SPACE MINING: THE NEW FRONTIER

The plans of the company Planetary Resources that recently made headlines have revived a controversy that has long surrounded space activities: whether natural resources beyond our planet should be exploited by private companies. The issue raises a host of technical and legal questions, and it remains to be seen whether private companies will legally be able to appropriate resources that, under international space treaties, belong to mankind.

Planetary Resources was founded by Peter Diamandis and Eric Anderson, well-known entrepreneurs who have pioneered private space missions, and has signed up some of the technical engineers who led NASA´s most successful robotic missions to Mars, as well as notable investors and advisors including James Cameron, Charles Simony, Larry Page and Ross Perot Jr. Its goal is to mine asteroids, an objective which demands a huge financial investment as well as the most advanced technical and logistical capabilities in order to be successful. Space mining involves identifying the asteroids which contain high-value or strategic resources (and in space one, if not the most, valuable element is water), capturing and/or safety landing on the asteroids in earth orbit or lunar orbit, in-situ-resource utilisation (ISRU) or transportation of resources to Earth, and exploitation of the resources.

The company is committed to a philosophy of developing low-cost commercial missions, and plans to put telescopes into orbit to detect target asteroids, send prospecting spacecraft to them and, after contact has been made, mine them. During the first stage the prospecting will focus on asteroids which have water.

Planetary Resources is just one of a number of companies that share the same goals. Other companies include the Shackleton Energy Company, which is planning to mine lunar water, and the company SpaceDev, which was taken over by Sierra Nevada, whose first project is to land on an asteroid and claim it as private property.

Furthermore, space mining has attracted the attention of universities and mining companies around the world, who see in it an opportunity they can benefit from.

Technical complexity

To put it very simply, there are three main technical challenges:

a) Locating the celestial bodies to be mined: initially there are two clear targets: the Moon and asteroids, both near-Earth asteroids, as well as those in the asteroid belt beyond Mars.

The asteroids will have to have certain characteristics in order to make them an attractive mining target: presence of water, rare and/or strategic minerals, helium-3, etc. The companies´ main goal at the moment is water, as it can be easily converted into fuel for spacecraft (hydrogen) and used to breathe in installations (oxygen) etc.

So far around 10,000 celestial bodies of varying sizes have been located in near-Earth orbit, with around 900 bodies large enough to be a target for mining. Since programmes whose mission is to detect near-Earth objects that may collide with Earth already exist, it is not beyond the bounds of possibility that public and private resources could collaborate on missions with the dual purpose of detecting potential collisions and locating valuable natural resources for utilisation.

b) The second challenge is how to reach these celestial bodies: the companies intend to use a fleet of low-cost spacecraft, which makes it financially feasible, and then capture asteroids or land on them to mine the surface. In terms of pure physics, asteroids´ low gravity makes them attractive targets, as it makes it much easier to take the minerals off them, even though it does make mining and processing more difficult.

c) Finally, it is necessary to determine the best way of exploiting these resources: in-situ resource utilisation (*ISRU*); setting up stations in orbit that would act as service stations; or bringing them back to Earth in controlled descents. It must be emphasised that the most important factor in all these operations is safety, to ensure that asteroid mining and the transportation of the minerals does not endanger the Earth, the ISS or any other satellites.

Legal complexity:

While it is true that the practical challenges of asteroid mining are enormous, the legal framework which regulates (*or not, as the case may be*) this activity is equally complex.

Article II of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies (Resolution 2222 (XXI) of the General Assembly, annex), approved on 19 December 1966, open for signature on 27 January 1967, and which entered into force on 10 October 1967, established that: *Outer space, including the Mon and other celestial bodies, is not subject to national appropriation by claim of sovereignty , by means of use or occupation, or by any other means.*

Article 11.3 of a second international agreement, namely the "Agreement Governing the Activities of the States on the Moon and other Celestial Bodies", which is dedicated specifically to the activities of the States on the moon and

other celestial bodies, but which as yet has not been ratified by the major space powers, states: *Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person.*

There are three main viewpoints on this question:

i) The first view takes the view that the regulation governing the exploitation of space applies only to States, but not to private entities or individuals, and therefore any company can dedicate itself to space mining; ii) The second viewpoint considers that the international treaties are binding on both States and their nationals, and consequently space mining cannot be undertaken by companies for private gain in a way that would exclude the rest of mankind; iii) The third body of opinion believes that since the situation today is very different to when the original treaties were first enacted, and there is no specific regulation on this matter, new regulation is required to regulate and promote this activity.

