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Space Resources, the Enabler of the Earth-Moon Ecosphere (5)

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GRAVITY IN ASTEROID MINING

Abstract

In recent years, the interest in the resources of celestial bodies has been steadily rising. The reasons are manifold: the depletion of easily accessible minerals in the earth's crust, the rapid industrialization of the developing world, which stimulates demand for resources, and the reduction in the cost of space launches. Asteroid mining could complement Earth-based supplies of rare earth metals. In this work, we first want to predict which asteroids would be the most valuable to exploit and then predict the flow of resources between the Earth's orbit and the asteroids in the inner Solar System (both those in the main asteroid belt between Mars and Jupiter and the near-Earth asteroids). To do so, we adapt the gravity model of trade used to predict economic flows on Earth to interplanetary space. The challenge is to estimate the key variables of the gravity model: the economic size or value of the asteroid and its distance from Earth. The economic size is estimated from meteorites, which have been chemically and spectroscopically analyzed, as well as from the market prices of the elementary components of the asteroids. The economic distance of asteroids is estimated from the The velocity vector (Δv) that is applied to the spacecraft during the manoeuvre. From our size and distance predictions, we estimate which asteroids are the most valuable to exploit. We also consider the endogenous change in the economic value of asteroids due to the increased supply of resources on Earth and its effect on market prices.