Space Resources Activities from the Perspective of Sustainability: Legal Aspects

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Abstract

Space resources activities present numerous opportunities for expanding the exploration and use of outer space, but they also involve undeniable environmental risks. The purpose of the present article is to navigate across such risks from a regulatory perspective and investigate the potential solutions. The final findings relate to three fundamental questions: how shall we ensure that the entities active in the area of space resources take account to space environment? That they utilize the best possible and less invasive technology? And, that they restore the "mining" area when finishing their tasks? To this purpose, firstly an overview on the planned space resources activities will be provided, together with a summary of the involved entities. Subsequently, the analysis will shift to the legal framework, starting with the main international treaties and the related applicable principles, and will move then to national legislations. The concluding remarks will indicate an international framework as the most suitable solution to the problem of environmental sustainability, taking into considerations existing models and proposals.

1. Introduction[1]

With the new forms of the use of outer space as space resources activities, not only their contribution to the research and industry, but also their potential negative impacts to the environment are discussed: How shall we ensure that the entities active in the area of space resources take account to space environment? That they utilize the best possible and less evasive technology? And, that they restore the "mining" area when finishing their tasks?

The more general question of how to secure sustainability of space activities emerged within the context of the proliferation of space actors and intensifying of uses of outer space over the last ten years. The main deliberations on these issues took place in the UN Committee on the Peaceful Uses of Outer Space (UN COPUOS), which agreed upon a set of recommendatory guidelines on the long-term sustainability of outer space activities in 2016 (UN COPUOS 2018). Recent plans to exploit mineral resources found on the celestial bodies – on the Moon and asteroids - have only intensified these discussions.

This contribution focuses on the environmental aspect of these future space resources activities and observes it from its legal perspective. The object of analysis are the selected UN space treaties, the US and Luxembourg domestic legislation on space

[1] The article is a continuation of the research published in EYIEL 2018. See Hofmann M, Bergamasco F, *Mining in Outer Space: Legal Aspects*, in: Bungenberg M et al. (eds.), pp. 313-334, European Yearbook of International Economic Law 2018 (EYIEL) (Springer).

resources, as well as the principles elaborated by the international Hague Space Resources Governance Working Group.

2. Space Resources Activities: Overview

In several countries, intense activities on space resources exploitation and extraction have been developed in the last years. In the United States, Planetary Resources, Inc., came forward with a plan to transform asteroid water into rocket fuel and eventually to harvest platinum-group metals from space rocks (Planetary Resources, 2018; Wall, 2015). Before its acquisition by Bradford Space Group, Deep Space Industries (DSI) had a project to change the economics of the space industry by providing the technical resources, capabilities, and system integration required to prospect for, harvest, process, manufacture, and market in-space resources (Deep Space Industries, 2018).

For Japan, space resources development may be a promising industry in the future (Mizushima *et al*., 2017) as symbolized by the Hayabusa Project, where a spacecraft operated by the Japanese Aerospace Exploration Agency succeeded in landing on the surface of a small near-Earth asteroid returning samples of the materials back to the Earth (JAXA, 2018). There are also reports stating that China is planning to exploit resources like titanium, helium-3, and water from the far side of the Moon where its first module landed in January 2019 (Goswami, 2016). Its Chang'e lunar exploration program is an on-going robotic mission to the Moon based on the White Papers on China's Space Activities (Shouping, 2017) led by the China National Space Administration. There is also information available that investments are being made in asteroid exploration (Mizushima *et al*., 2017). Additionally, space resources programs are being pursued in the United Arab Emirates (Gulfnews 2017).

In Luxembourg, the Government announced its "SpaceResources.lu" initiative in February 2016, which is a series of measures "to position Luxembourg as a European hub in the exploration and use of space resources." One of the central elements of this policy was the development of a legal and regulatory framework confirming certainty about the future ownership of minerals extracted in space (Luxembourg Space Agency, 2019). To foster international cooperation, the Government of Luxembourg concluded bilateral cooperation agreements with Portugal (2017), United Arab Emirates (2017), Japan (2017), China (2017), Czech Republic (2018), Poland (2018) Belgium (2019) and the USA (2019) aimed at the exchange of information and strengthening bilateral relations in the field of space activities (Luxembourg Space Agency, 2019).