



## AGV Plattform und italo Projekt für NTV

March 2013

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TRANSPORT

**ALSTOM**

# 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





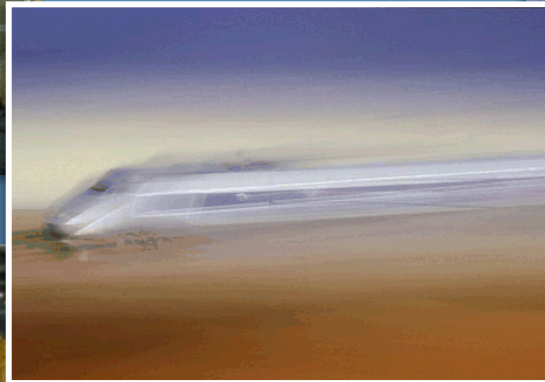
A new piece in the high speed range

# The TGV system: a cultural revolution

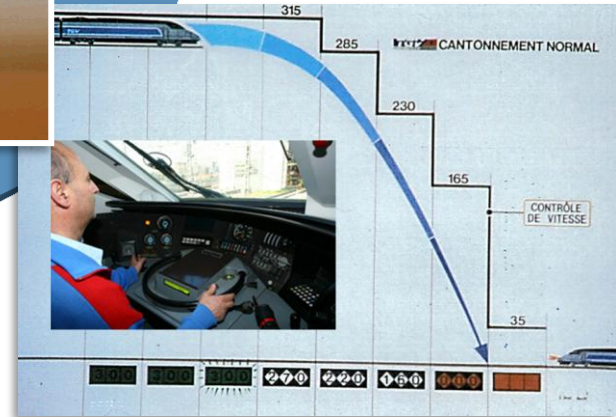
New infrastructure optimised for high speed train only



Full compatibility with existing lines



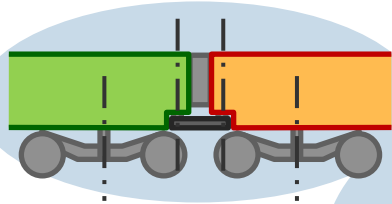
Revolution for the maintenance of the train



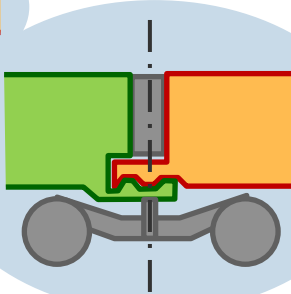
New protection system: on-board signalling

