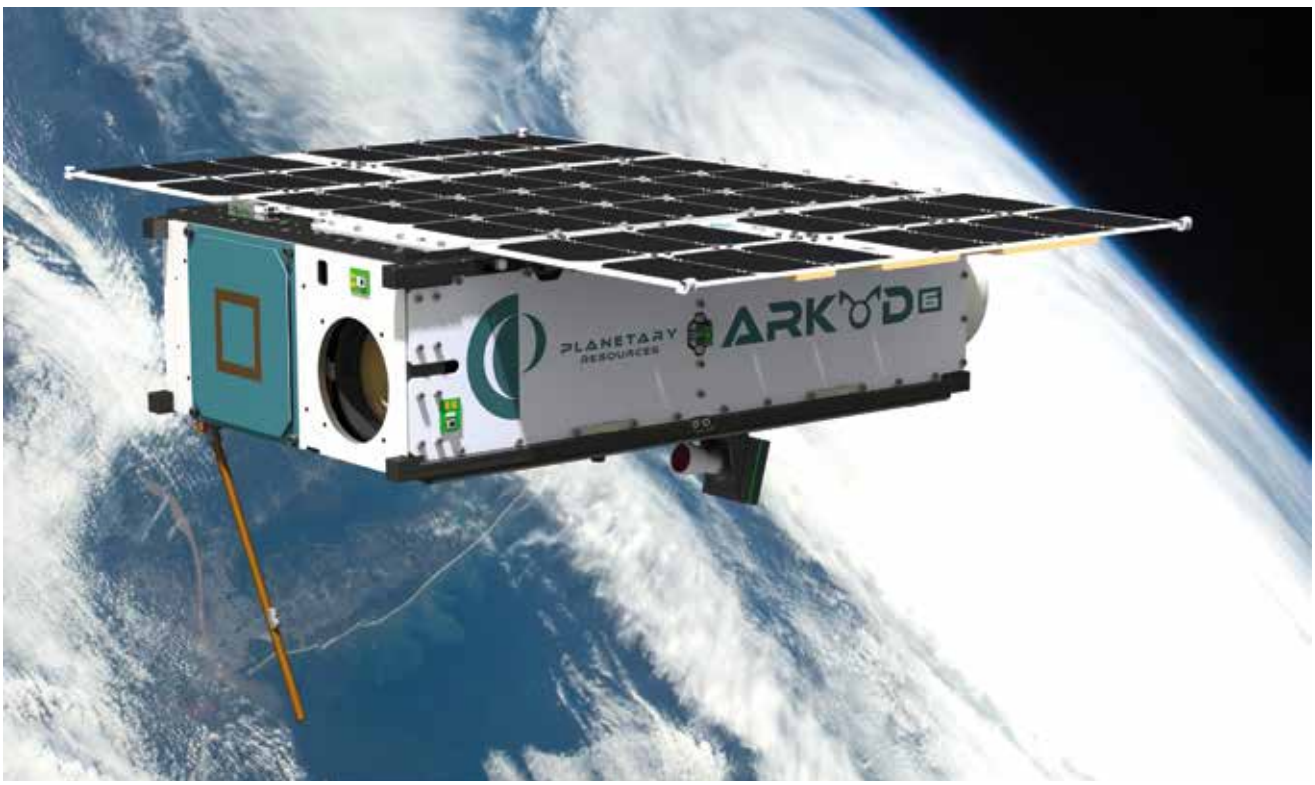
Space mining; fantasy or reality?

Ian R Coles, head of global mining team at Mayer Brown, talks through the international legal minefield that is extra-terrestrial mining



Artwork showing Planetary Resources' Arkyd-6 spacecraft in Earth's orbit. Photo: Planetary Resources

Recent press articles have suggested that astronomers have identified asteroid 2005 VL1 as the prime target for 'aerobraking' – a technique using the earth's atmosphere to slow down and capture a passing piece of rock. The imprisoned asteroid would then be examined for possible clues as to the beginning of life on Earth, and then subsequently plundered for its mineral content.

As further evidence of interest in the subject, the Colorado School of Mines in the US has just launched the first graduate level programme in space mining.

Does space mining offer a long-term solution - possibly the longest of long-term solutions - to the commodity supply chain for future generations?

