RAIL and SATELLITE

Role and Contribution of the Space Agency

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SOGEI Workshop
GNSS technology advances in a multi-constellation framework
Italy has recently set up a Space Economy Strategic Plan as an instrument to design a new sustainable national space policy.

This Plan details the long term objects of national positioning (2030) in the global Space Economy market. It recognises the importance of downstream activities to sustain space systems.

It defines the action lines and the necessary resources to allow the necessary development initiatives.

It establishes a new integrated model of intervention based on combined efforts at national, regional and private level.
The Italian Space Agency, in order to foster and guarantee effective solutions Applications and Services, is promoting the integration of satellite technologies NAV, COM, EO:

*Galileo Programme and its precursor EGNOS;*

*The national wide band communication satellite programme;*

*The earth observation programme COSMO-SKYMED, high resolution, dual mode imaging system.*
Projects financed to start RAIL Applications

ASI has financed RAIL application projects such as:

**RAMPS – Railway Augmented Multisensor Positioning System**

**PEGASUS (Platform of Enhanced Gns receiver for Application in Sol User Segment**

and in the frame of ESA ARTES 20 Integrated Applications Programme has financed rail applications projects like:

**3INSAT - TRAIN INTEGRATED SAFETY SATELLITE SYSTEM**

A project aiming at developing and validating a new satellite-based platform (a multi sensor Location Detection System using GPS, GLONASS, EGNOS and Galileo with the objective to guarantee the stringent safety requirements of SIL4, and on the telecommunication part, will select and implement an integrated SatCom (e.g. mobile satellite services) and terrestrial (e.g. TETRA, public GSM) system able to guarantee full coverage along the rail tracks) to be integrated into a ERTMS system.

**SBS-RAILS - SPACE BASED SERVICES FOR RAILWAY SIGNALLING**

Objective of the feasibility study is to determine the technical feasibility and economic viability of an integrated satellite navigation and satellite communication solution complementing the ERTMS signalling system.
ERSAT : 3InSat Test Site – Olbia-Cagliari railway

3InSat features for satellite assets validation on the test site:

- **Total length**: approximately 50 km
- **Double track**: to test train localization on parallel tracks
- **Satellite localization system** at SIL-4 level
- **Multi-bearer TLC network**
- **Augmentation network validation**
- **Test Procedures validation**
- **Independent assessment** by a NoBo (Italcertifer)
Major Objective: Identify satellite products capable to support the needs for transport sector automation in fields as aeronautical, maritime and terrestrial transport.

A roadmap has been identified for the RAIL transport sector: specifically for the ERTMS evolution.

The railway system ERTMS-ETCS (European Train Control System) is evolving to include GNSS and the communications based in IP protocol.

The reference scenario is the one established by the ERA (European Railway Agency), which foresees the use of satellite technologies in the evolution plan of the ERTMS.
Among the 5 major strategic innovations of the ERA ERTMS evolution Plan it includes the satellite technologies in the 3 main new functionalities:

- ETCS Level 3 (with the train integrity)
- TLC (with the hybrid solutions cellular-satellite)
- Localisation (with GNSS).

Synergy with the Joint Undertaking Shift2Rail, co-funded by the H2020 programme, is fundamental, in order to promote rail technology innovation.

The economic advantage for the railway operators induced by the satellite services of telecommunications and localisation is the reduction of infrastructures along the tracks, without change the safety level (SIL4) granted by the ERTMS system.

Further, the reduction of operational costs would contribute to the sustainability of the low traffic lines.
A national roadmap, taking over the results of the European projects GRAIL and SATLOC and the indications of the rail community, starts with the projects 3InSat, ERSAT and SBS-RAILS, foreseeing the following main activities:

- Standardization, Validation and Certification Activities to include GNSS and Satcom in the ERTMS platform (started with European initiatives NTGC UNISIG (FP7), Shift2Rail (H2020))

- Assessment and pre-industrialization (TRL 7-8) of a GNSS localisation system to implement a virtual balise function compatible with the requirements being established by the NGTC WG (PEGASUS, RUNE/GRAIL, 3InSat contribution)

- Close monitoring of the European projects under GSA responsibility RHINOS and STARS aimed to study new rail standards for the use of GNSS.

- PILOT Projects for development and validation of new satellite products compatible with the ERTMS evolution.
The PILOT Projects are aimed to launch technological developments and test beds for GNSS and SATCOM, in line with RFI programme which include authorization process from the Italian Agency for Railway Safety (ANSF):

- Extensive use of the Sardinia test bed, developed with 3InSat project, supported by simulation and verification tools and platforms to characterize the railway environment;
- Solutions for interferences and along track disturbances mitigation;
- Solutions of High Integrity Positioning (using multi-GNSS Constellations);
- Satcom Antennas with high reliability;
- Multipath Routers for hybrid communication networks (satcom and cellulares);
- Technological solutions for "delay tolerant“ networks in railway environment.
Major industrial partners involved so far are: ANSALDO STS, Radiolabs, Telespazio, Sogei, Trenitalia, RFI, Bocconi, Quascom.

ASI Agreement with Sardinia Region for exploitation of ERSAT activities.

ASI, in coordination with the Ministry of Transport, is discussing with France to start cooperation on railway applications, with the aim to promote EGNOS evolution and ERTMS evolution.

Close interactions with GSA are undertaken on the topic.

Collaboration with Germany has been started within the 3InSat and ERSAT projects with DLR.
Other Cooperations

ASI Cooperation with the Istituto Italiano di Navigazione

- To Sustain the Institute in the divulagation action, promoting the use of satellite technologies in the navigation world, in the various transport modalities.
- To Sustain the Institute in the activity of promoting and diffusion of space services towards the public administrations interested to navigation, as well as promoting the industrial activities in the transport applications.
- To Sustain the proposals of partnership programmes towards the H2020 European Research Programme.

Potential future Cooperation with ESA for a new GNSS programme including the downstream development