DIGITAL DESCRIPTION OF RAILWAY INFRASTRUCTURE IN THE EUROPEAN SIGNALIZATION CONTEXT

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Agenda

SNCF Réseau & Harris

ETCS Project

• A European initiative
• ETCS implementation in France

Data ETCS, an SNCF Réseau program

• Overview
• The Esri/Harris solution

Conclusion
SNCF Réseau

**1 SIGLE STATE-OWNED RAILWAY COMPANY**

**SINCE 1 JANUARY 2015,**

SNCF RÉSEAU

manages the French railway system:

- 2,024 km of high-speed tracks
- + 800 km of additional track planned in 2017

15,000 daily trains (freight and passenger)
250,000 tonnes of merchandise
More than 5 million passengers per day

52,000 employees
1,000 km of renovated railway lines

7 million rail paths allocated each year

Centenary infrastructures, national heritage

AND IN THE FUTURE?

2019:
The French railway system will be OPENED UP TO COMPETITION
Complete Earth observation, weather, geospatial, space protection, and intelligence solutions from advanced sensors and payloads, ground processing, and information analytics

Commercial Customers

DigitalGlobe  exactEarth  Dewberry

iridium  SiriusXM

SNCF RÉSEAU
From sensors and software to actionable information, our solutions and products help you make informed decisions – when and where they are needed

- Off-the-shelf and custom solutions for advanced geospatial analysis
- Tools for hosting and managing distributed data processing in a high-performance computing environment
- An online marketplace that puts the best commercially available geospatial data and imagery at your fingers
- Innovative Geiger-mode LiDAR sensor to collect faster and at 10x the resolution of traditional LiDAR
- Value-added services (VAS) to give you actionable information
European Train Control System (ETCS), guarantees a common control system that enables trains to cross national borders and enhances safety.

- Promoted by the EU Commission, and specified for compliance with the High Speed and Conventional Interoperability Directives

- Unify the multiple signalling systems in order to:
  - Enhance safety
  - Increase competitiveness of the railway sector
  - Better inter-operability of freight and passenger rail services
  - Stimulate the European railway equipment market
  - Reduce costs and improve the overall quality of rail transport

*Installation of “Eurobalise” transponders to exchange with the train’s on-board equipment*
ETCS Levels

ETCS is specified at four different levels:

- **Level 0**: ETCS-compliant locomotives interact with lineside equipment that is non-ETCS-compliant.

- **Level 1**: ETCS is installed lineside and on board; spot transmission of data from track to train via ETCS Eurobalises

- **Level 2**: Same as level 1, with continuous ETCS data transmission by GSM-R and a control of train movement from the ground

- **Level 3**: Same as level 2, but train location and train integrity supervision no longer rely on trackside equipment
ETCS Level 1

**ETCS1 combines:**

- A continuous speed control in safety
- An on-board signalization displaying:
  - Real speed of the train
  - Permitted speed, permanent synthesis of:
    - The maximum speed of the train
    - The speed of its category (respect of TIV and RT)
    - The LTV (Temporary Limit Speed)
    - The speed allowed to maintain a target speed (stop or slow) at a target distance (TIV or Signal)
  - Punctually other driving information (ex: signs respect)

*The stopping point (EOA) is located at 1120 m downstream*
SNCF Réseau is the owner and principal manager of the French national railway network

SNCF Réseau takes care of:

• Maintenance and renewal of national railway network
• Traffic management of all trains using the national railway network

SNCF Réseau manages ETCS implementation in France
SNCF Réseau ETCS planning:

- Current status: “Phase 1”
  - Longuyon-Bettembourg-Bâle Axis
  - 376 km
  - ETCS level 1

- Next Step: “Phase 2” : Extension – 1 800 km

- PROJECT : “Phase 3” : classic network deployment – 13 600 km
ETCS implementation in France: Phase 1

Considered as a national issue

- Originally 2,200 km of lines in France with ETCS 1 on the European Corridors 2 and 6

- Step 1: Pilot Phase
  - Development of ETCS1 adapted to the constraints of the RFN and
  - Deployment on 2 pilot sites (2x20 km): 110 signals
  - Transition with Luxembourg and Belgium

- Step 2: Longuyon-Bâle
  - 376km / 1250 signals
  - Crossing of 3 railway nodes: Metz, Strasbourg and Mulhouse
  - Transition with Germany and Switzerland

Recent demand to equip the conventional network with ETCS level 2
## Data ETCS: a SNCF Réseau program

### Objective
Provide accurate and safe information of the railway infrastructure to ALSTOM in charge of designing ETCS system and installing corresponding Eurobalises

### Solution
A digital factory based on three chains (two independent ones for production and one for control) to deliver a railway representation

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<th>Output</th>
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<td>Geo-located Remote Sensing Data &amp; Business Schemes and Documentations</td>
<td>Digital Representation of Railway infrastructure and signalization</td>
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An accurate Railway network digital description

- Position and geometry of the railway track
- Railway infrastructure (signs, KVB, crocodile …)

Different sensors/ vectors

- LiDAR & Imagery
- Train & Helicopter
- Post-acquisition: Drone & Fixed scanners
Production Chain 1: Esri/Harris solution

SNCF Réseau (RFF at this time) tender in 2015

• Vector post-processing software based on rail imagery (laser) and vertical terrestrial imagery (360 °) and associated services

Esri/Harris solution

• One integrated software
• Automated extraction of railway features
• Post-processing QA/QC Tools
• Downstream processing to enrich the description of the signalization assets
Railway track extraction

LiDAR & Imagery

Business Signalization Schemes

ArcGIS

Railway track and centerline extraction (ENVI)

Railway referential
Conclusion

ETCS and SNCF Réseau

- Two pilot sites of 25 km are currently operational
- The Longuyon-Bâle axis is planned for 2020 / 2021
- ETCS project is considered as a digital transformation pilot scheme applied to the signalization engineering business

Esri/Harris Solution, an operational platform

- Easy to use and customize
- Robust to various LiDAR acquisitions
- Next development phase: automated object extraction with Machine Learning