HIGH(ER) SPEED: HOW FAST, HOW SOON?

JIM LINDSAY
04/29/2011
THREE MAIN ACTIVITIES - 96,000 EMPLOYEES IN 70 COUNTRIES

TOTAL SALES 2009/10: €19.7 BN

EQUIPMENT & SERVICES FOR POWER GENERATION

EQUIPMENT & SERVICES FOR POWER TRANSMISSION

EQUIPMENT & SERVICES FOR RAIL TRANSPORT
Multi-million dollar investments in Chattanooga, TN and Amarillo, TX will add up to 600 new jobs.
Hornell, NY Manufacturing Facilities

Plant 2 - ELECTRICAL SHOP (75,000 sq.ft.)

Plant 1 - CAR SHOP (420,000 sq.ft.)
New Car Facility (70,000 sq.ft.)

Plant 3 - PARTS, SERVICE AND TRUCK SHOP (135,000 sq.ft.)

700,000 sq. ft. under roof on 52 acres at 3 separate locations within a 1 mile radius
Alstom Signaling
Train Life Services

• 150,000 Sq. Ft. Facility
  in Rochester NY, 550
  Employees, 70%
  Engineering & Technical

• Annual Sales ($120M)

• North American Base
  for Signaling and Train
  Control Solutions with
  Satellite Offices
  Throughout NA

Alstom

• 68,000 Sq. Ft. Facility in
  Naperville

• Annual Sales ($75M)

• NA Headquarters for
  Parts, Supply Chain
  Management and
  Services.

• Additional Locations in
  Wilmington DE & Oakland
ALSTOM TRANSPORT: EXTENSIVE RANGE OF PRODUCTS & SERVICES

... AND EVERYTHING IN-BETWEEN
ALSTOM TRANSPORT: EXTENSIVE RANGE OF PRODUCTS & SERVICES
SIGNALING, SERVICES & MAINTENANCE AND INFRASTRUCTURE
ALSTOM TRANSPORT: EXTENSIVE RANGE OF PRODUCTS & SERVICES
SIGNALLING, SERVICES & MAINTENANCE AND INFRASTRUCTURE
HSR … Miles & Hours & don’t forget it takes Time to Develop!
**CONSTRUCTION SCHEDULE FOR TGV SUD EST**

(FRANCE - 242 Miles/ 390 km)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Week</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>10</td>
<td>13</td>
<td>16</td>
<td>19</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>28</td>
<td>31</td>
<td>34</td>
<td>37</td>
<td>40</td>
<td>43</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>49</td>
<td>52</td>
<td>55</td>
<td>58</td>
<td>61</td>
<td>64</td>
<td>67</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>73</td>
<td>76</td>
<td>79</td>
<td>82</td>
<td>85</td>
<td>88</td>
<td>91</td>
<td>94</td>
</tr>
</tbody>
</table>

- **PRE-CONSTRUCTION PHASE**
- **CONSTRUCTION PHASE**
- **SOUTH SECTION 275 KM**
- **NORTH SECTION 115 KM**

5 YEARS WERE REQUIRED TO DO DESIGN AND APPROVAL BETWEEN 1970 AND 1975

DUP = DECLARATION OF PUBLIC INTEREST
THE SUCCESS OF THE PARIS LYON TGV LINE 30 YEARS AGO
EUROPEAN HIGH SPEED LINES IN 2010

[Map of Europe showing new and adapted lines in 2010]
EUROPEAN HIGH SPEED LINES IN 2020

2006: 1900 MILES → 2020: 5600 MILES

European HS Network

Forecast for 2020

- New lines: $v \geq 250$ km/h
- Planned lines
- Upgraded lines: $v \leq 230$ km/h
- Planned lines
- Upgraded lines: $v \leq 200$ km/h

Information given by the Railways
UIC - High-Speed
Updated 17.11.2006 - IB

ALSTOM
Facts, Mainline Trends

High speed traffic - Development in Europe

+100 % over the last 10 years

.. And growth will speed up
In the years to come

Source UIC

ALSTOM
The US opportunities for VHSR are good.

VHS (>200MPH) backbone corridors would benefit all these densely populated areas.

FRANCE
Population: 65M
Pop. Density: 297/sq Mi.
HS ... some facts
BENEFITS OF HIGH SPEED TRAINS

VHST AN ECONOMIC AND ECOLOGIC ALTERNATIVE TO AIR TRANSPORT

Curve of the rail / air modal split
(Distances between 300 and 600 km)

% Plane

% High Speed

Rail market share (%)

Rail travel time (hours)

Source: UIC - ALSTOM
FACTS, WHY A VERY HIGH SPEED TRAIN?

