 ISSN: 2581-8503

WHITE BLACK LEGAL

LEGAL

VOLUME 1: ISSUE 8

||January 2020 ||

Email: editor@whiteblacklegal.co.in

Website: www.whiteblacklegal.co.in

 ISSN: 2581-8503

DISCLAIMER

EDITORIAL TEAM

 ISSN: 2581-8503

ABOUT US

WHITE BLACK LEGAL is an open access, peer-reviewed and refereed journal provide dedicated to express views on topical legal issues, thereby generating a cross current of ideas on emerging matters. This platform shall also ignite the initiative and desire of young law students to contribute in the field of law. The erudite response of legal luminaries shall be solicited to enable readers to explore challenges that lie before law makers, lawyers and the society at large, in the event of the ever changing social, economic and technological scenario.

With this thought, we hereby present to you

WHITE BLACK LEGAL: THE LAW JOURNAL

Legally Encouraging Asteroid Mining: Constructing a Conducive Environment for Space Resource Utilization

1. Abstract

The imminent nature of the asteroid threat, the depletion of earth's resources, the societal and ecological imbalances caused by mining in sensitive ecosystems, increasing private interest in space, and the interests of governmental agencies taken in total make this present time primed for space exploration and usage. The various incentives under the US legislations would also encourage private exploration of asteroids. The process needs only speeding up, as the interests are already in place. The threat looming large over the earth cannot be ignored, as all asteroids cannot be realistically monitored by a few space agencies. Private interests, once introduced, would help in not only monitoring the same, but also in eliminating the threat, and making profitable use of it. The closest NEAs (Near Earth Asteroids) are the most dangerous, as well as the most commercially viable and profitable. A few key changes in Space law, i.e., removing the prohibition of national or commercial appropriation of asteroids by creating an exception to the Ben Ching position for NEOs and NEAs would be overall helpful to the global economy and the scientific spirit in the national and international community.

Keywords **– Space Law, Asteroid Mining, Near Earth Objects, Space Resource Utilization.**

I. Introduction

A prominent Scientist has opined that the first 'multi-trillionaire' would be the first person to successfully mine and bring asteroids back home.[1] Many industrialists are trying to join the race early, even before the metaphorical blanks are fired, i.e., even before the domestic regulators and space agencies have formally allowed the same in their respective countries. This has, admittedly caused failures and investor dispassion.[2] However, interest is slowly being regained and momentum is building up again, as the mining industry has realized that the specific properties of rocks in space are such that even the most mediocre of asteroids can

[1] Katie Kramer, '*Neil deGrasse Tyson Says Space Ventures Will Spawn First Trillionaire',* NBC NEWS, May 3 2015, https://www.nbcnews.com/science/space/neil-degrasse-tyson-says-space-ventures-will-spawn-first-trillionaire-n352271

[2] AtossaAraxia Abrahamian, *'How the asteroid-mining bubble burst'* MIT TECHNOLOGY REVIEW, June 26, 2019, https://www.technologyreview.com/s/613758/asteroid-mining-bubble-burst-history/

contain a mine that is orders of magnitude more massive than any mine on Earth[3] – this makes the hardest part of mining not the extraction and processing, but just the exploration. With at least fifteen to twenty thousand such candidates within a couple lunar distances (406,700km), finding them is also not harder than necessary, especially in the wake of improving space telescope technology and rocket propulsion technology.

Asteroids are a threat to life on earth. They have altered the course of evolution on earth, possibly on multiple counts. Though the threat posed by asteroids seems too cinematic to be true, the National Aeronautics and Space Administration in the United States of America has shown interest in building a planetary defense system. In recognition of the hazard posed to the Earth by asteroid impact, Congress has mandated that NASA undertake a Near Earth Object (NEO) survey program to detect, catalogue, and track NEOs of 140 m diameter and larger. In June 2018, the DAMIEN IWG (Inter Agency Working Group for Detecting And Mitigating The Impacts Of Earth-Bound Near-Earth Objects) released a National Near-Earth Object Preparedness Strategy And Action Plan, as the threat seems more imminent and we are underprepared. While the probability of the earth getting hit seems low, this is because NASA have admitted that only a third of the Near-Earth Asteroids (NEAs) are being tracked. This is because funding for large space telescopes is hard to come by, and with the prevailing levels of light pollution even in the most serene regions of the Atacama Desert, detecting small asteroids is extremely difficult, even with the most powerful telescopes. Moreover, telescopes can only scan one area of the sky at any given time, and all the telescopes in the world would not be enough to scour for such threats. NASA has about 20,000 NEOs on roll, not all of which can be realistically tracked with the current resources. The frequency of large asteroids (above 140 m), similar to the one responsible for the Tunguska event, an impact which, had it happened in New York, would have destroyed all of Manhattan, have a frequency of about one in 20,000 years. Scientists at DAMIEN have expressed that the only question about an asteroid impact is that of when it will happen, and not whether it will happen.

