

SYMPOSIUM ON INTEGRATED APPLICATIONS (B5)  
Tools and Technology in support of Integrated Applications (2)

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MARITIME SURVEILLANCE BY MEANS OF SYNTHETIC APERTURE RADAR IMAGING  
COMPLEMENTED WITH AIS INFORMATION**Abstract**

Maritime security and environmental protection is becoming a crucial aspect of next years. In this ambit, the European Maritime Safety Agency (EMSA; [www.emsa.europa.eu](http://www.emsa.europa.eu)) plays a leading role on matters such as pollution caused by ships and maritime traffic security, providing the SafeSeaNet services, i.e. a centralized in-formation system which tracks ships on the basis of position reports delivered by Automatic Identification System (AIS). AIS, the coastal maritime safety and vessel traffic system developed by the International Maritime Organization and the International Telecommunications Union (Recommendation ITU-R M.1371-3, 2007), is under analysis to be extended to offshore vessels by means of constellations of LEO AIS. Maritime security is also under consideration by ESA in the framework of the European crisis response space architecture (paper IAC-10.B5.1.9) to comply with different issues: counter piracy actions, tanker accident monitoring and rescue support in the Arctic region. Greidanus (Satellite Imaging for Maritime Surveillance of the European Seas; in Remote Sensing of the European Seas, Springer, 2008) gives an important summary of spaceborne imaging potential with respect to maritime surveillance and identifies Synthetic Aperture Radar (SAR) as the key technology to detect ships. SAR enables ship imaging thanks to their appearance as bright dots over a dark image. SAR is also able to detect ship wakes as a couple of bright/dark lines, which supply information about ship heading. In addition, the inherent nature of SAR image creation leads to a displacement of the ship with respect to its wake, which depends on ship velocity. Performance of ship imaging depend on ship size and on radar characteristics, such as polarization and incidence angle. With this background, this proposed paper focuses on maritime surveillance by using current and/or foreseen spaceborne SAR system to detect ships, adequately supported by AIS information to select legal ships and identify potential alarms. In particular, a preliminary assessment of existing Earth observation constellation capabilities is presented and an adequate AIS constellation is identified in order to fulfil typical AIS requirement along with the "synchronicity" with the imaging system. Then, an analysis of ship detection algorithms is provided in order to identify most promising ones, which are finally validated on data from COSMO/SkyMed mission. In particular, some crucial parameters are estimated, such as detectable ship length, acceptable clutter level in the image, capability of ship velocity and heading retrieval.