HS SAVES ENERGY COSTS AND REDUCES GREENHOUSE GASES

<table>
<thead>
<tr>
<th>Mode</th>
<th>Petroleum equivalent gramme (per passenger-kilometre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plane</td>
<td>51.1</td>
</tr>
<tr>
<td>Private Car</td>
<td>29.9</td>
</tr>
<tr>
<td>Bus</td>
<td>18.3</td>
</tr>
<tr>
<td>Classic Train</td>
<td>17.6</td>
</tr>
<tr>
<td>TGV</td>
<td>12.1</td>
</tr>
</tbody>
</table>

Source: SNCF-I

"Petroleum equivalent gramme" per passenger-kilometre
DESIGNED WITH ENVIRONMENTAL CONCERNS IN MIND

**CO₂ EMISSIONS**
(per passenger per kilometre)

- AGV Automotrice Grande Vitesse
  - < 15 GR
- Bus
  - 90 GR
- Minivan
  - 180 GR
- Airplane
  - 100 GR

*HYPOTHESIS: 320 GR of CO₂/kWh in California 2020*
WHY A HIGH SPEED TRAIN?

VHST IS SAFER

<table>
<thead>
<tr>
<th>Mode</th>
<th>Kill Rate per Billion Passengers-Kilometre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airplane</td>
<td>0.27</td>
</tr>
<tr>
<td>Road</td>
<td>17</td>
</tr>
<tr>
<td>Classic Train</td>
<td>0.18</td>
</tr>
<tr>
<td>TGV</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: SNCF-I

Number of people killed per billion passenger-kilometre
WHAT ABOUT MY BACKYARD?

Land requirements are Smaller

A rail-line can carry as many passengers as an eight lane highway or more.
The capital cost to adding another 4 lanes to a highway or a HSR line are comparable.

Source: SNCF-I
HSR … What will it look like in my backyard?
Or... what will my backyard look like without HSR????
WHAT ABOUT MY BACKYARD?
Airport Connections and Economic Growth (TOD)
HSR … Equipment Options
**TGV MILESTONES**

**SIGNIFICANT WORLD RECORD**

- May 1990: 322 MPH
- 500 miles of test runs at speed above 312 MPH
- April 2007: 357 MPH

**UNMATCHED RETURN ON EXPERIENCE**

- The largest fleet in the world travelling over 180 MPH – over 50%
- Spread over the largest variety of networks, in 9 countries
- Over 1.9 billion miles service miles (more than 70,000 times the Earth circumference and 6,500 times the Moon-Earth distance)
- More than 1.8 billion passengers travelled
- Zero fatalities
A COMPLETE PRODUCT & SERVICE OFFER

VHST: TWO COMPLEMENTARY PRODUCTS BASED ON ARTICULATED ARCHITECTURE

- RECORD TRAVELLER CAPACITY FOR DENSE TRAFFIC: UP TO 1,100 SEATS OVER 400M
- COMMERCIAL SPEED 320 KM/H

TGV DUPLEX

- FLEXIBLE PRODUCT (7 À 14 CARS) FOR DIVERSESIFIED TRAFFIC
- COMMERCIAL SPEED UP TO 360 KM/H
- OPTIMISED OPERATING COSTS
- AND DEVELOPMENT BASED ON CONVENTIONAL ARCHITECTURE WHEN NEEDED (CUSTOMER REQUEST, WIDE GAUGE)

AGV

SPEEDELIA

TGV Duplex

AGV

SPEEDELIA
MANY PRODUCTS FOR VHS ON THE MARKET (V > 150 MPH)

TRANSPORTATION SPECIFICATIONS FOR INTEROPERABILITY) IS HIGHLY RECOMMENDED FOR VHS APPLICATIONS IN THE USA.

