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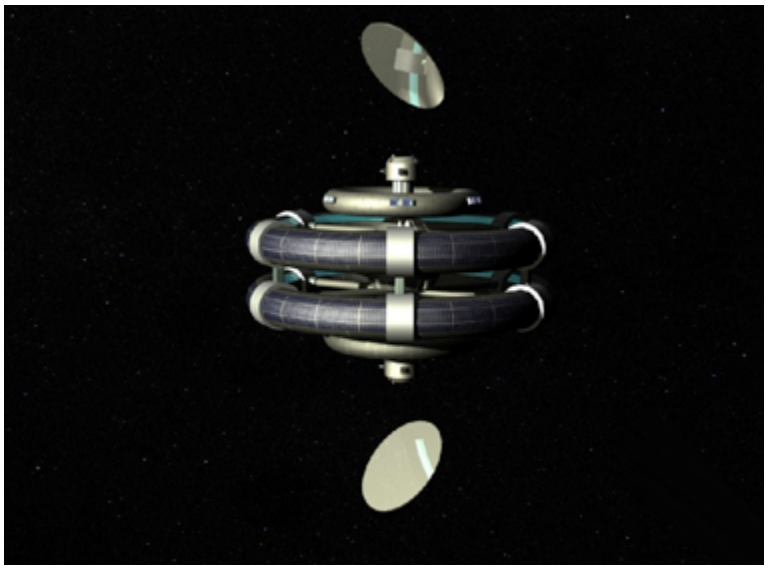

Space Solar Power Aids Space Settlement

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ABSTRACT

The Grand Prize for the 2011 NASA Ames Space Settlement Contest went to a team of 7 students (11-12 grades) from Punjab, India for creating the Hyperion Space Settlement. This year the contest received 355 submissions from 1078 students sponsored by 114 teachers. Entries came from 14 countries: Australia, Bulgaria, Canada, China, India, Ireland, Japan, Pakistan, Romania, Singapore, Turkey, Ukraine, United Arab Emirates, and the United States. The prize was conferred on the students during the International Space Development Conference 2011 (ISDC 2011) held in Huntsville, Alabama, USA.

TECHNICAL BRIEF

This section describes the principal energy components of the Hyperion Space Settlement.

Sunlight being abundantly available in space, electricity will be produced to meet the settlement's basic energy requirements. To the extent feasible, Hyperion will also trade its surplus energy with Earth.

Photon Enhanced Thermionic Emission (PETE) solar panels are mounted on the residential tori, covering 1/6th of the curved surface area of 1,592,785.5 m2.

The efficiency of the PETE solar panels is double that of the traditional solar panels. Hence the solar panels shall produce 2 kW per sq. metre per day.

Energy requirements for various sections of settlement (kW/day)	
Sections of the settlement	**Energy required**
Residential	80,000
Industries	40,000
Automated systems	5,000
Agriculture	3,000
Docks	4,000
Thrusting section	150,000
Total	**28,2000**

Power Resources and Justification		
Technique	**Reasons for selection**	**Power produced /day**
Photon enhanced thermionic emission (PETE) Solar Panels	• Solar energy is the cleanest and cheapest source of energy • Solar energy is abundantly available in space and is a renewable source of energy	**1,592,785.5 kW**
	Advantages of PETE solar panels	
	• PETE solar panels generate electricity both from solar sunlight and heat of the sun • Traditional solar panels often stop working on hitting **100C°**, whereas the PETE solar panels can even work at **250C°**; this is mainly due to the coating which enables it to work even at higher temperatures • Ordinary solar panels can only use light of specific wavelengths and the unused frequencies just generate heat proving a hindrance to their working. But this is not the case in PETE panels as they convert the waste heat into electricity.	

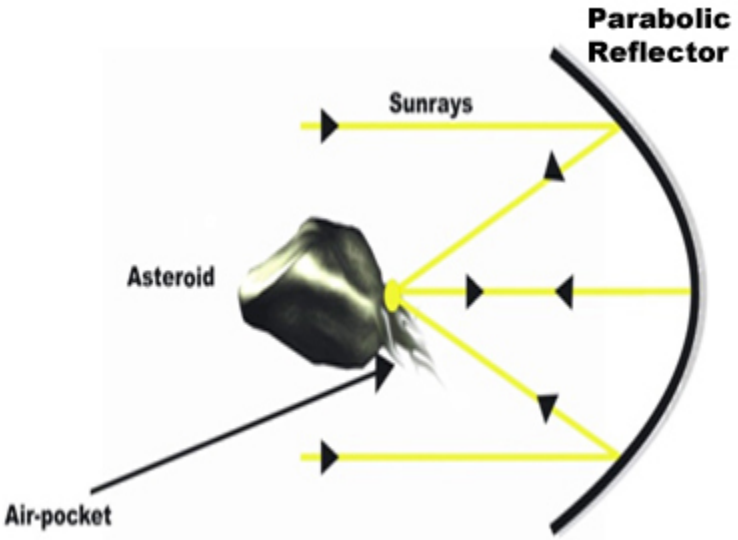
- Power produced by settlement /day = 1,592,785.5
- Power required by settlement/day = 282,000
- Surplus Power/day = 1,592,785.5 – 282,000 = 1,310,785.5 kW

Asteroid Contingency

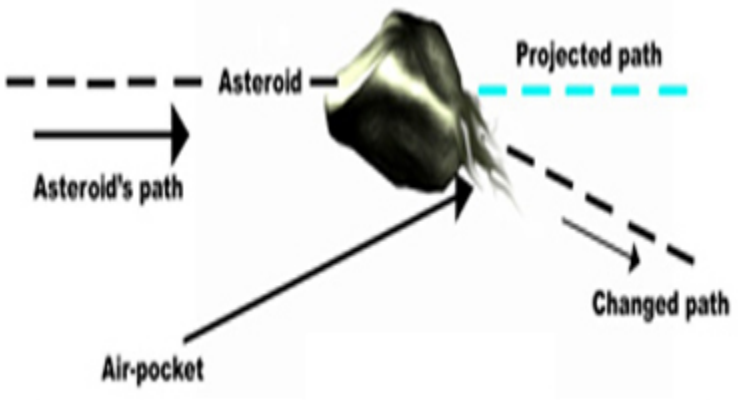
In the event that an asteroid or any large piece of space debris approaches the path of the settlement, a contingency plan will be followed to prevent damage to the settlement.