A new piece in the high speed range

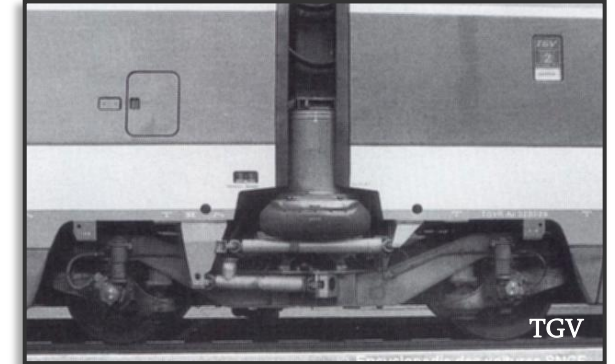
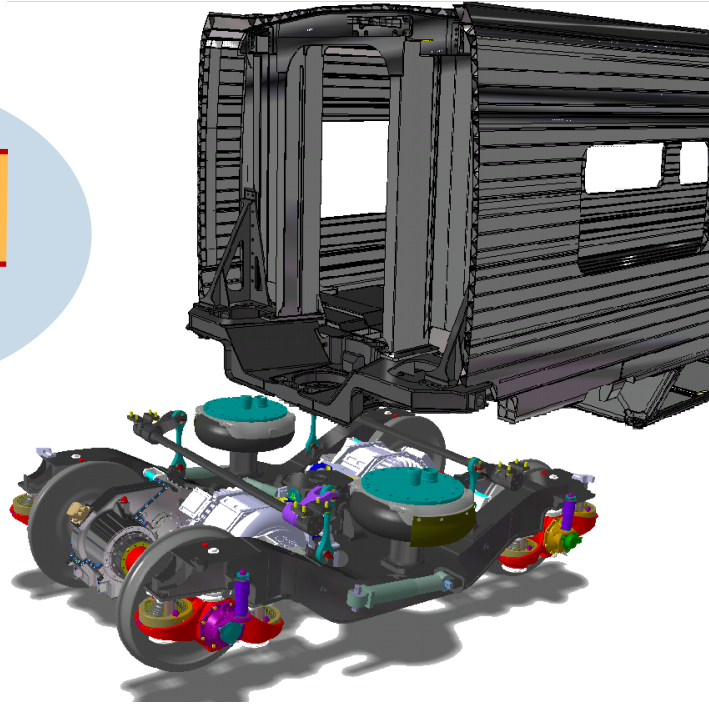
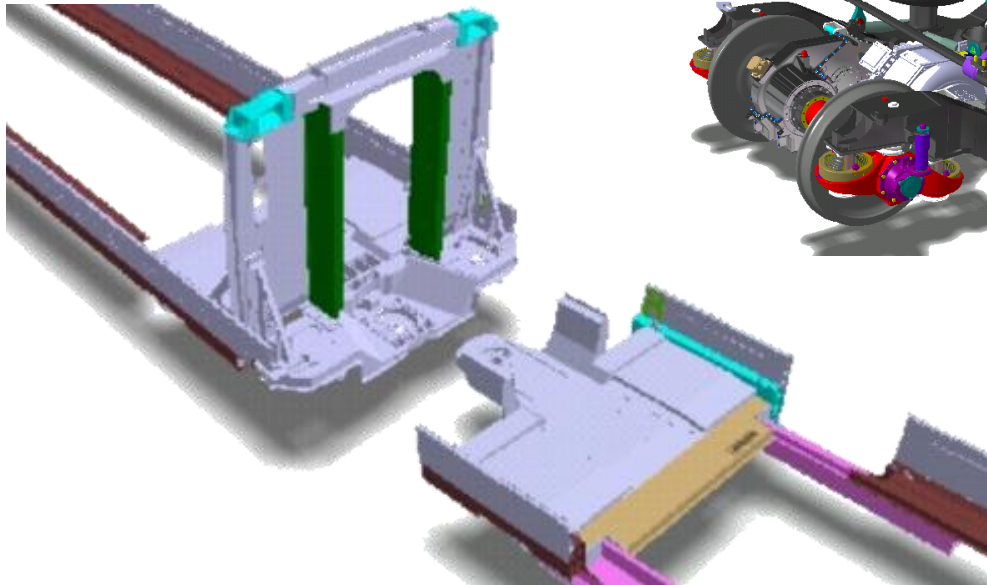
## A new architecture for the train: articulated train-set