EUROSTAR
FRANCE, ENGLAND

TGV EAST
FRANCE, GERMANY, LUXEMBOURG, SWITZERLAND

THALYS
BELGIUM, FRANCE, HOLLAND & GERMANY
Many products for HS on the market (V >125 to 150 MPH)

- **TGV Duplex (France)**
- **AVE (Spain)**
- **New Pendolino (Italy)**
- **Virgin West Coast Pendolino (UK)**
- **KTX (South Korea)**
US INTERMEDIATE HS TECHNOLOGY IS NEARLY READY

EXCITING USA SOLUTIONS ARE BECOMING AVAILABLE BASED ON PROVEN TECHNOLOGY
**“INTERMEDIATE HIGH SPEED” TECHNOLOGY**

**TILTING VS. NON-TILTING:**

- Many US locations will not benefit from “tilting technology”.
- Speed of locomotive-hauled trains are often limited by the locomotive dynamics.
- Track design and maintenance must be aligned to tilting.
- VHSR does not use tilting technology...

---

**EUROPEAN STYLE “TILTING TRAINS” EMU STYLE**

**AMERICAN STYLE 100-125 MPH TRAINS, NON-TILTING**
### Incremental Speed is Part of VHS Success

<table>
<thead>
<tr>
<th>US Electrified Track</th>
<th>Vs.</th>
<th>US Diesel Trains</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VHS (&gt;150 MPH to 220 MPH)</strong> must be electrified and should form the main feeder corridors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HS (100 MPH to 125 MPH)</strong> can be done with diesel power, and obviously would have cheaper infrastructure.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Global technology can be transferred to USA for VHS application.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Incremental HS solutions are available in the USA.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
“INTERMEDIATE HS” AND “VHS” TECHNOLOGY

DOUBLE DECK CAN INCREASE LINE CAPACITY:

- SNCF’S SUCCESS WITH VHS LED TO INCREASED CAPACITY DEMANDS ON MANY LINES.
- TODAY SNCF PURCHASE ONLY DUPLEX TRAINS.
- FUTURE DEMAND INCREASE TO BE CONSIDERED

US STYLE 100-125 MPH DUPLEX INTERCITY TRAINS

FRENCH TGV DUPLEX
“INTERMEDIATE HS” AND “VHS” TECHNOLOGY

PASSENGER SAFETY IS PARAMOUNT:

- High Speed Rail: The safest mode of transportation
- Trainsets to be designed and tested to ensure:
  - Car shell design integrity
  - Proven articulated cars with trucks between cars (enhanced rigidity) for VHS.
  - Crash resistance / impact resistance
  - Safety design of passenger compartment interiors
- Automatic Train Control (ATC) is imperative.
INCREASED CUSTOMER COMFORT: A MUST

ON-BOARD LAYOUT

- More space on board: comfort of travel including work zones, areas for socializing such as lounges, and leisure zones.
- Accessibility: for reduced mobility. (wheelchairs, pushchairs, elderly, luggage... all need to be able to get on board effortlessly. Multiplication of the number of access points, the end-to-end low floor, and filling of the gaps between the platform and the train make access and getting around in and between the coaches easier.
- Lighting ambiance resultant comfort elements: development of fibre optics lighting fabrics, vary ambiance between zones.

PASSENGER INFORMATION

- Real-time passenger information systems
- Real-time automated announcements with updates via wireless networks
- IP-based networks, wireless LAN, wireless WAN

PASSENGER ENTERTAINMENT

- Wi-Fi Internet, Train TV and m-Services
- IP-based networks, wireless LAN, wireless WAN
THE ENVIRONMENT: IMPROVED BY MODERN RAIL SOLUTIONS.

DESIGNING TRAINS FOR BETTER LIVING

- Optimized train mass and technology reduce energy consumption:
  - 4 to 6 times less energy than a car,
  - Less CO₂ emissions.
- Improved “recyclability” of up to 98%:
  - Use of biomaterials
  - Use of “clean” renewable materials
  - Dismountable assemblies needing few consumables
- Noise reduction both internal and external by 10 decibels:
  - Improved noise levels of individual sub-assemblies
  - Improved insulating materials
  - Improved acoustic dampers on trucks
- Extended lifetime (> 30 years)
PTC and High Speed Rail

ALL PASSENGER LIFE IS IMPORTANT, ON THE NEC, IN THE WEST A

- ALL SOLUTIONS ARE > 79 MPH, SO ENHANCED ATC SOLUTIONS ARE REQUIRED
- REQUIRES A VITAL COLLISION AVOIDANCE SYSTEM (EG. ERTMS / ACSES / ACES)
- RAIL SAFETY BILL HR 2095 REQUIRES PTC TO BE INSTALLED BY 2015.
- PTC DEFINITION URGENTLY REQUIRED TO ENSURE MINIMUM SAFETY LEVELS ARE ENSURED.

INFRASTRUCTURE AND CARBONE EQUIPMENT