IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Space-Based Navigation Systems and Services (5)

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MEOSAR-NG: A POWERFUL NEW CONCEPT FOR SEARCH & RESCUE FROM MEO

Abstract

COSPAS-SARSAT is an international satellite-based Search-And-Rescue (SAR) system, which is dedicated to the reception and positioning of emergency beacons anywhere on the Earth in order to aid coordinating rescue efforts for people, vehicles and facilities in distress. This is achieved by evaluating the time and the frequency of the beacon signal upon arrival at a SAR transponder, which can be used to determine the relative distance and velocity of the sender if sufficient data points are available.

Current elements of the COSPAS-SARSAT system in geostationary and lower Earth orbit are being vastly expanded with the MEOSAR component on new GNSS satellites such as Galileo, which combines good coverage characteristics with high detection and localisation performance. Contemporary emergency beacons transmit their distress signal in UHF at a frequency of 406 MHz. Current generation MEOSAR transponders, which are based on a transparent payload architecture, relay the received UHF distress signals, perform up-conversion to L-band and transmit this L-band signal back to ground. On Earth, the so-called Local User Terminals (LUTs) are responsible for the reception of the downlinked signal and the estimation of the beacon position by determining the Time-of-Arrival (ToA) and Frequency-of-Arrival (FoA). Combining multiple ToA and FoA measurements in the Central Location Processor (CLOP) enables the position determination of the distress beacon and subsequent generation of the alert data.

MEOSAR-NG is a proposed new generation space segment. Instead of merely forwarding received beacon messages it decodes them on board. ToA and FoA are computed by the satellite payload and then sent to ground on an L-band carrier. Moving complexity into the space segment has huge advantages in the ground segment. Instead of large MEOSAR receiving ground stations with multiple parabolic dish antennae the signal can be received by a handheld unit. Furthermore, an optional storage and bulk download feature allows archiving all received beacons for later analysis. Finally, filters will be implemented on-board to reduce misuse of the system and to avoid malicious or accidental spamming.

In this paper, the overall functionality of the MEOSAR-NG system architecture will be presented, including the characteristics of the space segment, ground segment and user segment as well as the corresponding interfaces. An analysis of the overall traffic model related to distress beacon activations will be presented, followed by a discussion of advantages and disadvantages of the MEOSAR-NG innovation and a way forward.

This work was performed in the frame of an ESA contract.