

Exploration of Near-Earth Asteroids (4)  
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## SOLAR SAILS ASTEROID GRAND TOUR COOPETITION

### Abstract

For many decades, solar sails have been considered as a futuristic way to travel in space. The recent demonstration by the Planetary Society through its LightSail2, of the feasibility of controlling solar sails and the decision by NASA to launch the first Scout sailcraft towards an asteroid prompts us to revisit this point of view.

Designing a space mission that would allow the flyby of several asteroids is a far from trivial due to the large number of potential targets and the ability to continuously modify the orbit of the spacecraft.

Having a worldwide network of ‘coopetitors’, who would share information by releasing the orbit solutions they have found while competing against each other, is fully in line with the ethics of space exploration while remaining an opportunity for each team to demonstrate its talent.

Collecting data about asteroids from close observations is essential for Science, Planetary defense and in a farther future for mining.

These three objectives are very different in nature but each of them entails acquiring much more information about possible targets and this can be achievable only through dedicated space missions. Small spacecraft equipped with solar sails are a credible answer to the cataloguing of large samples of asteroids.

The orbit initial conditions could be imposed. For instance the departure could be located at the L2 Lagrangian point of the Sun Earth system. Choosing these departure conditions gives an appreciable flexibility with respect to the departure time, which can thus be considered as a free parameter. An upper limit for the ‘lightness number’, which is the ratio of the solar sail surface to the spacecraft gross weight, should also be specified. The duration of the mission as well as the number of asteroids that should be encountered could be split into different categories.

A special category could be arrival to an asteroid at zero velocity so that some instruments could be delivered on its surface.

What is proposed in this paper is the organization of a challenge aimed at identifying solar sail trajectories towards different types of asteroids. The U3P is proposing to provide a spaceflight simulator to allow participants to search for trajectories even if they are not specialized in celestial mechanics. The expected participants will come from Universities, engineering schools or private companies.