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INTEGRATED MONITORING OF REFUGEES IN THE MEDITERRANEAN SEA WITH SMALL SATELLITE CONSTELLATIONS

Abstract

In the last two decades, intense immigration phenomena have occurred in the Mediterranean Sea. Some of the most exploited routes originate in North Africa and terminate in the southernmost Italian islands and shores. Dangerous vessels, adverse weather, diseases, and traders' cruelty have led to nearly 20,000 recorded deaths. The total death toll is not known but, without any doubt, is even harsher.

Currently, the Southern Mediterranean surveillance relies on ground-based information, air and sea patrols, and reports from fishery vessels. These methods have limited range (cannot see over the horizon), required good weather and daylight conditions, and, as for the case of the patrols, they are subject to constraints imposed by territorial waters. As a result, monitoring a relatively small portion of sea requires a considerable amount of resources (namely, men and means).

Satellites represent a competitive assets that can be integrated in this surveillance system and fill its gaps. In this work the use of satellites equipped with both synthetic aperture radars and optical payloads is proposed to monitor the portion of Mediterranean Sea ranging from Lybia to Sicily. The former allow for an all-condition, wide-area search for undetected vessels, whereas the latter are used for tracking the detected vessels through acquisition of images samples over the estimated vessel position.

We prove that the efficiency of the whole rescue chain can be significantly improved trough an integrated scheduling of satellites acquisition and route planning for ground assets, such as Search-And-Rescue (SAR) ships, helicopters, and drones that are already being used for this purpose. Earlier studies [Topputo et al, 2015] put into evidence that reducing times between acquisitions reduces in turn uncertainty about vessel position, thus increasing chances for an effective monitoring, so improving situational awareness and SAR chances of success.

New constellations with very large number of small satellites for Earth observation are being proposed and are foreseen to be launched in 2016-2018. The use of these in place of institutional satellites allows shortening the time gap between observations, while also reducing the cost of the overall system. Furthermore, the system results to be extremely scalable as it can be easily extended to further improve its effectiveness whenever new assets or constellations become available. The paper presents the results of the study, analyzing monitoring effectiveness and comparing results with and without the use of small satellites constellations.