SBAS 2015 Workshop
Canberra - Australia

EGNOS for Rail
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Rationale

Australian railway sector represents a strong opportunity to deploy SBAS services and bring in a new generation of railway products & solutions:

- Obsolescence, heterogeneity and lack of standards of train signalling and control systems increasing exploitation, maintenance costs and risks.

- Need to improve the productivity of the supply chain in freight/mining sector through cost effective and integrated operational solutions.

- Geographical environment (low density lines, and long distance in non-urban environment) makes very competitive the satellite based solutions for communication and train control.

- Open market capable to deal with new technologies/solutions if they are competitive and bring in an added value.

- Presence of private companies capable to support innovative solutions if they allow productivity gains, costs saving and increase of reliability and safety.
Market Needs: Freight Sector

- **Improve rail management capability, safety and competitiveness**
  - Centralised management of train movements.
  - Complete automation of the train operation.
  - Automatic train protection
  - Increase capacity
  - Overall integration and optimization of the supply chain

- **Reduce operations and maintenance costs**
  - Reduce track side equipments

- **Projects**
  - Rio Tinto;
  - Roy Hill,
  - FMG Ltd
  - BHP Billiton
Market Needs: Passenger Sector

- Australian Government’s Nation Building investment of $50 million into the first stage implementation of an Advanced Train Management System (ATMS) on the Australian Rail Track Corporation Interstate network, to improve:
  - rail network capacity,
  - operational flexibility,
  - train service availability,
  - transit times, rail safety and system reliability.
PTC (Positive Train Control):

- PTC is an enforcement equipment (overlay system)

- PTC protects against:
  - Train-to-train collisions
  - Over-speed derailments
  - Incursions into established work zone limits
  - Movement of a train through an improperly aligned wayside switch

- Many implementations but two major technical architectures have emerged:
  - ACSES: Advanced Civil Speed Enforcement System
    - uses track-embedded transponders as primary means of train position determination
  - I-ETMS: Interoperable Electronic Train Management System
    - uses of GPS as the primary means of train position determination

- PTC seeks to lower infrastructure deployment costs
ERTMS/ETCS

- In the last years, the EC policy has been focused on the concept of interoperability, to allow trains to easily cross state borders without experiencing problems for the different signaling standards utilized in the different countries.

- Main outcome of this policy has been the development of the ERTMS (European Rail Traffic Management System), which is mainly composed of:
  - The ETCS (European Train Control System)
  - The GSM-R (Global System for Mobile Communications Railway)

- ERTMS solutions have been exported to several markets in the world (China, Australia, Brazil) thanks to the considerable benefits associated with the underlying concepts:
  - Increased capacity,
  - higher reliability,
  - improved safety for passengers.
EGNOS added value for Railway

EGNOS is an overlay system that provides:

- an enhanced navigation function to GPS users
- an enhanced integrity function

EGNOS is certified for Safety of life services in aviation

- System design compliant with safety standards
- System operations certified
EGNOS/SBAS use for railway

- **Global coverage**
  - Unified solution for an ANZ country

- **Increase accuracy**
  - GPS performances: around 10 meters
  - EGNOS performances: around 1 meter

  Without requiring additional wayside equipment as DGPS or GBAS

- **Reinforce safety**
  - Protection level: ensure that real position is within a protected level range (meters)
  - Time to alert: notification of satellite failure in 6s

- **Enhanced robustness**
  - Transmission of Ionospheric corrections to users receiver.
Way forward

- **EGNOS applications for Railway is under experimentation in EU**

- **Evolution of ERTMS/ETCS standards to include GNSS**
  - GNSS is in the roadmap of ERTMS (part of ERA evolution program)
  - Several EU programs (Shif2Rail, NGTC, SBASRail,..) are targeting this objective

- **Set-up a collaboration between Railway and GNSS industries through a stepwise approach**
Step 1: EGNOS Rail Test Bed in Australia

ARGN: Australian Regional GNSS Station Network

**Speed:** System Platform for Egnos Evolutions and Demonstrations

EGNOS Navigation Overlay Frame
EGNOS Rail Test Bed in Australia

- **Objectives:**
  - Assess SBAS Performances in a real railway operational environment
  - Assess SBAS services for Automatic Train Protection Systems
  - Assess SBAS solution added-value for Australian-like markets
  - Validation and Enhancement of APS products using SBAS services

- **Main concepts:**
  - Reuse of already deployed GNSS sensor stations network in Australia
  - GNSS Data collection and Processing by SPEED platform (EGNOS emulator)
  - Dissemination of EGNOS Navigation Message through an existing TLC network
  - Processing of the EGNOS NOF and GPS SiS by Train receiver

- **Fast and Light deployment:**
  - Reuse of existing assets and test facilities should allow a cost effective solution
  - Deployment could be achieved in around 6 months
Summary

1. Australian railway sector represent a very relevant application and opportunity for deployment of Satellite based services to support train control systems.

2. The SBAS approach can optimize the existing railway control solutions (ETCS/PTC) to increase capacity, improve reliability and reduce OPEX cost.

3. EGNOS system due to its strong maturity reached in the aviation domain, can provide an effective solution to meet the railway safety and performances requirements.

4. Thales Alenia Space thanks to its major role on EGNOS/GALILEO and deep involvement in several European initiatives targeting the usage of satellite based services for railway could help to:
   - Support the evolution of ERTMS/ETCS standards to include satellite based services into system solutions and products that Australian market could benefit.
   - Support the deployment of SBAS initiatives in Australian to demonstrate the added-value of the proposed approach in real railway applications
A train is an aircraft which is permanently landing....
Thank you for your attention

Jean POUMAILLOUX
Navigation System Architecture Expert
Thales Alenia Space, Business Line Observation, Exploration and Navigation
Email: jean.poumailloux@thalesaleniaspace.com
Tel: +33 5 34 35 47 65
Mobile: +33 6 23 69 22 63