Environmental impact
Design criteria: common platform to offer wide range of versions

- Multiple configurations of speeds & accelerations ➔ modular traction

- Multiple train lengths ➔ modular traction

<table>
<thead>
<tr>
<th>Trainset configuration</th>
<th>Train</th>
<th>Length (m)</th>
<th>Std capacity</th>
<th>High density</th>
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<tr>
<td>300 kph</td>
<td>AGV 7</td>
<td>132</td>
<td>245</td>
<td>312</td>
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<tr>
<td>360 kph</td>
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<td>200</td>
<td>445</td>
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<tr>
<td>360 kph</td>
<td>AGV 14</td>
<td>252</td>
<td>593</td>
<td>654</td>
</tr>
</tbody>
</table>

Seat Pitch (mm) 1st Class 2nd Class
980 920 900
Design criteria: one train to operate in multiple contexts

- Interoperability, crossborder
- High reliability and redundancy
- Ready for multiple signalling system, including universal driving desk
- All main lines power voltages foreseen, multi-voltage configurations
Flexibility in services

**Design criteria: customer adaptation by modular configurations**

- Flexible fitting rails for seats, modular interiors, lighting...
- Different ambiances with same fixing systems
- Flexibility during lifetime, including design features to ease modernizations and refurbishments.
- Homogeneous distribution of access platforms and services areas

- Higher number of spaces
- Homogeneous distribution of doors, and all doors with passenger flow at both corridors

10 doors with even distribution

11 ambiances

17 to 23 m
Reducing operating costs

- Design application of widest experience in manufacture and maintenance:
  - More than 1000 high speed trains built
  - Maintaining TGVs and Pendolinos for decades

- Less bogies thanks to articulation:
  - 200 m conventional train has 33% more bogies than AGV
  - Bogies are 40% preventive maintenance

- Less motors thanks to PMM and low weight (articulation):
  - 200 m AGV can run:
    - at 320 km/h with only 5 motor bogies
    - at 350 km/h with only 6 motor bogies
  - PMM closed motors require less maintenance

- Enhanced maintenance engineering. Train Tracer cost optimization:
  - Predictive maintenance
  - Dormant failure detection
Operating costs: Energy

Maximum energy efficiency

- Fewer bogies, under gangways, and on even distribution
- Enhanced aerodynamics
- Lower weight (about 70 tn less than non-articulated)
- Traction efficiency (Permanent Magnet Motors)
- High power regenerative brake (same power as in traction thanks to PMM)

15-20% measured energy saving
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Safety

No compromises

* Fully articulated architecture
  - Coupling consistency anti-roll
  - Stability in derailment

* Crash Energy Management
  - Full TSI compliance
  - Full front absorption for driver protection

* Fire protection, adaptation for long tunnel operation and evacuation
  - Capability to run with on-board fire. Fire barriers up to 30 min
  - Full detection. Extinction also in passenger area
Maximized interior space for passengers

- Wider interior thanks to articulation
- Quasi-static wide gangway
- Full compliance with accessibility regulations
- Greater windows

Interior Width 2700mm
(UIC Gauge)

Gangway Width
> 1m

+ 15% of windows surface
Comfort

Technology at the service of passenger

- Articulated architecture: minimum vibrations and lateral movement
- Reduced noise, bogies under gangways and enhanced aerodynamics
- Modular acclimatization for all environments
- Flexible interiors to cover most customer requirements
**Arrive fast**

- Maximum speed can be chosen according to configuration
  - Up to 360 km/h in commercial operation
- High acceleration configurations
  - Example italo residual acceleration: 0.11 m/s² at 300 km/h with only 7.5 MW
- High power and low weight: highest specific power
  - Example: in 200 m train, up to 22.2 kW/t with only 9 MW

**Arrive on time**

- Deliver maximum punctuality. Components and Systems are designed for:
  - High reliability. Endurance tested components
  - High availability. Redundancy in key systems and components
- Maintenance optimization:
  - Predictive maintenance
  - Corrective: quick detection and short maintenance times
AGV designed for passengers

Fast and in time

Proven technologies and expertise at highest ground speeds

- AGV components tested beyond 500 km/h
- Proven Alstom expertise to master very high speed. Explored for the first time speeds beyond 500 km/h
  - Measure and validate: Aerodynamic, Acoustic, Dynamic and Vibratory phenomena
  - To continue to explore (modelisation & measurements) the field of very high speed
  - World speed record on rails: **574,8 km/h**

- Plus: AGV Pegase prototype.
  - Tests up to **360 km/h**
AGV and Eco-Design: sustainability 360°

- Low energy consumption
  - Articulated architecture, low weight (70 ton less)
  - Enhanced aerodynamics
  - Traction efficiency