Conventional

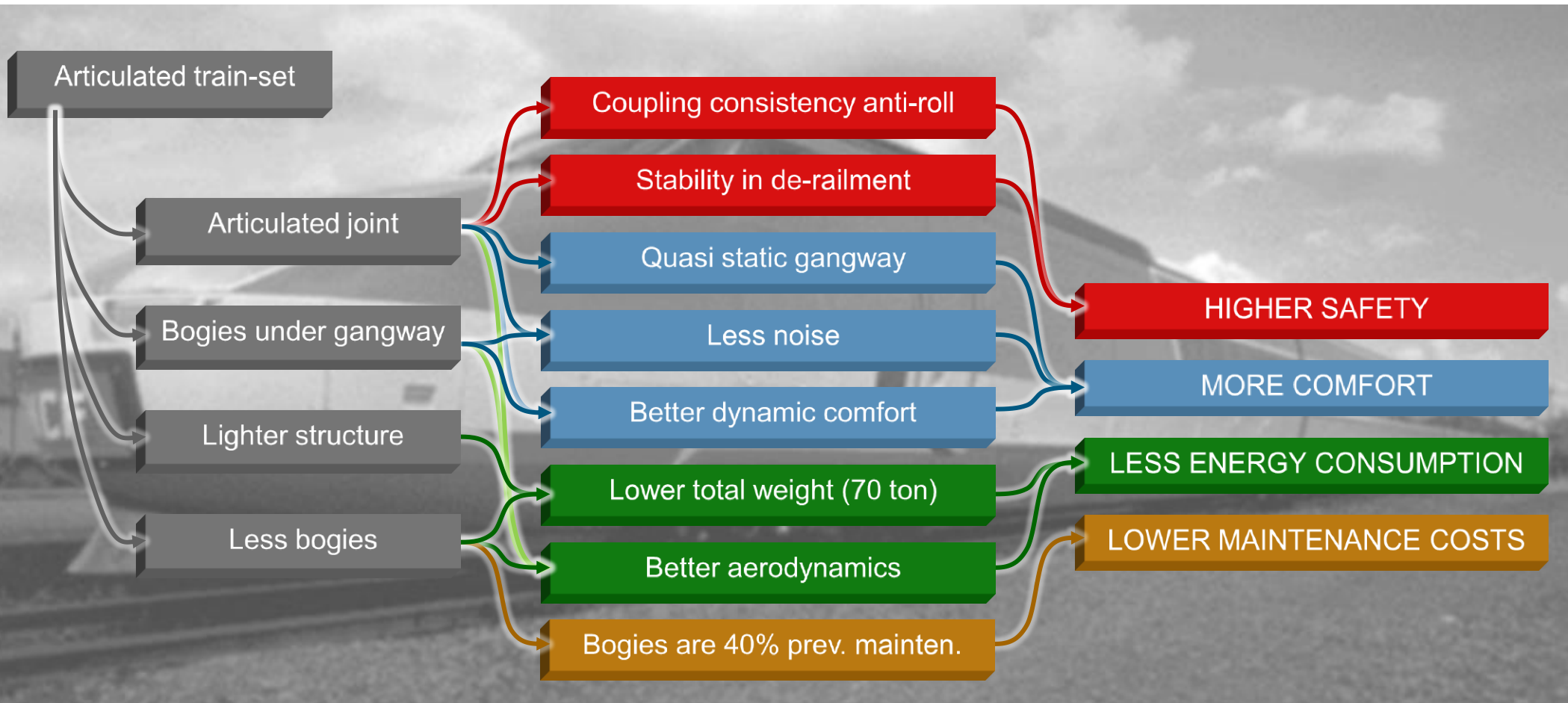


Articulated



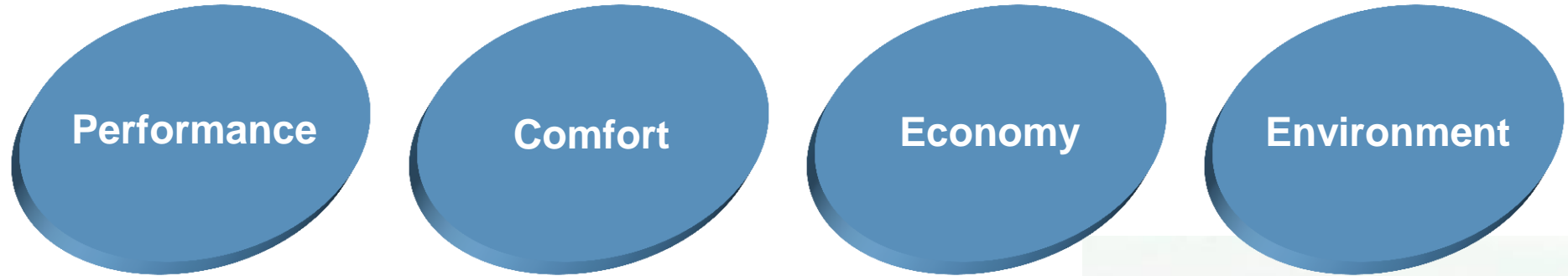
## A new architecture for the train: articulated train-set

Conceived for very high speed





# Very high speed technology



Constant evolution for already 30 years...



