Abstract #1740

English

Framework for Evaluating Economic Impact of Asteroid Resources

We report on the development of a framework for evaluating the impact of extraterrestrial resources on the cost of human operations in cislunar space. In our analysis we consider the development and operation of three alternative cislunar transportation networks, each based on fully reusable launch and in-space transportation vehicles such as planetary landers, upper stages, and Orbit Transfer Vehicles (OTVs). One of the networks is based on Earth supplied propellant, one on asteroid provided propellent focussing on LOX-LM systems, and one which uses asteroid derived water based solar thermal propulsion for in space transportation and LOX-LM systems for landed systems. Missions considered included development and ten years of operation of a lunar orbiting outpost; development and ten years of operation of a lunar surface outpost, human exploration of Near Earth Objects (NEOs), and human exploration of Mars through four Mars mission opportunities. Our analysis suggests a savings in excess of $200B over a twenty year program, enough to bring NASA's ambitions for human exploration within a politically feasible total agency cost cap of approximately $20B/yr. Peak year funding without large scale ISRU is found to be approaching $30B/yr in 2017 dollars for just the human exploration program even with the benefit of fully reusable systems and commercial development approaches. For the asteroid ISRU case, peak year human exploration program funding never exceeds $10B/yr. To independent cost models were applied and found to give results that agree within 20 percent. These architectures may also enable massive new space industries including asteroid mining of minerals, space adventure travel through cislunar space, space solar power, and massive increases in communications satellite applications.

French

No abstract title in French

No French resume

Author(s) and Co-Author(s)

Dr. Joel Sercel
Chief Engineer
TransAstra Corporation

Profile of Dr. Joel Sercel

General

Email(s): sercel@icsassociates.com
Position:

Preferred Language: [Language not defined]

Addresses

Business

Home

Biographies

Biography submitted with the abstract

Joel C. Sercel, PhD, is the Founder and Chief Engineer of the Trans Astronautica Corporation (TransAstra), a new kind of aerospace company dedicated to the belief that humanity will thrive as a species once we make the leap and homestead the solar system. With the recent swarm of technological breakthroughs in information systems, manufacturing, sensor systems, and robotics now is the time to move from dreaming about homesteading space, to doing it. TransAstra is building the technology to provide in-space transportation and related services with a fleet of reusable space tugs supplied by propellant derived from asteroid and lunar resources. Our first customer will be NASA, but soon after we will support the new asteroid mining industry for returning valuable resources to the Earth. Space tourism, space solar power, and then space based manufacturing will follow quickly. Dr. Sercel has decades of experience developing advanced technology and innovative products in fields ranging from aerospace and defense to software and robotics. In addition to his private sector work, Joel spent 14 years at JPL and taught systems engineering and space mission and satellite design at the graduate level at Caltech. Dr. Sercel led the conception and definition of the NSTAR ion propulsion system currently in use on the Dawn spacecraft in orbit around the asteroid Ceres. Dr. Sercel received his PhD and master's degrees in Mechanical Engineering from the California Institute of Technology with a doctoral dissertation in plasma physics as applied to space propulsion. His bachelor's degree was in Engineering Physics from the University of Arizona.

Biography in the user profile

Collaborators

Author(s) and Presenter(s)

Author(s):

Dr. Joel C. Sercel
President
TransAstra Corporation

Presenter(s):

Dr. Joel C. Sercel
President
TransAstra Corporation