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SPACE EXPLORATION GAINING MOMENTUM: BRIDGING THE GAP

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The US Space Policy Directive-1, signed by President Trump on December 11, 2017 is a shift in focus to a new direction that calls for a US-led, integrated program with private sector partners for return of humans to the moon, followed by missions to Mars and beyond. The policy in a way also ends NASA's existing effort to send humans to an asteroid. Following issuance of the directive, NASA is developing new concepts for lunar orbit, exploiting the cis-lunar space, and a permanent moon station to provide the foundation for human exploration deeper into the solar system. NASA has also been studying an orbital outpost concept in the vicinity of the Moon with American industry and the International Space Station partners. As part of the fiscal year 2019 budget proposal, NASA is planning to build the Lunar Orbital Platform-Gateway in the 2020's. This also sets the ball rolling for human expansion across the solar system.[1]

The immediate goal seems to be directed towards building a foundation by setting up a lunar outpost. This is being viewed as a stepping stone for access to deep space and a training ground as well. This lunar outpost will also serve as a testing ground for new technologies like solar electric propulsion techniques and optical communication techniques which are essential for travelling into deep space. While recognising space security as vital to offset the counter-space capabilities of China and Russia in the near term, the recent shift in US space policy is a long term approach to regaining an edge after a realisation of being challenged in their leadership in space and ceding ground to dominant space powers in a multipolar world space order. This realisation has come almost half a century after the US abandoned its moon landing missions.[2] The urgency shown for space exploration is also evident from the acceptance of private participation and investments from private players and the initiative towards streamlining regulations to accelerate commercial space ventures.[3]

What is US trying to accomplish by announcing such ambitious plans for sending astronauts to the moon and deep space exploration? This is a question which gives rise to many speculations. Why would the US choose a path requiring massive budgetary allocations and years of scientific research when the returns would be imperceptible in the near future? Moreover, there is enough data and study of the moon already existing from previous moon missions undertaken by the space faring community.

The most lucrative agenda seems to be the natural resources on the moon which could be harvested and transported back to earth. Ever since the possibility of existence of water on the moon was announced two decades ago, the moon has been visited by a variety of robotic exploration missions from many nations, including the Chandrayaan-1 mission from India launched in 2008. Though multiple measurements taken by instruments flown on previous missions was an indicator of ice caps at the poles of the moon, the Chandrayaan-1 mission was successful in detecting water in vapour form in trace amounts, leading the space community to firm their belief on the presence of water on the moon.[4]

The other lucrative resource that is said to be available in abundance on the moon is 'Helium' which can be extracted from moon rocks and moon dust, a substance called 'Regolith'. Large quantities of Helium-3 are deposited on the surface of the moon by solar winds. The discovery of Helium-3 on the moon has generated enthusiasm amongst the scientific community for alternatives in cleaner and efficient power generation on earth. It is believed that 1 gm of Helium-3 generates a hundred times more power than Uranium through fusion reactions without any radiation or nuclear waste.[5] Such power plants would entail lower capital and operating costs, higher efficiency, and smaller power plants and reduce air and water pollution. The cost of Helium-3 on earth cannot be predicted as it has limited availability on earth. Nevertheless, the discovery of Helium-3 on the moon could free the world from dependence on fossil fuels.

Besides the mineral resources, moon offers possibilities of colonisation, and the infrastructure for launching deep space missions, which allows for acclimatisation of astronauts, scientists and space tourists. That outer space will be the ultimate highground for military operations, is a belief which is only getting emboldened, every passing year. Orbital outposts and lunar / deep space military stations would be an ultimate possibility, given the exclusivity attainable by only a few space powers. These few will exploit the lesser known dimension of warfare in the garb of space security measures.

The Moon Treaty of 1979 which is an agreement governing the activities of states on the moon and other celestial bodies is finding more relevance today and is likely to be put under the scanner as many articles of the treaty are favourable to the pioneers of moon missions and deep space missions, and which were foreseen in the 1970's. The treaty, though being emphatic of the moon and its natural resources being the common heritage of mankind, gives enough leeway for exploration, mining of resources and setting up of manned and unmanned stations. Whether such mining of resources can be commercialised or not is an issue which has been left open ended. Article 11 of the treaty indicates establishing an international regime to govern the exploitation of natural resources. This may happen in a few years from now. Also, Article 3 of the moon treaty allows for military personnel, any equipment or facility to be used for peaceful exploration and scientific research. Overall, the moon treaty gives a lot of scope for pioneers to take advantage and is a cause for concern.

India is far behind in human and robotic space missions due to the technology gap that exists. Though Indian Space Research Organisation (ISRO) has had commendable successes with the Chandrayaan-1 and Mangalyaan missions, it is only the beginning. ISRO has also flight tested the Reusable Launch Vehicle (RLV) and the human spaceflight capsule. The significant fact is that there are not many countries besides the leaders like US and Russia and India, and ISRO needs to capitalise on the opportunity. The incremental approach to space exploration being followed now is the right way forward, however, diversification to multiple agencies and involvement and investment of the private sector and entrepreneurs will hasten the process.

As global demand for rare earth elements is steadily increasing, access to lunar resources becomes both a strategic and inevitable development. With its vast stores of the non-polluting nuclear fuel (Helium-3), the possibility of sustaining human life in controlled conditions, and the option of giving a military edge, our lunar neighbour holds the key to the Earth's future.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies [CAPS])

Keywords: Space Exploration, US Space Policy Directive, Chandrayan, Mangalyan, Helium.

Notes:

[1]'New Space Policy Directive Calls for Human Expansion Across Solar System', At https://www.nasa.gov, accessed on February 22, 2018

[2] Hanneke Weltering, 'National Space Council Meets with VP Mike Pence Today: Watch It Live', February 21,2018, at https://www.space.com/39753-national-space-council-2nd-meeting-webcast.html, accessed on February 22, 2018.

[3] Sarah Lewin, 'Pence: To Lead in Space, US Needs Less Red Tape for Commercial Space Companies', February 21, 2018, at https://www.space.com/39769-second-national-space-council-meeting.html, accessed on February 22, 2018.

[4] 'Chandrayaan - 1: Results', at https://www.isro.gov.in/pslv-c11-chandrayaan-1, accessed on February 23, 2018.

[5] 'Competitiveness of India's Space Programme' A Sivanthu Pillai, Talk during Kalapana Chawla ORF Annual Space Policy Dialogue, February 17, 2018.