In this regard there is already a legal precedent, the case of Gregory Nemitz of the company Orbital Development versus the Government of the United States and NASA. Gregory Nemitz claimed ownership of Asteroid 433 Eros, and when NASA landed its spacecraft NEAR Shoemaker on the asteroid his company Orbital Development issued NASA a parking ticket. On the basis of the aforementioned cited article of the 1967 Treaty, both NASA and the United States Government stated Mr Nemitz´s claim to appropriate a celestial body had no foundation in law, and the case was eventually dismissed.

However, an increasing number of people believe that there is currently a legal vacuum, or at best a state of legal uncertainty, with respect to space mining, and that new regulation is required to promote and open up this activity. It would be advisable, when preparing any new regulations, to take into the account two similar cases, the Antarctic and seabed mining, since they have been the subject of intense legal debate as both are considered to belong to mankind, and not subject to the jurisdiction of a specific country.

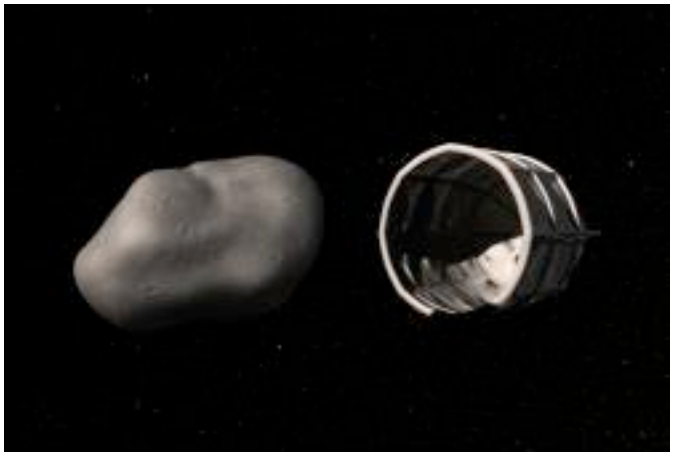
What would be the best way to legalise space mining? One option would be for the UN to issue space mining concessions, through the United Nations Office for Outer Space Affairs. This could be modelled on the Mining Code established by the International Seabed Authority, an autonomous international organization established under the 1982 United Nations Convention on the Law of the Sea. A supervisory body could be created to supervise space mining, and manage a licensing and supervision system which would promote and encourage the activity, while simultaneously ensuring that some of the profits obtained are returned to "mankind".

There is also another, equally important, challenge to be faced. Even though asteroids are relatively small celestial bodies, supplementary missions should be prepared to undertake scientific exploration, the search for life and planetary protection. This is even more important in the case of space mining on the Moon. Any commercial mining activities on our satellite should be preceded by a study on possible life forms, and every effort should be made to preserve its environment, even though it may appear to be completely barren. Moreover, if these missions are implemented following strict protocols established by scientific institutions, the knowledge gained could be one way of ensuring that the activities of private companies benefit the whole of mankind.

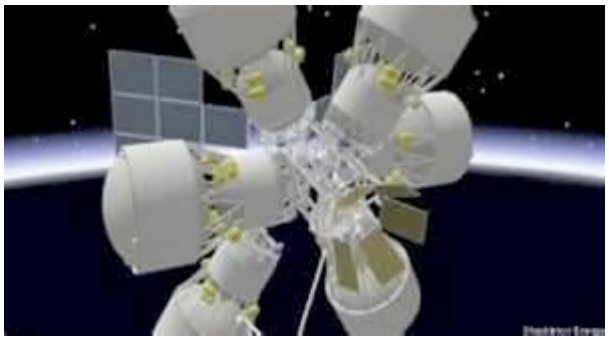
Conclusions

Today the idea of space mining may sound like science fiction to many, in the same way that flying commercially did just a few decades ago, or the plans for commercial access to space just a few years ago. However, over the ages history has shown us that ambitious people who set themselves a goal often achieve it, and it is usually the pioneers who lead the way, followed later by the rest. In this sense, we see how most of the exploration of our world was undertaken as a quest to discover natural resources, which would be used for commerce and trade, and improve the quality of life for many, although naturally it had both a positive and negative side.