- Reduced carbon emissions
  - Highest standards in manufacturing
  - Low energy consumption
  - Electric distribution: source independent

- 98% of easily recyclable materials
  - Aluminium, steel, copper and glass

- High power energy regeneration when braking
  - Up to 8 MW feedback into the grid

- Lowest noise emissions
  - Enhanced aero-acoustics
  - Same noise at 360 km/h than others at 300 km/h
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The partnership

25 AGV (+ 10 options): start of operation 2012

+ 30 years of maintenance
The partnership

Alstom high speed trains chosen by the private operators

- Low and credible LCC
- Proven technology and wide return of experience
- Rolling stock is part of a complete SERVICE
- Develop close partnership with the operator
- Understand business model and provide the tool
AGV “.italo” designed for NTV

AGV configuration for .italo

Conceived under the Technical Specifications for Interoperability

**AGV 575: “.italo”**

- **Length:** 200 m
- **Car number:** 11
- **Passengers:** 449 + 2 WCU seats
- **Commercial speed:** 300 km/h
- **Voltage:** 25 kV 50 Hz / 3 kV dc
- **Bogies:** 5 motors, 7 trailers
- **Power:** 7.6 MW
- **Specific power:** 18.5 kW/t

**ERTMS L1&L2, SCMT**
- **Universal desk**
- **Articulated trainset**
- **Distributed motorisation**
AGV “.italo” designed for NTV

AGV .italo interior flexibility

11 cars provide 11 different atmospheres

- 4 seating accommodations
- Car with / without galley
- Car with / without stand-up area
- Car with / without screens on ceiling
- One car fitted for RMP
- Car with / without food / drink dispensers
- Bar replaced by seat-service and self dispensers
AGV "italo" designed for NTV

AGV .italo: Ambience Club

- 11 leather covered seats
- Very high comfort
- 1 m seat pitch
- Individual video screens in armrests
- Dedicated galley for at-seat service
AGV “.italo” designed for NTV

AGV .italo: Ambience Club Private Lounges

- 2 Lounges of 4 seats
- Electric reclination high-comfort seats
- Booked only in-pack for privacy
- Dedicated lockers
- Individual video screens in armrests
- Leather walls for comfort and privacy
AGV “.italo” designed for NTV

AGV .italo: Prima and Prima Relax

- 143 seats in 4 cars
- 1+2 seat layout
- Wide corridor
- Leather seats
- Break area & snack galley
- 1 silent car for Prima Relax
AGV “.italo” designed for NTV

AGV .italo: Ambience Smart

- 288 seats in 6 cars
- 2+2 seat layout
- Leather seats
- Self-vending area
- 2 places for wheelchairs
- Universal accessibility
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AGV .italo: Ambience Smart Cinema

- 39 of the smart seats
- 1 car Cinema ambience
AGV “.italo” designed for NTV

AGV .italo: Fully Internet on-board

- Fully internet fitted
- Wifi in all cars
- Roof satellite antenna
- GSM repeaters
- External Internet & local Intranet server
- Cooperation with local phone provider
  - 1 car multimedia screens at seat
  - 1 car video screens on ceiling
  - All cars, full service for passengers equipped with their own device
AGV “.italo” designed for NTV

AGV and NTV achievements

Chronology:
- Contract signed in January 2008
- Prototype test in France and Velim in 2008
- Prototype test in Italy in 2010
- 1st train unveiled in December 13th 2011
- Commercial service in April 28th 2012
- 25th train delivered in March 2013

Maintenance:
- Commissioning of a new maintenance facility
- Operation start of one control room in Rome
- Train and deploy 180 expert personnel
- Prepare to deliver fleet maintenance, repairs, vandalism, refurbish...
- Launch full inspection and services 24h/7d
- Provide 21 trains available at any given time
AGV “.italo” designed for NTV

AGV and NTV achievements

**Operation:**
- Naples, Rome, Florence, Bologna, Milan, Salerno, Turin and Venice
- More than 90 round trips every day
- 25 trains put in service in 11 months
- 11 months of commercial service
- 6.4 million kilometers
- Growing ridership, 2.2 million passengers

**Performance:**
- In 10 months *98.7% of punctuality reached*
- Train availability every morning *99.8% reached*
- Reliability growth better than expected

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**NTV Fleet Availability**
February 2013: *99.8% - 1 train lost*
AGV "italo" designed for NTV

AGV and NTV achievements

AGV .italo among winners of Design Award 2013, by British magazine Wallpaper*, within the category "Life enhancer of the year", the section dedicated to projects that make life better.

THANK YOU FOR YOUR ATTENTION