POTENTIAL VALUE

That asteroids and planets (including moons such as our own) are prospective for metals is beyond doubt. It is suggested that our Moon has sufficient helium-3 to meet Earth's energy demands for more than a millennium. One estimate of the value of commodities in asteroid 16 Psyche - which orbits between Mars and Jupiter - is US$10,000 quadrillion, although of course flooding the market with commodities on that scale might have some impact on prices (an issue already flagged by some optimistic commentators).

The somewhat obstinate issue obviously lies not in whether the metals are present but rather at the mining end of the equation. Landing mining equipment and operating it on a slab of rock heading through the solar system at 40,000mph (64,374km/h) presents certain engineering and logistical difficulties. All of a sudden, perhaps deep-sea mining is not so challenging after all.

The economics are also placed into perspective when the cost of NASA's OSIRIS-REx mission to the Bennu asteroid is taken into account – something in the region of US$800 million capital expenditure to return 2kg of sample material. That mission also illustrates timing issues; launched in September 2016, a sample is due to be returned to Earth in September 2023.

SPACE MINING HOPEFULS

There are multiple companies already active in the space mining sector. In 2016, CNBC reported that space mining was attracting investment at the rate of US$2 billion per year. Two of the market leaders are US-based – Planetary Resources and Deep Space Industries.

The former – backed by one of the co-founders of Google – had originally aimed to be commissioning mines by the early 2020s. Earlier this year, the company launched the Arkyd-6 satellite to test various technologies for use in space mining. However there have been press rumours of financial challenges, and the commissioning target date may be delayed.

The actual use of any minerals once mined is also challenging and

transporting them back to Earth is a very expensive proposition. Their use in situ with 3-D printers is a frequently mentioned solution, particularly in the context of rocket manufacturing.

It could well be though that water – rather than minerals – might be the most important commodity found in space. Water can be used to produce rocket fuel, with the idea that it could then be used to power rockets launched from low gravity satellites such as the Moon.

It has been calculated that the cost of transporting water from Earth into space is in the region of £60 million (US$79 million) per tonne. Finding water on the Moon or on an asteroid could therefore be a potential game changer.

None of this is easy though. There is water on the Moon, but it is located in lunar craters which are in permanent shadow. At a temperature of minus -400°F (-240°C) and with no solar energy option, significant quantities of external energy would be required to access this water.

LEGAL FRAMEWORK

The absence of any widely recognised legal regime for the exploration and exploitation of natural resources in space creates uncertainty. It is therefore a significant issue for those contemplating an investment in space mining.

Currently, there are five international conventions which purport to address activities in space generally. The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, passed in 1967, is still probably the most important piece of international legislation. It covers a variety of issues including, for example, a prohibition on the use of space for military purposes.

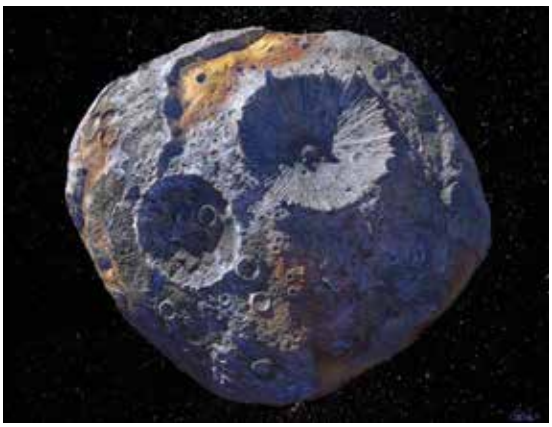
Four further treaties, passed between 1968 and 1979, cover a variety of issues ranging from damage caused by satellites etc, to the ability (or rather the inability) to make proprietary claims over territory on the Moon.

However, at the time each of these treaties was implemented, mining in space was on nobody's radar screen. The possibility was limited to purveyors of science fiction.

To date, only the US and Luxembourg have purported to implement domestic legislation applicable to mining in space. Of course, neither of these have application beyond resident companies and nationals of those two countries.

Luxembourg's motives in this area are possibly the most ambitious to date – clearly hoping to ensure that the sole centre for activity in the space mining sector does not default to the US. The government plans to offer funding and investment to private enterprises for research and development in space mining. Its legal framework aims to ensure that companies based in Luxembourg which are engaged in that activity are entitled to the resultant benefits.

