

SPACE PROPULSION SYMPOSIUM (C4)  
New Missions Enabled by New Propulsion Technology and Systems (6)

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DECELERATION OPTIONS FOR A ROBOTIC INTERSTELLAR SPACECRAFT

**Abstract**

Owing to the extreme long distance and long time, interstellar flight is a problem with significant challenges. However, decelerating the vehicle when it arrives at the target star is one of the most essential and difficulty technologies for a robotic interstellar spacecraft. Otherwise, the spacecraft cannot make thorough or long-duration observations for the target stars. The aim of this paper is to review some main advanced decelerating methods for a probe entering into another star system. First, the current research status of interstellar deceleration solutions is summarized. Then, some deceleration ideas like magnetic sail, electric sail, and interstellar ramjet propulsion are mainly described in detail because they have the common benefits of decelerating the interstellar spacecraft without carrying any expenditure of rocket propellant, which results in a dramatic lowering of both rocket mass ratio and the total mission mass. In addition, the ideas of Medusa concept based on nuclear fusion pulse and anti-matter propulsion are also analyzed to decelerate an interstellar spacecraft due to their higher specific impulsive. With regarding to each method, the basic principles are given. Under the initial conditions of a 1000 tons spacecraft with about 50 tons science payload travelling at cruise speed of 10% of the speed of light when it is 1 light year from the target stellar system, the deceleration performance is analyzed and the advantage and disadvantage of each technical solution is assessed. In final, some single and combined deceleration solutions are recommended for the potential future interstellar missions.