This paper has three objectives – to simplify and express the current asteroid threat looming over Earth in commercial and legal context, to evaluate certain asteroid mining technologies and their legal viability, and to suggest some changes to national space legislation, i.e., the Space Activities Bill, 2017 and to the current international 'soft law' such that it encourages asteroid mining.

[3] Martin Elvis, *'How Many Ore-Bearing Asteroids are there?*' PLANETARY AND SPACE SCIENCE, 20 Novemer 2013, https://arxiv.org/ftp/arxiv/papers/1312/1312.4450.pdf

I. The Urgent Need Due to the Current Threat Posed

It has been found that the asteroid that killed off the dinosaurs was due to a combination of two reasons – the devastating impace itself, and that the impact region was an oil reserve – thereby multiplying the impact's devastation.[4] The mass extinction 12,900 years ago is theorized by many to have been caused by a comet impact, with growing evidence for the same, though the academic debate does not seem to have reached a consensus about it.[5] Astronomers have stressed on the need for a concentrated search for not just more 'Taurid Asteroids', but also for the need to search for their source, which is theorized to be a much larger and potentially more harmful group of bodies lurking in the Earth's orbit around the sun.[6] The redirection of these bodies by Jupiter's orbit, a planet which used to protect the Earth from asteroid impacts previously, is increasing the risk taken on by Earth each time it encounters the Taurid stream. These asteroids are also larger than usual, and would not easily break up in the Earth's atmosphere.

In order to deal with this threat, NASA created the Planetary Defense Coordination Office which collates observations of asteroids to create a larger database of asteroids and to observe them more widely.[7] The European Union also has a similar 'planetary defense project'[8]. In 2019 alone, 1539 new asteroids have been discovered. In general, without accounting for other factors like the location and angle of impact which can significantly aggravate or mitigate the damage caused by a Near-Earth Object, NEOs below 25m cause airbursts, below 50m cause damage on a local scale, below 140m cause regional level damage. Above 300m, they can cause continental level damage. Below 600m, the damage is below the global catastrophe threshold, and crossing the threshold, such catastrophe is a possibility. Above 10km, they can cause mass extinctions. The orbital distribution of undiscovered asteroids and comets capable of producing damage to human life or property is used to compute the collision probabilities and impact velocities of the possible impactors on Earth.

[4] Kunio Kaiho& Naga Oshima, *'Site of asteroid impact changed the history of life on Earth: the low probability of mass* extinction' SCIENTIFIC REPORTS, 9 November 2017, https://doi.org/10.1038/s41598-017-14199-x
[5] RB Firestone, *'Evidence for an Extraterrestrial Impact 12,900 Years Ago That Contributed to the Megafaunal Extinctions and the Younger Dryas* Cooling', PROCEEDINGSOG THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA(VOL. 104, ISSUE 41), October 9, 2007, https://www.jstor.org/stable/25449261
[6] P. Spurny, *'Discovery of a new branch of the Taurid meteoroid stream as a real source of potentially hazardous* bodies' ASTRONOMY AND ASTROPHYSICS (VOL. 605), September 2017, https://doi.org/10.1051/0004-6361/201730787
[7]Govermental Project website by NASA: 'Planetary Defence Coordination Office' https://www.nasa.gov/planetarydefense
[8]Intergovernmental Project website by European Union: 'NEOSHIELD'https://cordis.europa.eu/project/id/282703/results

Asteroid Impact events are characterized as 'low probability, high consequence events', as the risk calculation is made complicated by the multitude of factors affecting the event, and the incomplete knowledge of scientists with regard to these events, which have not occurred enough times to be under constant study and can only be studies through the geological record. The wide range of events that can occur – minor property damage to global extinction events characterized by climactic change and worldwide famine, disease, infrastructure failure and societal disintegration, further complicate calculations of the fatality rates and other important actuarial calculations. Thus, we see an almost incalculable but existential risk in these events and a woefully underprepared global community, which consists of collating scattered observations which make up a tiny percentage of NEOs and which cannot possibly meet the threat alone.