...but still





# Very high speed records: Why?

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

1<sup>st</sup> generation

TGV Sud Est



260 km/h

300 km/h

2<sup>nd</sup> generation

TGV Réseau



300 km/h

3<sup>rd</sup> generation

TGV Duplex



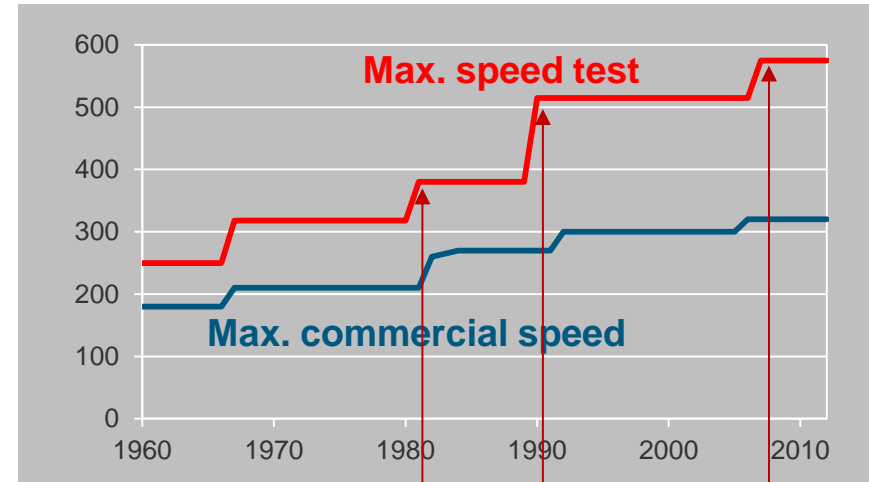
320 km/h

4<sup>th</sup> generation

AGV



360 km/h



Feb. 81:  
380 km/h

May 90:  
515,3 km/h

April 07:  
574,8 km/h

A new piece in the high speed range

## A complete high speed range

A global world requires a wide portfolio

### Pendolino



New Pendolino

**HST  
tilting**  
155 mph  
250 kph

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



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



Euroduplex

**VHST  
double deck**  
200 mph  
320 kph

### TGV



AGV

**VHST  
single deck**  
220 mph  
360 kph

# 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



# 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



# 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

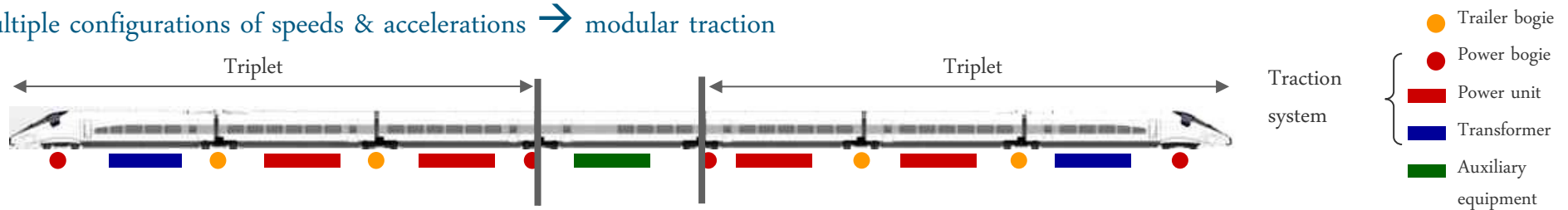
- Operating costs
- Power consumption
- Investment per seat
- Environmental impact



# Flexibility in configuration

Design criteria: common platform to offer wide range of versions

\* Multiple configurations of speeds & accelerations → modular traction



\* Multiple train lengths  
→ modular traction

Trainset configuration	Train	Length (m)	Std capacity	High density
300 kph 	AGV 7	132	245	312
300 kph 	AGV 8	149	321	378
320 kph 	AGV 10	183	374	462
360 kph 	AGV 11	200	446	510
360 kph 	AGV 14	252	593	654
Seat Pitch (mm) 1 <sup>st</sup> Class			980	-
2 <sup>nd</sup> Class			920	900



## Flexibility in operation

### Design criteria: one train to operate in multiple contexts

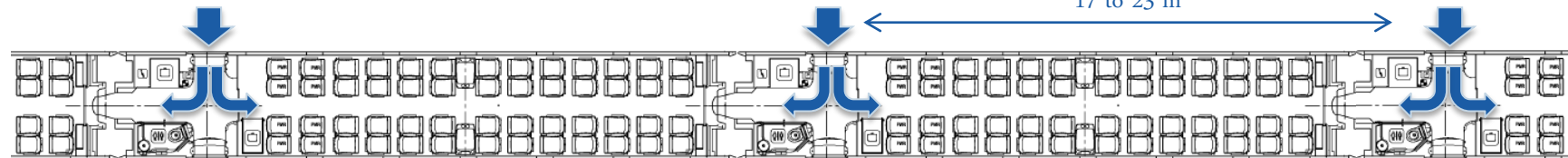
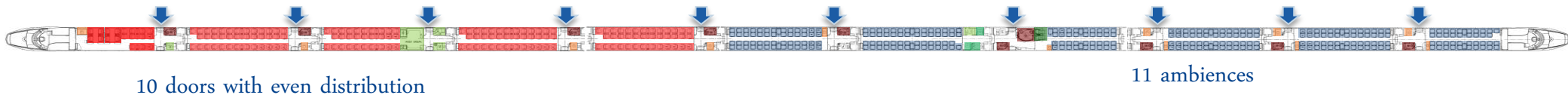
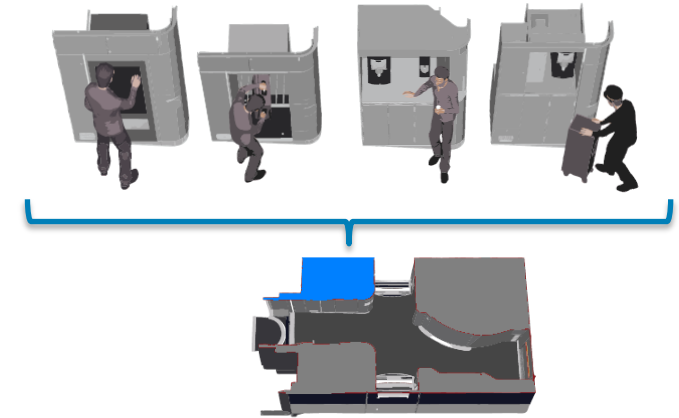
- \* Interoperability, crossborder
- \* High reliability and redundancy
- \* Ready for multiple signalling system, including universal driving desk
- \* All main lines power voltages foreseen, multi-voltage configurations



