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THE NARAS APPROACH TO EARTH OBSERVATION AND GNSS DATA FUSION TO IMPROVE  
NAVIGATION RISK ASSESSMENT**Abstract**

With the increased frequency of shipping activities, such as tourism and transport of freights, navigation safety has become a major concern. Even if new technologies have already supplied aids to pilots for navigation risk reduction, the International Maritime Organisation (IMO) reports that the majority of accidents could have been avoided by providing suitable input to the navigation decision-making process — this is where Earth Observation data can represent complementary information, to improve traffic monitoring and guidance along safe routes. NARAS is an ESA project carried out by S.A.T.E. (as prime contractor), MARIN and Planetek Italia, aiming at the improvement of safety in critical maritime operations. This is attained through the extraction of Preferred Routes for ships (described by environmental-dependent trajectories with space-time way-points tolerance), using Big Data techniques on large sets of Automatic Identification System (AIS, ship positions obtained from GNSS—Global Navigation Satellite System—receivers) and Vessel Traffic Service (VTS, marine traffic monitoring systems established by harbour or port authorities) data. In an autonomous shipping scenario, vessels navigate following prescribed routes, adaptively changed based on risks and environmental conditions. GNSS and its augmentation systems will represent the key enabling technology to attain safety of navigation, especially considering systems providing accuracy and integrity information. However, they may not be sufficient to assure such safety when ships are not using good quality GNSS receivers, or when they switch off positioning systems. Also, “non-collaborative” objects (ships/objects in the sea not transmitting AIS), such as natural and artificial debris, may represent possible hazards. Therefore, the combined use of SAR and optical Earth Observation (EO) data will increase available information and could provide support to vessel detection. NARAS aims at expanding the Preferred Route concept by exploiting the combination of EO and GNSS to improve navigation risk modelling, provide near real-time updates on preferred routes

for navigating ships and, in view of future applications, also raise early warnings and provide input for ships trajectories optimisation. The usage of the combined EO/GNSS information can provide fundamental support either for the shore assisted navigation or, in the future, for ships' autonomous navigation. In this contribution, the results from the analysis performed in the framework of the NARAS project are presented, demonstrating the improvements of the security in traffic monitoring deriving from the adjustments to the preferred paths assigned to ships in that area, based on the evolution of the traffic conditions by detecting the non-collaborative objects.