I. Private Interests and Recent Space Policy

Commercial interest in these asteroids – large, deadly, close to earth, thereby easier to reach, exploit and eliminate their threat – is anything but scarce, with 11 companies entering the space in the last decade alone. Some firms are admittedly more focused on asteroid mining than others, but all are dependent on the success and proliferation of the industry. In a 2017 report, the investment bank Goldman Sachs was optimistic about the prospects in asteroid mining, stating that the only barriers to it are psychological, and the obvious tanking of the worldwide platinum market, which has often been criticized as an artificially inflated market. The barriers are not financial or technological – with the estimate for a 7m large 500-ton asteroid being $2.6 billion, with existent technology.[9] It would take $1 billion to set up a platinum mine on earth. A large asteroid could contain up to $50 billion worth of platinum. However, it is prudent to be cautious about such figures, as they do not account for the massive fall in prices and the structural shift in the market for platinum after such a resource is found. However, the one thing that is certain is that such a venture would be profitable as it requires less maintenance and processing than a traditional mine on Earth. The steadily falling prices of rocket propulsion[10] and the expanding need for rare-earth minerals like platinum in the semiconductor and technology field will sustain a market. The primary consumers of platinum will shift completely from conspicuous consumers to large commercial technology companies – as a single 500m asteroid would contain 175 times to

[9]John Brophy, *'Asteroid Retrieval Feasibility Study'*,KECK INSTITUTE FOR SPACE STUDIES, 2 April, 2012, https://www.kiss.caltech.edu/final_reports/Asteroid_final_report.pdf

[10]Jim Edwards, *'Goldman Sachs: space-mining for platinum is 'more realistic than perceived'* BUSINESS INSIDER, April 6, 2017, https://www.businessinsider.com/goldman-sachs-space-mining-asteroid-platinum-2017-4?IR=T

global output of platinum, instantly reducing its value as a conspicuous commodity. However, platinum is not the only resource – cobalt, iron, nickel, and the plentiful rocket fuel (water) would only serve to encourage further exploration of space for mining and other human activities.

The direction taken by US Lawmakers was to pass the Commercial Space Launch Competitiveness Act, 2015 and to cut funding to NASA's Asteroid Redirection Mission Project in 2018, which would have brought an asteroid into Lunar Orbit and studied it, thereby creating a body of public knowledge, encouraging space activities, exploration. The actions were supposed to firmly place the asteroid mining firmly in the hands of the Private Sector. However, in the business of space, governmental institutions play a vital role in the furtherance of private firms as they are often the biggest buyers in the market. Therefore, the market, even if it is completely deregulated, is heavily dependent on government-run space agencies. Immediately after funding was cut for NASA' ARM project in 2018, in November of the same year, the first asteroid company was acquired by a blockchain company, and Deep Space Industries, their main competitor was acquired by Bradford Space Group, with the former diverting to 'space blockchain apps' and the latter diverting to rocket propulsion technologies.[11]

It is patently seen how the shift in focus of governmental space policy has shifted the industry heavily. Commercial interest in space is not peaked when the government completely releases controls on the industry, but when the government continues academic interest in the industry. The asteroid threat still looms large and will not disappear just because the NASA did not receive funding for the same. The lack of funding does not mean that the threat of asteroids has reduced and that the government need not concentrate on it. NASA shifted its focus to lunar mining and moon bases, thereby driving the industry towards a similar direction. There are strong arguments against lunar mining[12], however, asteroid mining necessitates the existence of lunar bases to make such ventures profitable and therefore it would be incorrect to chastise NASA for changing its direction.

However, the interest in space resource extraction has not dimmed and is only increasing. Space policy also needs to devote similar focus to asteroid mining as it has devoted to other realms like lunar mining and bases, because asteroid mining and exploration is combined

[11]Alan Boyle, *'Bradford Space Group buys Deep Space Industries, shifting focus from asteroid mining to propulsion'*, GEEKWIRE, 2 January, 2019,https://www.geekwire.com/2019/bradford-buys-deep-space-industries-shifting-focus-asteroid-mining-green-propulsion/

[12]Julie Michelle Klinger, *'Rare Earth Frontiers: From Terrestrial Subsoils to Lunar Landscapes'* Cornell University Press (2017)https://www.jstor.org/stable/10.7591/j.ctt1w0dd6d.1

with a real existential threat to humanity, whereas the likelihood of the Moon ever colliding into Earth are too low to be reality. In fact, Moon is a contributor to the stability in the Earth's orbit, which has been propounded as one of the reasons for life on Earth.[13] Therefore, it is unwise to discourage private observation and cataloguing of NEOs by shifting the focus of a governmental space agency and diverting resources towards a non-threatening venture. Asteroids not only pose a threat to Earth but also to future space missions to the moon and beyond.

