

Who Owns the Natural Resources on Asteroids?

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Abstract

The development of space technology and non-traditional commercial space activities have brought challenges to space law, one of which is the uncertainty of ownership over natural resources on asteroids. This paper focuses on three core questions. The first question is that if and to which extent a national legislation granting ownership to that space actor, or relevant national practices could “contribute to” or stimulate the development of space law. In addition, the political risks that might be triggered by the given national legislation or practices should be taken into consideration as well, both nationally and internationally. The last question is that what kind of international regime is expected and practical as to the exploitation and mining of natural resources on asteroids.

Firstly, this paper points out the legal ambiguity under the Outer Space Treaty, due to the omission of “natural resources” at the beginning of Article II which raises the divergence concerning the scope of non-appropriation principle thereof. The Moon Agreement, as one of the legal resources of international space law, presents arguments against ownership of space actors on natural resources on the Moon and other celestial bodies within solar system (Art. 11). However, this position is weakened by the vagueness of the legal meaning of “common heritage of mankind (Art. 11)” and the commitment about disposal right on the “Moon samples of its mineral and other substances (Art. 6)”.

The paper then analyzes the effects and limits brought by national practices on the interpretation of relevant treaty terms. The United States has explicitly qualified samples from Apollo mission as property, whereas material extracted by Soviet probes has lawfully entered free market under domestic law. Recently, it should be noted that the needs for the legal certainty on mining extraterrestrial resources are increasing, even though the “asteroid act” is not passed by the U.S. congress. The function of national practices as to the interpretation of treaty should be highly valued, but it should be also prudently examined concerning the desired and due balance of interests of private sectors, states, international organizations and all mankind.

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The paper holds a world-wide accepted solution that only through bilateral or multi-lateral agreements could the relevant rights and obligations be well arranged. Although the Moon Agreement is far from being generally accepted, the idea to establish an international regime indicates the way ahead.

I. Needs and Feasibility of Asteroid Mining

A preliminary question is why a government should consider providing incentives for resource use and exploitation in outer space? As far as the author is concerned, asteroid mining caters for the need of developing a positive space strategy.

It contains three factors, the first of which is economic strategic need. The exploitation of natural resources in outer space could lead to a revolution of resource energy utilization, producing enormous economic and social interest.

The second factor is technological strategic need. The technology for the exploitation of natural resources is usually dual-use, namely it is both civil-use and military-use. It is noteworthy that the exploitation of natural resources in outer space is not a one fold activity but a complex, involving launching, space transportation, asteroid retrieval, capture, space station construction (that is capable of transiting and storing), base construction on the Moon and other celestial bodies, deep space exploration and NEO defense, etc. This mission would also allow the testing of automated mining and processing equipment, reducing the risks of future large-scale asteroid mining operations. Technological strategy also refers to national security interests, as well as civil and commercial interest.

The third factor is political strategic need. On one hand, the strategic competitions between space-faring countries reveal in outer space as well. After all, natural resources in outer space are limited. Strategically, the precursor would definitely set restrictions for the newcomer to jump in the game, while the strategic option for the newcomer is to postpone the exploitation of the former. On the other hand, international reputation, symbolic value, is also a goal of politically strategic need.

There are some researches providing an overview of the rationale for and the feasibility of asteroid mining, based on current technology and information. It concludes that the mining of asteroids is a medium-term to long-term project (20 to 30 years) that requires a stepwise approach.¹ Even so, several private corporations, such as Planetary Resources and Deep Space Industry had already expressed interests in asteroid mining of one kind or another.²

1 Andrea Sommariva, Rationale, Strategies, and Economics for Exploration and Mining of Asteroids, *Astropolitics: The International Journal of Space Politics & Policy* Volume 13, Issue 1, 2015, pages 25-42.

2 The relevant plan, roadmap and demonstrations of the missions of these two companies are available at: www.planetaryresources.com, <http://deepspaceindustries.com/>.

