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Introduction

In August 2024, South Korea launched its new space agency, the Korea Aero Space Administration (KASA).[1] With the launch of a new space agency, South Korea has also announced that it will double its budget to US $1.1 billion by 2027 for space exploration.[2] South Korea launched its first locally developed rocket, Nuri, in 2021.[3] Since then, South Korea has sent various satellites and rockets related to military surveillance and spy satellites into orbit through foreign-made launch vehicles like SpaceX. Seoul has realised the critical importance of space exploration for its civilian and military purposes. With the space agency's launch, the government announced a new rocket program and navigation satellites would be launched in the coming years. This ambition of South Korea has come as a response to North Korea's testing of ballistic missiles, sounding rockets, and possessing nuclear capability. Also, North Korea has had a dedicated space agency since the 1980s, called the National Aerospace Technology Administration (earlier called the Korean Committee of Space Technology).

India stands one among the top nations when it comes to space exploration. In the year 2013, India became the Asian country to orbit Mars, as well as the first in the world to do so in its first attempt. Additionally on August 23, 2023, India also became the fourth country to land on the moon. In the year 2024, ISRO's solar mission Aditya-L1 was launched to study the solar winds, chromosphere and corona of the sun.[4] India also aims to launch its first manned spaceflight program, Gaganyaan in the year 2025. ISRO (Indian Space Research Organisation) has also sent many missions with the collaboration of many countries, for example, the NISAR Mission with the USA, SARAL with France for oceanographic studies, Deep Space Support with the European Space Agency to assist in tracking Chandrayaan, LUPEX with Japan (JAXA) and even with the collaboration with many countries of multilateral organisations like SAARC, BIMSTEC, and others.[5]

Contextualising India-South Korea Space Collaboration

Space exploration provides potential scope for Seoul and New Delhi to explore new dimensions in their relationship through space missions and satellites. India can provide its expertise in launch vehicles as India has many launch vehicles like Geosynchronous Satellite Launch Vehicle (GSLV), Polar Satellite Launch Vehicle (PSLV), GSLV Mk III, Small Satellite Launch Vehicle (SSLV) and recently, with the help of private company India developed Rhumi-1(Reusable Hybrid Rocket) which is India's first reusable rocket which is also 100 per cent pyrotechnic-free. Rhumi is 65 per cent cheaper than building new rockets for every launch. India can provide its launch vehicles to South Korea for the launch of satellites. In 2017, India launched 104 satellites of various countries through PSLV-C37. ISRO and KARA can collaborate on joint satellite developments, such as earth observation and communication satellites.[6] Sharing expertise in deep space missions through interplanetary exploration like India's Chandrayaan and Mangalyaan can help South Korea design and execute lunar and Martian missions and further collaborate on asteroid exploration. Other potential regions where both agencies can collaborate are regional space cooperation like the SAARC Satellite Program plus South Korea; India can assist South Korea in framing policies for sustainable space exploration, human spaceflight programs, data sharing, which is collected from various missions, etc. India also aims to launch its space station called Bhartiya Antariksha Station (BAS) by 2035; with collaboration with South

Korea, both nations can take advantage of this opportunity to create their own position in the outer space.[7]

South Korea's Robust Semiconductor Industry

In September of 2024, India organised South Asia's biggest semiconductor conference, positioning India as a trusted partner in the global semiconductor supply chain as part of India's semiconductor mission. India's semiconductor mission aims to build a vibrant semiconductor and display ecosystem to position India as a global electronics manufacturing and design hub. The Ministry of Electronics and Information Technology of the Government of India has launched four schemes: semiconductor fabs, display fabs, compound semiconductors/silicon photonics/sensors fabs/discrete semiconductor fabs/ and design-linked incentives.[8]

South Korea has a remarkable record in semiconductor manufacturing. South Korea stood at world number one in memory semiconductor production and number two in semiconductor production[9]. As per INVEST Korea, the global semiconductor market reached USD 604 billion in 2022. South Korea produces 60.5 percent of the worldwide memory semiconductor market, with a DRAM market share of 70.5 percent and a NAND market share of 52.6 percent. [10]