II. Issues within the International Soft Law Framework

The International framework of Space Law consists of the following treaties: The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Outer Space Treaty); The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Space (Rescue and Return Agreement); The Convention on International Liability for Damage Caused by Space Objects (Liability Convention); The Convention on Registration of Objects Launched into Outer Space (Registration Convention); and The Agreement Governing Activities of States on the Moon and Other Celestial Bodies (Moon Agreement). These treaties have been drafted under the auspices of the principles agreed upon under the 1962 un Declaration of Legal principles Governing Outer Space:

- Space is open to free exploration by all states;
- No state can appropriate space or celestial bodies;
- States must bear responsibility for their activity in space, supervise activities of nongovernmental parties, and be liable for harm caused by their activity or by their nationals;
- States must maintain a registry of their space objects and the state of registry must maintain jurisdiction and control over the space object; and
- States must provide assistance to astronauts in distress and return errant space objects to the launching state.

The difficulties posed towards private exploration by way of these legal principles can be easily seen. The soft law framework places a bar on appropriation of space objects and any

[13]Laskar, J., Joutel, F. &Robutel, P. *'Stabilization of the Earth's obliquity by the Moon'*. NATURE 361, 615–617 (1993). https://doi.org/10.1038/361615a0

claims of property upon them. The principle stating that States are responsible for the activities of their own and those of their nationals also discourages states from allowing private parties to launch and control space. In fact, most countries do have provisions disallowing any person from launching space probes without governmental permission. While that is completely rational and justified, most countries have outright banned such activities for private parties or have kept it as a governmental portfolio to which only close state partners have access. We have already seen how it would be unwise to keep the realm of asteroid observation and detection a closed field.

Issues have already cropped up regarding the jurisdictional extent of national space registries and the liability paradigm which were envisioned in the 1972 Liability convention – it could only envision governmental space activities and their control over space probes throughout the probe's lifespan. However, the advent of private space entities and their usage and sale of satellites during the operational lifespan, i.e., when the space object is outside the country's physical borders, is in direct opposition to the rules under the 1972 Convention. Attaching absolute liability to the "launching state" when the space object is on the surface of Earth or to an aircraft in flight[14], while imposing liability only when the State is 'at fault' when it causes damage to another space object in space[15] is outright contradictory as well. The reality of space objects is such that, at interplanetary speeds, a space object out of control in space is far more damaging than a space object within the bounds of Earth's gravity, i.e., an object that does not have escape velocity. Such rogue objects are more likely to cause damage to other space objects and compound the problem of space debris and endanger future space exploration. An object that does harm on the surface of Earth can do only so much harm and not anything more. Therefore, it does not make complete sense to penalize the lesser wrong as well.

Moreover, the liability of the State does not end there – it continues to be held liable even when the space object has been transferred to another party. The vestiges of the Cold War mistrust between states can be seen in this principle. Holding a State liable for an accident of a space object it no longer exercises any control over, is a strong discouragement for States to develop their respective domestic private space industries and foster the free trade of satellites and rockets. This impairs the ability of the global community to keep a watch on the asteroid threat.

[14] Art II, The Convention on International Liability for Damage Caused by Space Objects, 1972.
[15] Art III, The Convention on International Liability for Damage Caused by Space Objects, 1972.

The Registration Convention of 1976 mandate that every state maintain a register of all its space objects and provide details of the same to the UN to be included in the international register.[16] Once registered thus, Art VIII of the Outer Space Treaty of 1967 declares that the state of registry has perpetual jurisdiction and control over the object. The increase in commercial space activity renders this rule at least partly unpracticable when most space transactions are international and space objects are often sold outside their state of registry. This approach was rational at a time when spacefaring was a preserve of the State. It is no longer so, and it would make more sense to grant jurisdiction and control to the transferee state. There is a two-step solution to this problem: Under Art. II of the Convention, agreements to transfer jurisdiction are allowed, and no bars have been placed to transfer jurisdiction to a non-launching state as well. The second step involves deregistration of the space object form their own registry, which is not expressly banned by the Convention as well.

Investors in this industry are obviously wary of investing in a field where the foremost international treaty on the same bans appropriation of space objects.[17] Scholars have interpreted the same to be prohibitive of claims of sovereignty and ownership of space objects, but not prohibitive of the resources extracted. This article makes sense when space colonization is envisioned in the sense that no country or corporation should be allowed to stake claim over the Moon, or over Jupiter, for instance. However, in space, resources are anything but limited and harmful asteroids are in plenty. Making an exception and allowing for the full ownership, control ad sovereignty over NEOs and NEAs would greatly encourage the field of asteroid mining and would help mitigate investor fears that they might not have ownership of the asteroid that they had painstakingly prevented from entering Earth's atmosphere and hoped to exploit commercially. The United States, in order to mitigate investor grievances had enacted the Space Resource Utilization Act of 2015, a bottom-up law, which was not without controversy and was passed via the strong lobbying presence of private space industries, which simultaneously grants ownership over 'any abiotic resource in situ found on or within a single asteroid' and gives up any claim of 'sovereignty, exclusive rights or jurisdiction or ownership' over any celestial body. A 2017 law in Luxembourg, another major investor in the ill-fated 'Planetary Resources Inc.' also granted rights to asteroid miners that 'space resources' are capable of being appropriated. Therefore, we can see a pattern of silent international law and over national law, which would obviously put