Meanwhile, some official lunar or deep space projects are implemented or announced, for instance, China's three-phase moon exploration plan, which is known as Chang'e Mission,³ OSIRIS-REx, an asteroid sampling mission of NASA;⁴ Besides, on March 25, 2015, NASA announced the details of an asteroid-capturing plan at the budget of \$ 1.25 billion.⁵ Officials from both ESA and Russia announced plans of lunar base building in the near future. Besides, some other states like U.K.,⁶ India,⁷ Japan⁸ also have their own deep space projects.

As mentioned above, space resources exploitation, in particular with asteroid mining, has brought regulatory and legal challenges due to vacuum or ambiguity of space law, both domestically and internationally. Without a clear domestic authorization, it's hard to persuade venture capital to believe their investment could get an expected return. Thus, an academic campaign was undertaken in the U.S. And even internationally drove by some private actors, aiming at solving this legal problem by national legislation.

II. Asteroids Act

A bill cited as "the American Space Technology for Exploring Resource Opportunities in deep space act", or the "ASTEROIDS Act" was introduced to the House of Representatives in the U.S. in September last year, and it failed to pass. However, the similar Space Resources Exploration and Utilization Act of 2015 (hereafter cited as 2015 Act) was approved by the House in May 13 this year, together with other three bills. The four bills are formally known as the Spurring Private Aerospace Competitiveness and Entrepreneurship Act, or SPACE Act.⁹ The act provided property rights to space resources obtained by American companies. It's no wonder that it generated debates widely. Democrats on the committee, though, raised concerns about whether the bill would comply with international treaties, like the Outer Space Treaty. "We're not going to be able to resolve any of these issues today, and so I think we need to take a step back and get the information we must have to

3 The latest process and plan of this mission is available at: www.cnsa.gov.cn/n360696/n361228/n361378/371772.html.

4 See www.nasa.gov/mission_pages/osiris-rex/index.html.

5 See www.cnsa.gov.cn/n1081/n7529/n7950/755272.html.

6 Lunar Mission One, See www.dailymail.co.uk/sciencetech/article-2868740/Next-stop-moon-Lunar-Mission-One-reveals-plans-build-human-base-10-years.html.

7 India's plan on Mars, See www.dailymail.co.uk/sciencetech/article-2982537/Indian-Mars-spacecraft-snaps-breathtaking-images-red-planet-including-dormant-volcano-tiny-moon-orbit.html.

8 Japan's Hayabusa mission, See <http://spaceflightnow.com/2015/03/09/japans-hayabusa-2-asteroid-mission-checks-out/>.

9 The details and relevant information of these acts are available at: <http://science.house.gov/sites/republicans.science.house.gov/>.

make an informed policy decisions,” Johnson said, introducing and amendment to replace the bill with one that called for an interagency study on the legal issues of space resource property rights.¹⁰

Posey, who serves on the science committee, objected to the amendment, saying the reports would take years to complete and could delay the progress of commercial asteroid mining ventures. “We won’t be providing any of the leadership or certainty that American companies need to move forward,” he said. Sen. Ted Cruz (R-TX), chairman of the space subcommittee of the Senate Commerce Committee, formally introduced the Commercial Space Launch Competitiveness Act. That bill contains many of the same provisions as the House’s SPACE Act. Unlike the House bill, the Senate bill, S. 1297, had bipartisan support. The full Senate Commerce Committee approved the bill with virtually no debate during a markup session on May 20, 2015.¹¹ On November 16 2015, the “U.S. Commercial Space Launch Competitiveness Act” was signed by the President Obama, of which is the Title IV “Space Resource Exploration and Utilization”. Title IV contains most of the articles in the Asteroid Act.

Up to now, these acts in the U.S. are the only attempt to eliminate legal uncertainties about ownership of space resources through national legislation.

III. The Insufficiency of International Space Law

III.1. The Ambiguity of Legal Bases of Asteroid Mining

Nevertheless, it’s still an open question in international law that whether state is permitted to allow granting private ownership over space resources. As far as the author is concerned, the most significant and relevant article to judge whether such legislation infringe international law is Art. VI of OST.

