SMALL SATELLITE MISSIONS SYMPOSIUM (B4)
Small Satellites Potential for Future Integrated Applications and Services (4)

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ENHANCED SATELLITE AIS PERFORMANCES THROUGH AN OPTIMIZED SPACE SEGMENT DESIGN

Abstract

The Automatic Identification System (AIS) is a maritime safety and vessel traffic system developed by the International Maritime Organization (IMO) and the International Telecommunications Union (ITU). It is used by ships and traffic services to identify and locate vessels, using VHF data link to transfer packets data about identification information from AIS equipped vessels. The system assists in collision avoidance in situational awareness and also providing location and additional information on buoys and lights. However, as being a terrestrial-based system, the actual AIS is limited to identify vessels up to 40 nautical miles far from the coasts.

A recent study of an European consortium, (TPZ, Carlo Gavazzi Space, Edisoft, Elman, ITS) led by Telespazio and co-financed with ESA, has investigated about the possibility of receiving AIS signals (i.e. AIS transmissions of vessels equipped with regular AIS transponders) from space with improved performances with respect to the current literature thanks to an optimized mission design and enhanced technical capabilities mainly in terms of antennas and signal processing. After consolidating the requirements provided by the user community, the study has achieved the definition of a technically optimized space-based AIS system compliant to the consolidated user requirements and with associate a sustainable business model. Following the global space-based AIS system design, the design of a possible mission, representing the first element (i.e. one or two satellites) of the full AIS constellation to be implemented, has been performed.

The optimization is mainly focused on the satellite constellation architecture and the receiver design, in order to maximize the probability of detection of the ships from space within a specified time interval.

This paper describes the main results achieved under this ESA AIS System Study and CGS internal research activities regarding the Space Segment design.

The satellite constellation has been optimized, accordingly to the revisit time required, in terms of number of satellites, geometry of the pattern, orbits parameters (e.g. altitude and inclination), related platform dimensions and complexity. Several constellation patterns were analysed and compared and a final trade-off defined the high level architecture.

Moreover, a flexible innovative AIS receiver has been designed, able to decode and detect the AIS messages transmitted by the ships covered by the Antenna FoV of a LEO satellite. The receiver has been analysed in terms of architecture, algorithms and antennas types and number.

Finally the performances achievable with the proposed system are described.