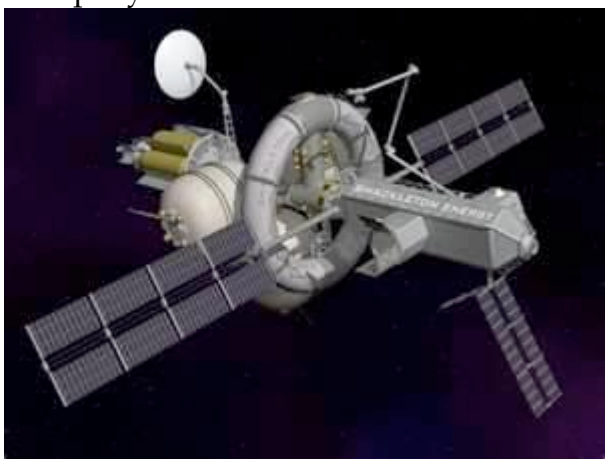
There are mining communities in extremely harsh conditions in the most inhospitable places on earth, and in a sense they can be seen as daring adventurers following in the footsteps of the first explorers. The challenge facing us is to learn from the successes and mistakes of earlier space exploration, and to make sure any resources obtained from space mining are used in a rational way. Space mining needs to be regulated effectively and fairly, in a way that provides legal certainty to those who want to undertake it, while also safeguarding the general principle that all of mankind should, to a degree, benefit from it.



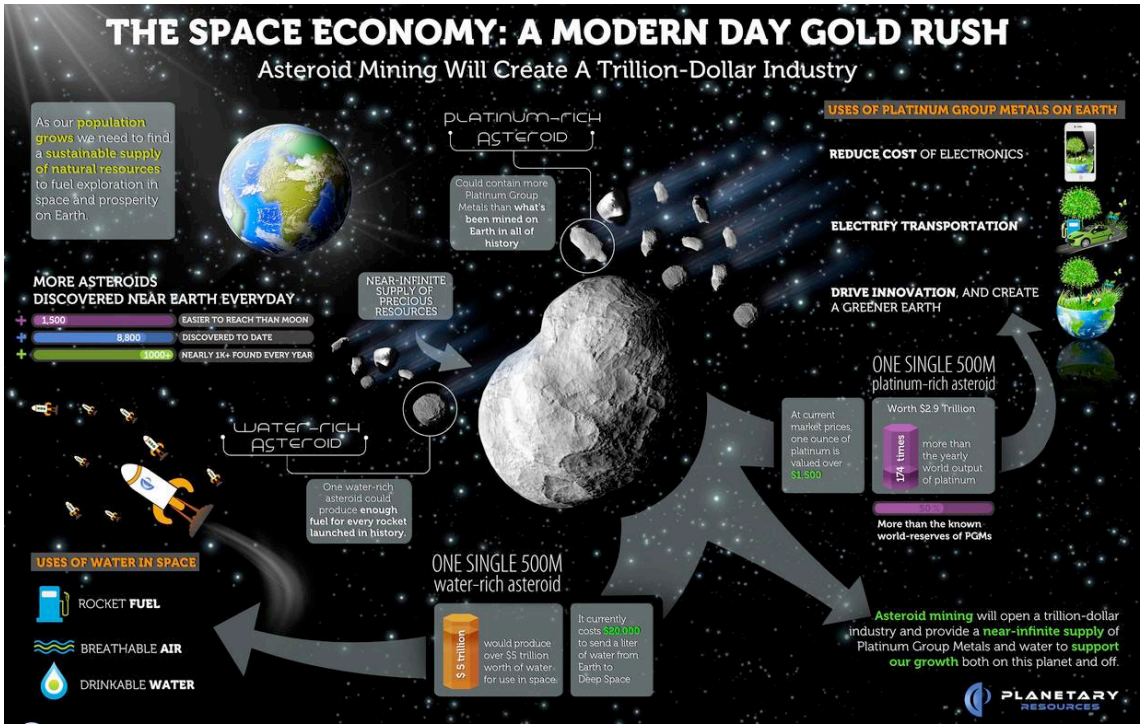
Acknowledgements: Planetary Resources



Acknowledgements: Shackleton Energy Company



Acknowledgements: Shackleton Energy Company



Acknowledgements: Planetary Resources