“States Parties to the Treaty shall bear international responsibility for national activities in outer space, [...], whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.”

Obviously, it articulates State has the obligation to assure private actor’s activities are carried out in conformity. In other words, as long as private actor’s activities contravene international law, there will be a possibility that its responsible State violates its obligation about assuring. And it might be in a high possibility if a State procures the activities, such as through a national legislation to facilitate such activities.

10 *Jeff Foust*, Congress launches commercial space legislation, *Space Review*, May 26, 2015, www.thespacereview.com/article/2759/1.

11 *Ibid.*

On this account, it is still necessary to examine whether private appropriation on space resources violate international law, by claiming ownership or by any other means. Therefore, Art. II of OST which stipulates the principle of non-appropriation is undoubtedly the spotlight of this discussion.

This principle is stipulated in Art. II OST: “Outer space, including the moon 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.”

The interpretation and application of this principle is the legal prerequisite of asteroid mining and any other relevant activities. However, it happened that the term of “natural resources” is literally missing in the treaty language. Then whether natural resources falls within the scope of the prohibition, is still uncertain. Besides, literally this article only prohibit “national appropriation”, thus whether “private appropriation” falls within the scope of Art. II is still debatable.

It’s noteworthy that the Moon Agreement articulates that both “natural resources” and “private appropriation” shall be the subject to non-appropriation principle. Article 11(3) of the Moon Agreement stipulates:

“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 inter-governmental or non-governmental organization, national organization or non-governmental entity or of any natural person.”

However, whether the international community could get consensus on this interpretation is still in question, since it took the context of the Moon Agreement as a reference, rather than the Outer Space Treaty per se. As far as the author is concerned, as a subsequent treaty, the Moon Agreement inherits the object and purpose of the mother law, the Outer Space Treaty. The five space treaties should not be disconnected, but should be taken as a whole. Thus it’s appropriate to take its context as a reference to interpret Art. II of OST. In general, Art. 11(3) of the Moon Agreement tends to be read as an negative way towards the ownership title to abstracted resources.

III.2. The Absence of Specific Rules of Asteroid Mining

Even if the international community could get consensus on the legitimacy of the title to space resources, there are still lacking specific rules of asteroid mining.

There are still many uncertainties about the rights and obligations arrangement during launching, on-orbit operation, detecting, landing, mining, manufacturing and transmission regarding to asteroid mining. For instance, which space actor should be granted the ownership over space resources, the one who first detects it, who first lands on it or abstract it? Is there kind of prior landing or mining right on an asteroid in case of two or more space actors involving in such space activities?

Once asteroid mining come ture, the legal and regulatory framework of relevant STM would be necessary.

IV. A Desired International Mechanism of Asteroid Mining Relevant Activities

IV.1. The Necessity and Rationale of Establishing an International Mechanism of STM on the Exploitation of Natural Resources in Outer Space

Article II along with the provisions of Articles I paragraphs 1 and 2 of the Outer Space Treaty has created a “balance of interests” of space powers and non-space powers.¹² Any attempt to appropriate outer space would upset that balance and could thus threaten the rule of law established for the governance of outer space.

As articulated in Paragraph 5 Article 11 of the Moon Agreement, States Parties hereby undertake to establish an international mechanism to govern the exploitation of the natural resources of the Moon as such exploitation is about to become feasible. However, there is yet no explicit provision on the determination of “feasible”.

In the author’s opinion, an international mechanism like this should be based on technical feasibility, market demand and strategic needs. Some space-faring nations, inter-governmental organizations and private entities have already obtained the technical capacity to develop natural resources in outer space, particularly among which private entities have shown more intense development needs, proving the existence of a strong market demand, no matter it presents commercial interests or political aspirations. On the other hand, when it comes to general international law, not to mention international space law, there is no clear prohibition on the exploitation and even commercial use of natural resources in outer space.

