



Traveling the Interplanetary Superhighway: An Autonomous Spacecraft Navigation System

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Imagine a spacecraft that could autonomously explore the solar system for decades. It would calculate its own route and not need to be refueled. This project investigates how such a craft could be created.

Such a spacecraft is possible using the posited Interplanetary Superhighway, the collection of low-energy orbits that would provide fuel-less transport for spacecraft throughout the solar system. Low-energy space travel is similar in many ways to the first explorers traveling the oceans. Sailing ships use winds and currents, natural energy sources on Earth, to travel our oceans. In the same way, spacecraft can use the gravity and movement of planets, natural energy sources in space, to travel our solar system. These paths are referred to as low-energy orbits.

While scientists agree that this 'sailing ship of the solar system' is theoretically possible, actually describing how it would work has proved to be a challenge. Low-energy orbits that reach other planets seem to take prohibitively long amounts of time to fly and are extremely complicated to plan. This project seeks to find efficient types of low-energy orbits and determine how a spacecraft would fly them.

A prototype software system has been developed that would allow a spacecraft to autonomously calculate and fly low-energy orbits. Results show that a spacecraft could use minute propulsion capabilities to reach other planets far more quickly than previously thought using a low-energy orbit. This research may represent a practical step forward, transforming the Interplanetary Superhighway from theory to a practical method for space exploration.

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