[16] Art II(1), The Convention on Registration of Objects Launched into Outer Space, 1976.
[17] Art II, Outer Space Treaty, 1967.

some states at odds with each other. What is more feasible would be to grant complete ownership over not only those abiotic resources in situ, but also of the asteroid itself, if it is an NEO or an NEA, and whereby such ownership should also not prevent academic overview over their activities.

III. Suggestions Towards the Space Activities Bill, 2017

In 2017, India entered the group of countries which have enacted legislations to control private space activities, almost in direct opposition to its foreign policy stance in 1967 when it helped formulate the Outer Space Treaty of 1967. At the time, India as a fledgling nation had backed the USSR in its stance that private activities are to be banned completely. However, today India has come far ahead in its exploration of space and in encouraging space research. Even though it is still heavily State-controlled, Commercial interests have arisen slowly with few firms like Antrix, Bellatrix Aerospace and Team Indus. The legislation, unlike that of the US, is a top-down legislation, i.e., that it has not drafted legislation with heavy input from the private players in the industry. Such bottom-up legislation would also not have a whole picture of space scene in India anyway as they have relatively narrow fields of operation when compared to giants like the ISRO and DRDO. It is also called as an 'off-the-shelf' legislation in that it emulates most of what has been envisioned in UN Model Laws by modifying it a little to suit the Indian scenario.

The business model that the legislation has envisioned for players in the space race is that of public-private partnerships. While this is completely practical when contemplating the legislation as one which seeks to expand India's rocket building and launch capabilities, it is not too practical when we envision PPP's in the field of asteroid detection and mining. Asteroids are plenty, and so should the efforts devoted to its exploration. While public private partnerships are a good starting point for such companies, the field should seek to become less and less reliant to State assistance. It is not contended that the State should take a completely hands-off approach – the State can act as a coordinator and can be an active participant in the realm. Taking a hands-off approach handed a heavy blow to the two prominent asteroid mining companies in the US.

The Bill as been criticized for potentially implying in s. 2(f) in its definition of "space activity" to include all hardware that has GPS/GLONASS receiver like smartphones, smartwatches, pet trackers etc. However, the usage of the word 'means' shows the intent of the legislature to use an exhaustive definition and how it does not seek to include any other activities. The definition could surely by drafted better, but it is not a prima facie broad

definition. Moreover, the legislation being a top-down legislation born out of the UN Model National Space Legislation, criticizing it as broad would be akin to calling out the obvious. The Bill however, as been rightly criticized of not being completely cognizant of the myriad needs of each specific space activity and how the rules for each need to be different.

The IP clause in the bill is also unrealistic, wherein it vests all intellectual property with the Central Government instead of granting it a compulsory license. This would greatly stymie space research and innovation of space technologies. If no grants have been given by the government, there exists no sense in vesting the intellectual property with the Central Government. National Security would not be better off by vesting the Government with the intellectual property instead of granting itself a compulsory license akin to German Law. Therefore, this clause needs serious reconsideration.

This Bill has great potential and serious ramifications if passed in the form that it currently is in. Some clauses need reconsideration and the approach itself needs a change in viewpoint. The Bill however, is mindful of the realities of space research in India and at least does not advocate hands-off approach in the field of commercial space exploration.

IV. Conclusion

The imminent nature of the asteroid threat, the depletion of earth's resources, the societal and ecological imbalances caused by mining in sensitive ecosystems, increasing private interest in space, and the interests of governmental agencies taken in total make this present time primed for space exploration and usage. The various incentives under the US legislations would also encourage private exploration of asteroids. The process needs only speeding up, as the interests are already in place. The threat looming large over the earth cannot be ignored, as all asteroids cannot be realistically monitored by a few space agencies. Private interests, once introduced, would help monitoring the same. The closest NEAs are the most dangerous, as well as the most commercially viable and profitable. A few key changes in Space law, i.e., removing the prohibition of national or commercial appropriation of asteroids by creating an exception to the Ben Ching position for NEOs and NEAs would be overall helpful to the global economy and the scientific spirit in the international community.