Meanwhile, due to the vacancy of current international space law, the capacity of regulating future activities concerning exploitation of natural resources in outer space is rather limited. From an international perspective, in order to

12 After the completion of the Draft Outer Space Treaty in UN COPUOS, the United States delegate, Mr. Goldberg, underlined that the ‘spirit of compromise shown by the space Powers and the other Powers had produced a treaty which established a *fair balance* between the interests and obligations of all concerned, including the countries which had as yet undertaken no space activities’: ‘Official Records of the General Assembly, Twenty-First Session, First Committee, Summary Records of Meetings, Meeting 1492’ (17 December 1966) UN Doc A/C.1/SR.1492 page 427 (emphasis added). Similarly, the delegate of Brazil, Mr. de Carvalho Silvos, stressed ‘the necessity of maintaining a proper balance between the rights and obligations of the space Powers and those of non-space Powers’: *ibidem*, 432; See also UN Doc A/AC.105/C.2/SR.64 page 9 (24 October 1966). The Soviet delegate, Mr. Morozov, responded by emphasising on the ‘principle of equality between space and non-space Powers, to which the Brazilian representative just referred’: UN Doc A/AC.105/C.2/SR.64 page 9 (24 October 1966). See S Hobe on Article I.

ensure an orderly development of activities concerning exploitation of natural resources in outer space, it is essential to establish an appropriate international mechanism, which should also be antecedent. As Halley, the founder of U.S. space law pointed out in 1950s: "Law shall proceed into outer space ahead of human."

From a national perspective, on one hand, the exploitation of natural resources in outer space is closely related to strategic resources in outer space in a political way. Prof. Joanne Gabrynowicz ever warned a House subcommittee on September 10, 2014, that a proposed bill to grant property rights to materials mined from asteroids could face legal and political challenges if passed in its current form. Apparently, unilateral behavior will certainly lead to a competition of the exploitation of natural resources in outer space, Asteroid Mining Race, from which no one is going to benefit in the long run. It will be a Zero-sum game and all the players will be trapped into prisoner dilemma.

On the other hand, according to Article VI of the Outer Space Treaty, States bear international responsibility for space activities carried out by non-governmental entities. The prerequisite of improving domestic managing system is ensuring its acceptance from international society; otherwise, both political and legal risk could rise. Therefore, from a national perspective, it is also essential to foster or participate in an international mechanism.

Meanwhile, such an international mechanism would not violate the principle of equality in the Outer Space Treaty.

As paragraph 2 Article I articulated, outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law.

On one hand, as same as "for the benefit and in the interests of all countries", the term "equality" presents a stronger nature of declaration than binding force, the specific content of which should also be interpreted by national practice. According to status in quo, with regard to limited orbit and spectrum resources, the International Telecommunication Union (ITU) is still implementing the principle of "first come, first served".

This basis implies a future where the same principle rules the exploitation of natural resource in outer space. The difference is that the occupation of orbit and spectrum resources is a necessary premise for exploring and using outer space, especially for space application. The reality is contrary to the principle of equality, but it has to be accepted. However, the exploitation of natural resources in outer space is a different issue. It is not necessary for the exploration and use of outer space.

In another terminology of economic, orbit resources are necessities, the demand of which would barely change despite of the prices. Yet the natural resources of outer space are luxuries, the increase of price (for example, legal

restrictions) can lead to the decrease of demand (i.e., capable nations or private entities may revoke the exploitation plan of natural resources in outer space).

On the other hand, differing from “for the benefit and in the interests of all countries”, the philosophical basis of “equality” provides reasonable interpretation for the “unequal” status in quo of exploration and use of outer space. For instance, athletes in the same starting line would achieve different scores due to different capacities. “Equality” is not equal to “equal distribution” or “same profit sharing”, making it different from “for the benefit and in the interests of all countries”. This provides a positive theoretical interpretation for the theory of “first come, first served” in the field of asteroid mining.

The so-called “for the benefit and in the interests of all countries”, for aerospace pioneers, is only for declarations when in need of political or international relations. The terms “basis of equality” and “province of all mankind” are merely superficial words, while “first come, first served” is the practice pursued in reality.

