

SYMPOSIUM ON INTEGRATED APPLICATIONS (B5)  
Integrated Applications End-to-End Solutions (1)

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INTEGRATED SPACE SOLUTIONS FOR RAILWAY SIGNALLING APPLICATIONS (3INSAT)

**Abstract**

The main objective of the European Space Agency Integrated Applications Promotion (IAP) program is to foster the development of sustainable user-driven services integrating multiple space technologies. This paper provides an overview of 3InSat demonstration project, which makes use of Satellite Navigation and Satellite Telecommunications technologies to the benefits of railway undertaking and operator. User community and their needs, the selected technical solution, the innovative elements and the operational prospects are discussed. The 3InSat project's goal is to develop a satellite-based train control systems, based on the ERTMS-ETCS (European Rail Traffic Management System - European Train Control System) standard, by integrating Satellite Navigation and Satellite Telecommunications with existing terrestrial infrastructure keeping the overall signalling system safety level in line with the SIL-4 certification requirement, minimizing fixed and operational costs through the reduction of track-side circuitry and equipment to the largest possible extent. The 3InSat project was initiated by Ansaldo STS (Italy), with the participation of the Italian railway undertaking RFI (Rete Ferroviaria Italiana) which contributes to the User Requirements Definition and provides a test train to validate the system on a 50 km railway line in Sardinia (Italy). The project consortium is also composed of Radiolabs, TriaGnoSys, DLR, AZD and an International Notify Body (Italcertifer) taking care of the railway certification procedure aspects. The 3InSat project aims at developing a Location Determination System (LDS) to compute the train position by using the GNSS signals (GPS, GLONASS, GALILEO, BEIDOU), the augmentation information for integrity monitoring and the data from other sensors (Inertial Navigation Systems (INS) and tachometers). The scope is to introduce the concept of virtual balise into the ERTMS-ETCS standard maintaining the required SIL-4 safety level. The system will make use of existing Satellite Based Augmentation Systems (SBAS), where available, and will deploy Track Area Augmentation Systems for Integrity Monitoring in regions out of the SBAS footprints. The Satellite Telecommunication solution will be developed to be

used as alternative or complementary to terrestrial systems using the GSM-R (Global System for Mobile Communications – Railway) standard.