# Flexibility in services

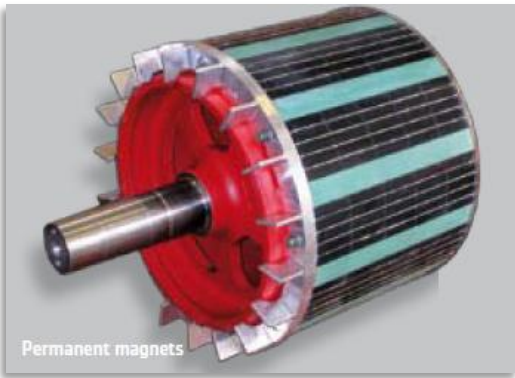
## Design criteria: customer adaptation by modular configurations

- \* 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



## Operating costs: Maintenance

### 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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2. AGV designed for operators

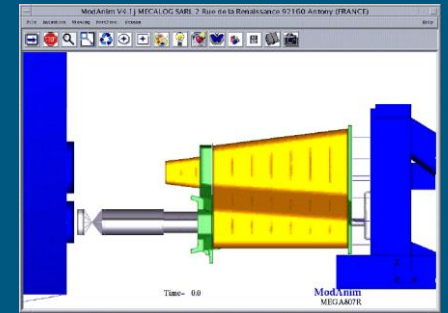
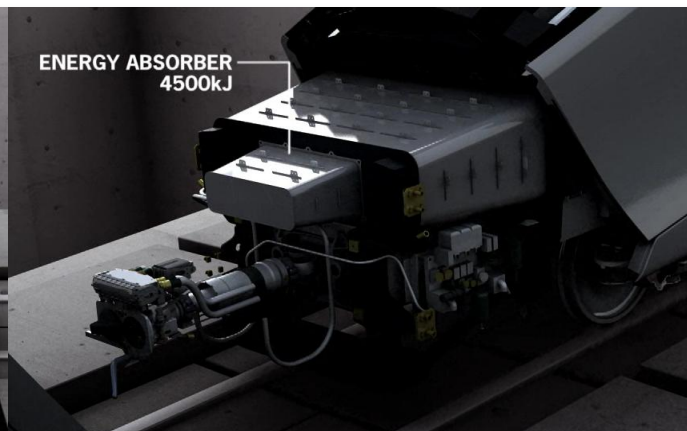
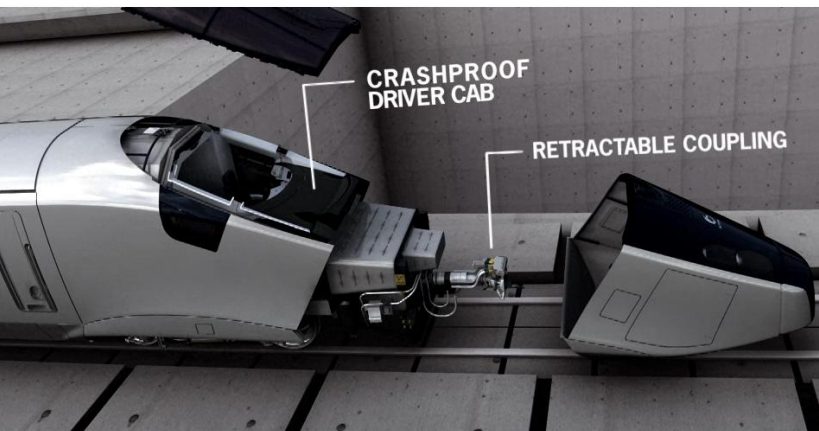
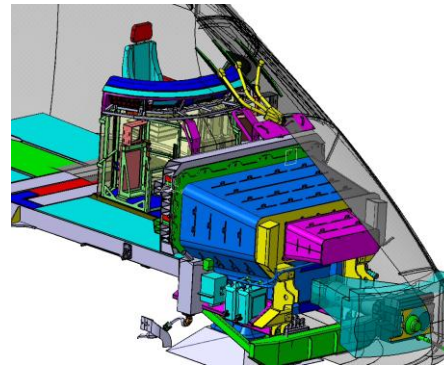
**3. AGV designed for passengers**