For asteroids with a diameter of 150 km or larger, projected to come within the path of the settlement, the Hyperion Executive will activate the several sets of large aperture parabolic

reflectors. These mirrors will be placed so that they focus the sun's rays to a point on the asteroid, creating very high temperature. At those points, the asteroid will begin to melt, thus forming an air-pocket. With air-pockets forming on its surface, the asteroid can be directed to change its path.



Working of Parabolic Reflectors



Asteroid's path

The Hyperion design Team with George Whitesides, CEO, Virgin Galactic at the International SpaceDevelopment Conference in Huntsville Al (USA) in May 2011

BUSINESS PLAN

Hyperion space settlement will have an economic base. Like any other human settlements, such as villages, cities or countries, the space-based community will be engaged in commerce, supporting multilateral trade.

Hyperion will have Earth as its principal trading partner. The settlement will be a provider of those goods and services that Space can uniquely provide. In turn, the settlement will barter or purchase those items it needs from its homeland.

There are advantages to the establishment of industries in micro gravity. Weightlessness provides uniquely desirable conditions for scientific and applications-oriented research. For example, on Earth, when a substance is heated, melted, solidified, crystallized, mixed, sprayed or burnt, gravity has a strong influence over what will happen. The work of certain industries will be easier to handle due to weightlessness in the microgravity environment of space.

Types of Industries

The four main industries with which Hyperion is most likely to be involved for purposes of research and production are:

1. Electricity
2. Pharmaceuticals
3. Glass, and

4. Ceramics

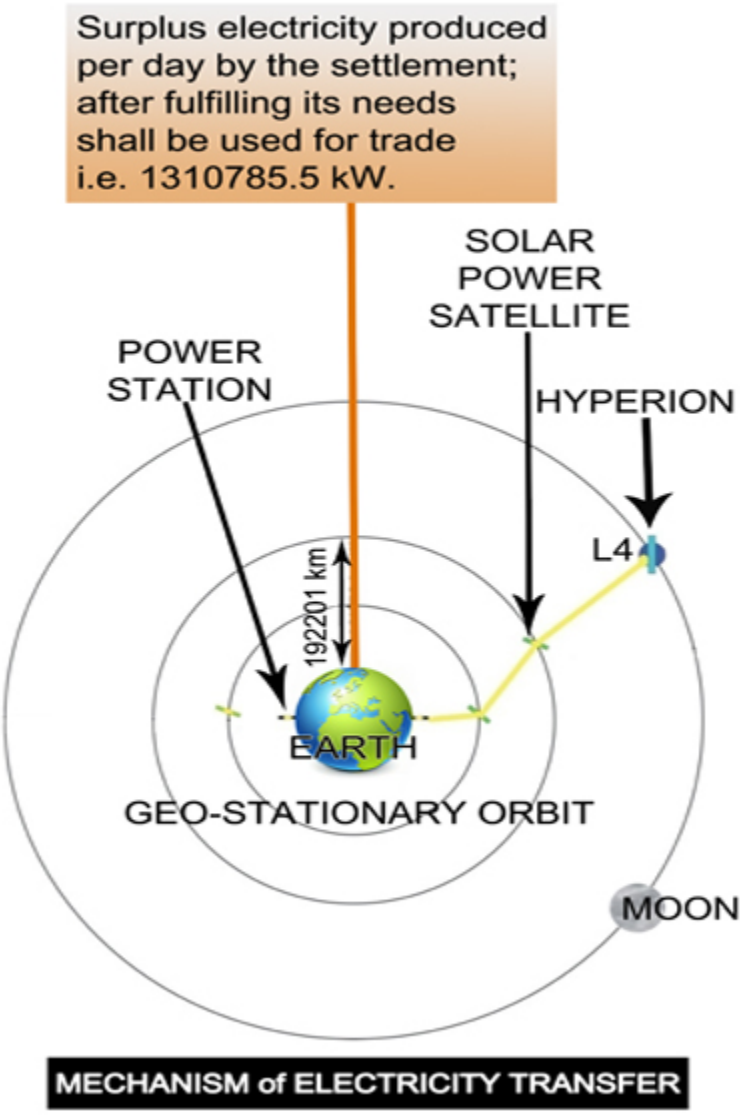
Each of these space-industries will be highly automated and expected to play an important role in sustaining Hyperion's economy. Control and maintenance of these and other ventures will be the responsibility of the Hyperion Executive.

Electricity industry

Electricity production and distribution is used as an illustrative example. Hyperion is powered by sun's energy generated by its own photon enhanced thermionic emission (PETE) solar panels (noted above).

As Earth is suffering from an energy crisis, Hyperion space settlement will act as an environmentally friendly energy provider microwaving its own collected power to Earth where the energy will be converted to electricity.

Surplus electricity in the settlement will be converted into microwaves and relayed to Earth via solar power stations positioned in orbits whose mean distance from Earth is 192,201 km, and further directed to space solar relay stations placed in geostationary orbit at 36,000 km from Earth. Ground stations on Earth will be installed in line-of-sight of the two respective power satellites where the energy will be received and converted into usable electricity.



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