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Author: Dr. Francesco Topputo  
Politecnico di Milano, Italy, francesco.topputo@polimi.it

Mr. Mauro Massari  
Politecnico di Milano, Italy, mauro.massari@polimi.it  
Dr. Riccardo Lombardi  
Politecnico di Milano, Italy, riccardo.lombardi@polimi.it  
Prof. Marco Gianinetto  
Politecnico di Milano, Italy, marco.gianinetto@polimi.it  
Dr. Andrea Marchesi  
Politecnico di Milano, Italy, andrea.marchesi@polimi.it  
Mrs. Martina Aiello  
Politecnico di Milano, Italy, martina.aiello@polimi.it  
Dr. Stefano Tebaldini  
Politecnico di Milano, Italy, stefano.tebaldini@polimi.it  
Mr. Francesco Banda  
Politecnico di Milano, Italy, francesco.banda@polimi.it

SPACE SHEPHERD: USING SPACE ASSETS TO MONITOR, TRACK, AND SEARCH-AND-RESCUE  
ILLEGAL IMMIGRANTS IN THE MEDITERRANEAN SEA

**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 trades' 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).

"Space Shepherd" is a project funded by Politecnico di Milano to assess the feasibility of a dedicated system capable to merge and process the information coming from a number of already-existing satellites. The tasks of this dedicated platform are: 1) to remotely monitor the southern Mediterranean Sea 2) to detect the presence of migrant vessels; 3) to track the vessels and issue warnings in case of danger; 4) to support the search-and-rescue operations. The ultimate aim is to report to the authorities the situational awareness in the Southern Mediterranean Sea.

In order to both monitor and track candidate vessels, a flexible scheduling system, capable of planning the satellites observations ensuring both overall surface coverage and specific spots reconnaissance, is needed. Acquired images must be analyzed to detect the vessels in the scene. Post-processing is then carried out to identify commercial, leisure, and fishery vessels. The motion of the remaining unidentified targets is then propagated to estimate their course and to plan the satellite acquisition coherently. The paper presents the results of the coverage and reaction time analysis as a function of number and

type of available satellites. The simulated detection, identification, and tracking of immigrant vessels is documented in the paper.