4. AGV “.italo” designed for NTV

# Safety

## No compromises

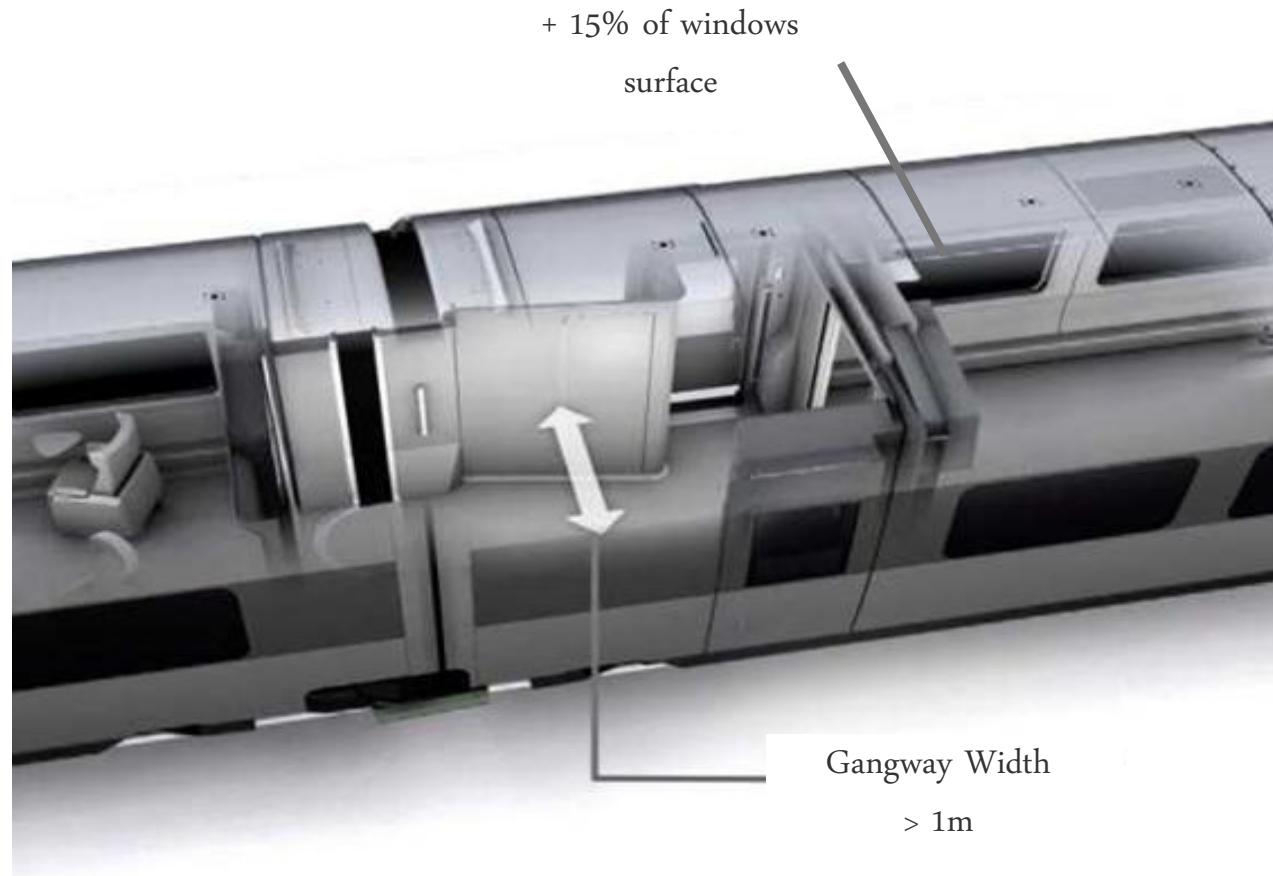
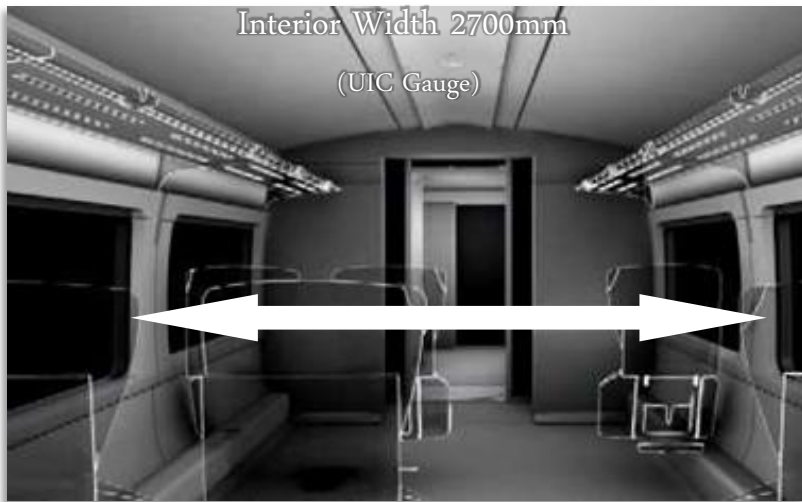
- \* Fully articulated architecture
  - Coupling consistency anti-roll
  - Stability in derailment
- \* Crash Energy Management
  - Full TSI compliance
  - Full front absorption for driver protection
- \* Fire protection, adaptation for long tunnel operation and evacuation
  - Capability to run with on-board fire. Fire barriers up to 30 min
  - Full detection. Extinction also in passenger area