To give traction to "Development of Semiconductor and Display Manufacturing Ecosystems in India" scheme, in 2024 three semiconductor units were established with collaboration and help from both domestic and foreign businesses. These proposed establishments collectively are expected to generate 20 thousand advanced technology oriented jobs and 60 thousand indirect jobs. It includes the following:-

(a) Tokyo's Renesas Electronics Corporation and Stars Microelectronics of Thailand for a semiconductor unit in Sanand, Gujarat;
(b) Tata Electronics Private Limited and Powerchip Semiconductor Manufacturing Corporation (PSMC) of Taiwan;
(c) Tata Semiconductor Assembly and Test Private Limited (TSAT) in Assam.[11]

In addition, Adani Group of India has also signed with Israels Tower Semiconductor for the semiconductor manufacturing ecosystem in Taloj, Maharashtra.[12] All the above mentioned projects is expected to bring larger scale employment with up to twenty thousand advanced technology jobs and sixty thousand indirect jobs. In addition, Adani Group of India has also signed with Israels Tower Semiconductor for the semiconductor manufacturing ecosystem in Taloj, Maharashtra.[13]

South Korea, with its acquired expertise in the field of semiconductor, can play a significant role and contribute in realising India's aspiration to become next global hub in semiconductor manufacturing. The strides made by South Korea's advancement in semiconductor processes, such as sub-10nm fabrication and 3D chip stacking, can bolster India's efforts to leapfrog into cutting-edge technology.[14] Both nations can facilitate the private players for joint ventures and investments, and Korean companies like Samsung and SK Hynix can take advantage of India's Production Linked Incentive. Since the semiconductor industry is highly skilled, South Korea can train Indian engineers and technicians. For this, India can open its top institutions like the Indian Institute of Technology, National Institute of Technology, Indian Institute of Sciences, and other institutions for South Korea to train India's next-generation engineers.[15] 5G, artificial intelligence, machine learning, deep learning, and the Internet of Things (IoT) are new zones where both nations can collaborate.[16]

The development of robust space and semiconductor industry plays a significant role in the power dynamics of any country. India and South Korea's mutual goal of regional stability in the Indo-Pacific can be fulfilled with collaboration and cooperation in space exploration and semiconductor manufacturing. The evolution of critical technologies like artificial intelligence has made a compulsion for a nation to develop chips and equipment for space indigenously to secure its cyber borders.

The China Factor between India and South Korea

China has emerged as the bellwether in the development of highly advanced technology, both for space exploration and semiconductor manufacturing. China has taken over as a leading player in new space race. China's Chang'e-6 brought lunar samples from the far site of the moon and has opened the moon exploration arena with long-term geopolitical implications. China, in 2017, also declared its goal to become a

major AI innovation centre by 2030.[17] Therefore, it has become imperative for both India and South Korea to collaborate in field of space and semiconductor manufacturing to bolster their positions in the race against China and maintain the technological parity viz-a-viz China.

Conclusion

India and South Korea celebrated their 50 years of diplomatic relationship in 2023 and will celebrate 10 years of being Special Strategic Partners in 2025. Both Seoul and New Delhi have moved ahead in economic cooperation, specifically post-1991 economic reforms in India. In 2022, South Korea was India's 13th trading partner from April 2000 to March 2024, at US $5.85 billion.[18] There have been not any significant bilateral activities between these two nations in recent years except for meeting on the multilateral platforms.

Space exploration and semiconductor manufacturing have the potential to open new horizons of cooperation between the two nations. With the intensification of US-China competition, the time is ripe for Seoul and New Delhi to introspect their collaboration beyond economic cooperation and look for other dimensions of cooperation in space, semiconductors, military cooperation like conducting joint exercises (annually or biannually), forming a regional organisation like Biopharmaceutical Alliance (India, USA, South Korea, Japan) which is QUAD minus Australia plus South Korea, and cooperation in diverse sectors of industries. Their collaboration can not only be crucial for critical technology development but also counter China in space exploration and semiconductor manufacturing.

Endnotes

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