The aim, of course, is to encourage international investors in these endeavours to do so via Luxembourg and thereby establish a hub for activity in the sector. The country's government states that it is keen to work with other countries in order to establish multilateral arrangements, but so far this has not led to anything. However, a fund of around €200 million (US$229 million) has ►



An artist's concept of the asteroid 16 Psyche, which is thought to be a stripped planetary core. Photo: SSL/ASU/P. Rubin/NASA/JPL-Caltech

been established for purposes of furthering investment in space mining. To date around six companies have taken advantage of the funding on offer.

The position in the United States with its Commercial Space Launch Competitiveness Act of November 2015 is similar. That legislation permits US citizens to engage in the commercial exploration and exploitation of space resources. However, it lacks international legitimacy.

The 1967 Outer Space Treaty provided that outer space should be considered as the common heritage of mankind. That phrase will be familiar to students of the legal regime applicable to deep-sea exploitation (although the actual phrase in the preamble to the treaty was "province of all mankind" – apparently reflecting the Russian view on preferred economic models at the time).

Appropriation of the Moon or any other celestial body by any sovereign state was prohibited. Under that regime, arguably, the same would also apply to a purported claim by any national of any state.

Arguments against this interpretation are numerous. For example, the treaty's reference to celestial bodies might not extend to minerals contained in those bodies. Others argue that the prohibition applies only to states and not to nationals. In addition, the treaty refers to space being free for exploration and use by all states without discrimination and "on a basis of equality".

It should also be noted that while more than 100 countries signed up to the 1967 treaty, fewer than 20 have ratified the subsequent treaty containing comparable provisions governing activity on the Moon (and none of those countries have realistic expectations of conducting such activity).

LEARNING FROM OTHER SECTORS

Commentators have pointed to legal regimes in other industries and sectors which might provide a useful comparator when considering the appropriate rule book for the exploitation of space. One example that has been mentioned is the International Telecommunications Union, which administers communication through satellites including geostationary orbital slots. However the first-come first-served approach used there may not work, and the fact that nations have equal rights irrespective of financial contribution has been the subject of adverse comment.

The Antarctic Treaty System is also mentioned as a possible example, but crucially it does not deal with the exploitation of minerals.

By far the most obvious pathfinder is the United Nations (UN) Convention on the Law of the Sea, and the International Seabed Authority that was established under its auspices. However, even this terrestrial example has not achieved universal recognition, principally because of the requirement to share economic benefits and technology, as well as the granting of equal rights to all state members irrespective of financial contribution.

The relevance of any of these various regimes to space mining is not immediately apparent. If one does immediately suggest itself then it is the deep-sea regime, although of course space is nowhere near as contiguous to national boundaries as the ocean environment.

In the absence of some immediate political or commercial imperative there seems little momentum behind any move for development from the 1967 treaty. Unless and until commercial exploitation becomes a real likelihood, then it seems unlikely there will be significant change in this position. International regulators do not seem particularly motivated to encourage change and those states with an interest in the sector seem concentrated on encouraging investment in domestic economies and/or facilitating certainty for domestic players.

What is really needed is some UN action in connection with these issues. The UN Committee on the Peaceful Uses of Outer Space, acting through the Office for Outer Space Affairs, would seem an ideal forum for the development of ideas (in much the same way as occurred in connection with the deep-sea sector), but momentum has yet to gather.

CONCLUSION

For the moment, the arguments in relation to the interpretation of the current legal regime are theoretical – space mining in any commercial manner is some time from becoming a reality. What is clear though is that international law is in great need of an overhaul at some stage before mining in space does become viable.

There is no international legal framework which lends certainty to the rights of anybody to exploit minerals in space. Experience would suggest that international investors are going to need that certainty before committing the substantial funds which will be necessary to exploit the resources which do exist.

Notwithstanding the prediction of an adviser to Deep Space Industries that the first mining on asteroids would occur within a timeframe of 10-20 years this writer suspects this will not occur in his lifetime or indeed the lifetime of many readers.

Representatives of the USSR, United Kingdom and the United States sign the Outer Space Treaty in January 1967