## Comfort

### Maximized interior space for passengers

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

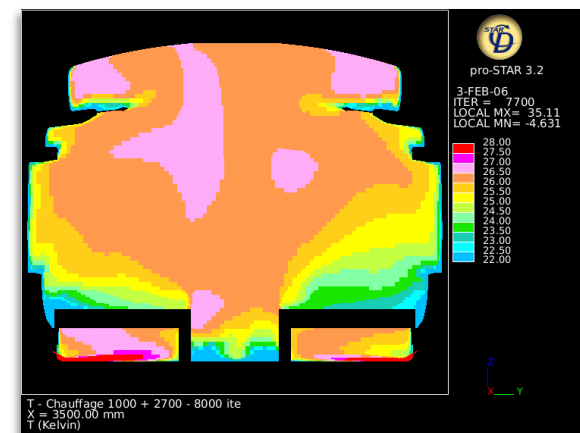
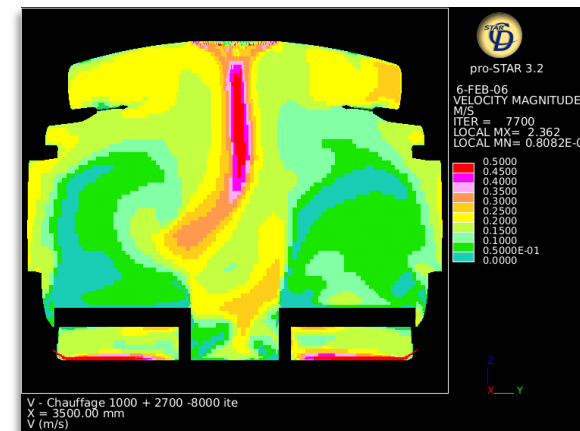