From the perspective of the economics of law, a rule is to be judged from whether it grants positive incentives. Apparently, in the time of early human exploration and use of outer space, the right incentives should be to encourage countries to actively explore and use outer space and to promote the development of human cognition.

However, if inappropriate emphasis is added on “for the benefit and in the interests of all countries” or “use on the basis of equality” and even using them as prerequisite for the freedom to explore and use outer space, it would reduce the enthusiasm of States greatly. After all, it is unfair for nations that have devoted a lot of manpower, material and financial resources for the exploration and use of outer space. These limits can only be regarded as a means of encouragement, but not legal binding force. In addition, the convention itself is legally binding for signatories, which has formed the so-called “soft provisions in hard law”.

For the development of exploitation of natural resources in outer space, the interpretation of existing rules and the establishment of future rules depend on the ultimate direction. From a perspective of political concern and strategic resources, a final consensus or compromise is likely to appear as limited exploitation.

If oriented by market, aiming at promoting space technology and the commercialization of space activities, it is likely that the exploitation would be encouraged. Different orientation would lead to a fundamental result concerning interpretation of existing international and future establishment of international mechanism with regard to the asteroid mining.

IV.2. The Approaches of Establishing an International Mechanism on the Exploitation of Natural Resources in Outer Space

Undoubtedly, it is ideal to regulate the exploitation of natural resources in outer space through treaties, but at this stage it is unrealistic, because capable countries of the exploitation of natural resources in outer space are in the minority.

In addition, differing from space activities in the past, natural resources in outer space are theoretically limited and non-renewable. Therefore, the development of conventions is facing enormous resistance.

Stepwise, the establishment of an international mechanism over the exploitation of natural resources in outer space can be divided into three approaches.

First: to clarify rights and obligations through bilateral or multilateral agreements. It is necessary to conduct in the means of agreement, especially in the case of exploiting the same object. This approach is mainly for current nations and international organizations that own capability of asteroid mining.

Second: to clarify rights and obligations through joining and amending the Moon Agreement when conditions are satisfied. Although the Moon Agreement has right now only 16 States parties, this has still outnumbered nations that own capability of the asteroid mining. Encouraging the latter to join the Moon Agreement could coordinate relations between developed countries and developing countries regarding space technology within the framework of the treaty. It could also bring internationality, representativeness and stability to the said international mechanism.

As for developing countries, they could put limited resources into space technology cooperation with developed countries and share the benefits of the exploitation of natural resources in outer space through the mechanism of cooperation. When conditions are satisfied, it is worthy to consider mirroring the Law of the Sea and establishing implementing agencies similar to the International Seabed Authority, namely, International Outer Space Resources Authority.

Third: to clarify rights and obligations through joining treaties on commercial activities in outer space. There are heavy needs for international agreements in various areas of commercial activities in outer space in addition to the exploitation of natural resources, such as commercial launch, commercial remote sensing, navigation, etc. Due to historic restrictions, the existing international framework enacted in 1960s lacks effective and clear regulative measures, particularly specific provisions concerning rights and obligations, as well as responsibility determination and dispute resolution. Therefore, in a long-term vision, it is quite reasonable to expect future demands for a unified treaty on commercial activities in outer space. It is also inevitable for the convergence between domestic and international law.

IV.3. Basic Contents of the International Mechanism on the Exploitation of Natural Resources in Outer Space

Whether the international mechanism would be established by means of international agreements or international treaties, basic contents should be included. For example, principles, specific rights, obligations, liabilities, provisions, dispute settlement measures, etc.

As for principles, paragraph 7 Article 11 of the Moon Agreement provides a useful reference. It establishes an orderly, secured, reasonable and fair principle for exploitation. Besides, the author recommends that the principle of “efficiency/effectiveness” should be included either, which is a prerequisite for the establishment of an effective incentive mechanism.

As for specific content, obligations should be clarified such as notification, consultation, negotiation and environmental protection; explicit rights and benefits should be included, such as ownership, the right to use and privileges; the contents should also provide for the duty of care of predecessors and newcomers; there are also responsibility determination approaches and dispute resolution measures to be included.