

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (Part 2) (4B)

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FEASIBILITY STUDY ON THE POSSIBILITY TO EXPLORE ASTEROIDS DURING A ROBOTIC
EUROPA MISSION**Abstract**

It is fairly clear that, at the actual state of the art of space technology, asteroids could represent an important threat to Earth. Thus, different national and international space agencies conducted exploration missions aimed at studying this type of object and also missions aimed at assessing the possibility to redirect Near Earth Objects: two examples could be the Osiris-Rex mission of NASA and the joint NASA-ASI mission DART, the former aimed at studying Bennu and the latter to change the trajectory of Didymos. Moreover, scientific analysis of this type of celestial bodies can reveal important data concerning the birth and initial life of our Solar System. Asteroids could also represent an important economic resource, since many of them are known to contain precious metals that are necessary for modern technology. In future, in-space mineral extraction could be able to generate the birth of a new economy. These are the global premises on which this study was settled. The goal of this paper is to illustrate a feasibility study of a double objective mission: the first objective is to explore the icy Jupiter moon Europa with a robotic mission comprising a lander and a subsurface system; the second objective aims to study several asteroids en route to Europa, placed amid Mars and Jupiter. This work comprises a review of the technical literature related to similar concepts, starting in particular from a Japanese mission that could exploit a solar sail for similar purposes, following which mission objectives and requirements are illustrated. Different possibilities are explored and a trade-off analysis is performed to assess the best solution before going into a more detailed preliminary design, in particular regarding the second objective of the mission. The project arose in the context of the international Second Level Specializing Master's Programme in Space Exploration and Development Systems – SEEDS XIV, which includes a six-months group project performed together by students from Politecnico di Torino, ISAE-SUPAERO Toulouse and University of Leicester in the three universities and in the concurrent design facilities of the national space agencies.