# Comfort

## 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



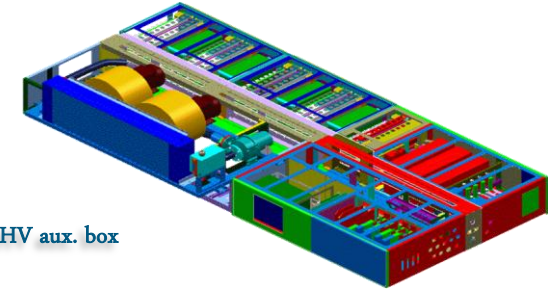
## Fast and in time

### Arrive fast

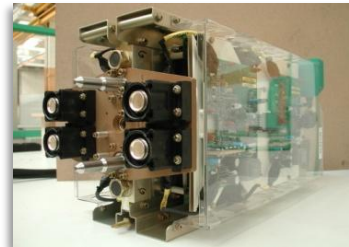
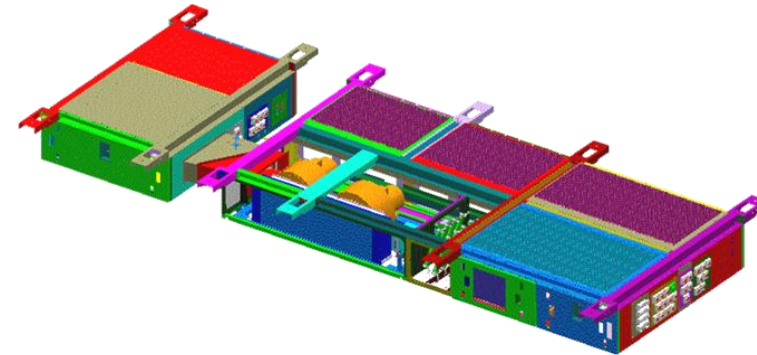
- \* Maximum speed can be chosen according to configuration
  - Up to 360 km/h in commercial operation
- \* High acceleration configurations
  - Example italo residual acceleration:  $0.11 \text{ m/s}^2$  at 300 km/h with only 7.5 MW
- \* High power and low weight: highest specific power
  - Example: 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



1,8 MW 2800 Kg  
Traction converter + HV aux. box



## 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 (modélisation & 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 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<sub>dc</sub>

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 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: 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: 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: 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: Ambience Smart



- 288 seats in 6 cars
- 2+2 seat layout
- Leather seats
- Self-vending area
- 2 places for wheelchairs
- Universal accessibility



## AGV .italo: Ambience Smart Cinema



- 39 of the smart seats
- 1 car Cinema ambience

## 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 and NTV achievements

### \* Chronology:

- Contract signed in January 2008
- Prototype test in France and Velim in 2008
- Prototype test in Italy in 2010
- 1<sup>st</sup> train unveiled in December 13th 2011
- Commercial service in April 28th 2012
- 25<sup>th</sup> 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 and NTV achievements

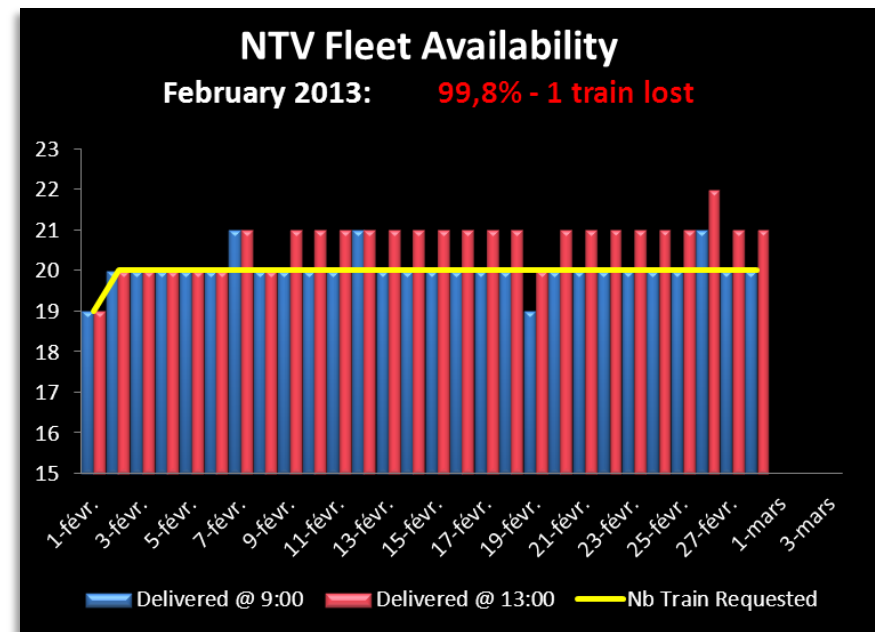
## \* Operation:

- 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:

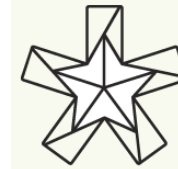
- In 10 months **98,7% of punctuality reached**
- Train availability every morning **99,8% reached**
- Reliability growth better than expected



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.



Wallpaper\*

DESIGN AWARDS  
PREVIEW 2013



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