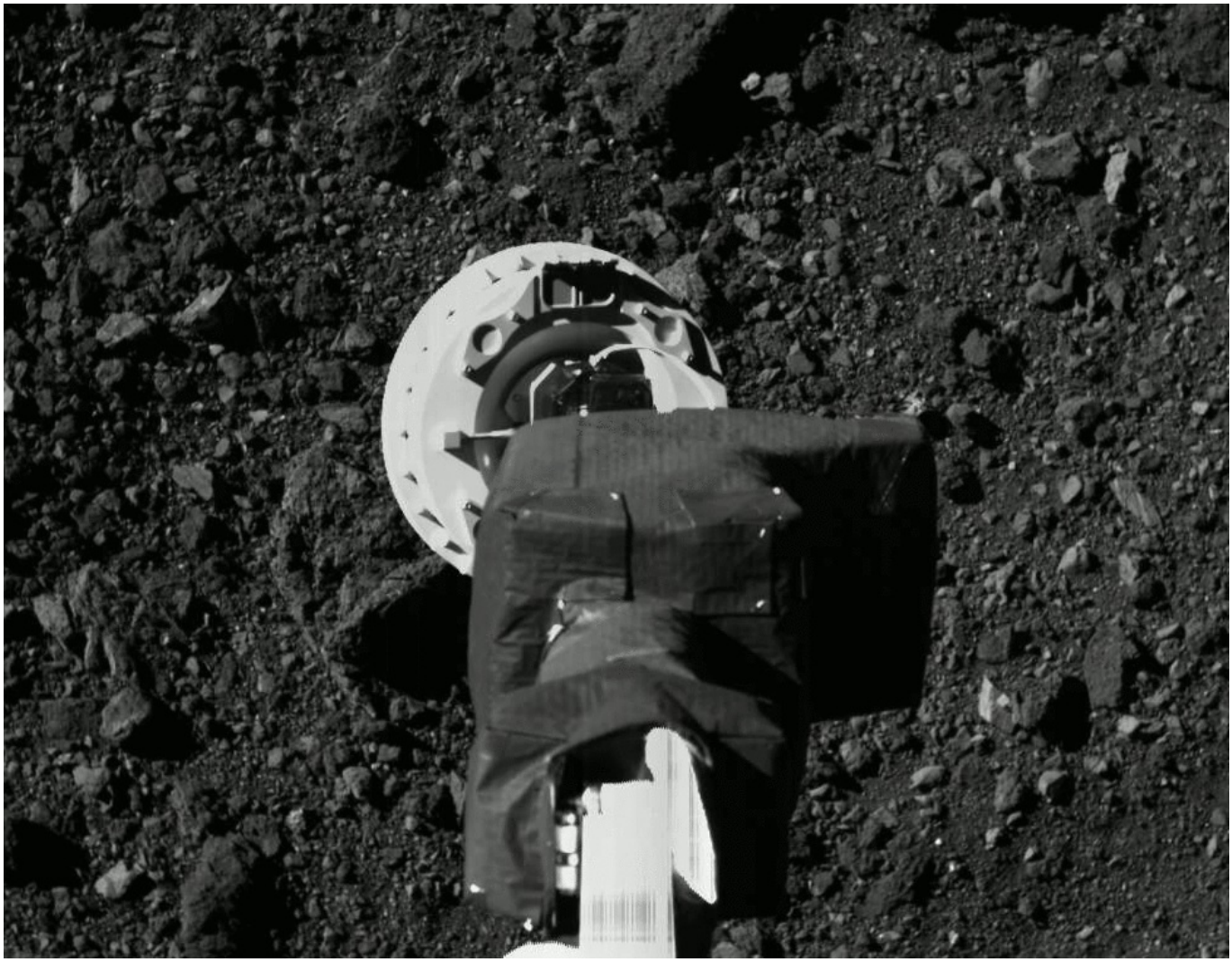
STATUS OF EXISTING AND EMERGING ASIA-PACIFIC SPACE POWERS CAPABILITIES



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I. INTRODUCTION

In this essay, Namrata Goswami shows **"**China, India, and Japan are major space faring nations with independent capacity to launch into space, with ambitions for space settlement and space resource utilization" and concludes: "The space future that we need to anticipate besides orbital presence and support for terrestrial military forces is countries developing military power projection capacities beyond GEO to cislunar space and the Moon."

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Banner image: Asteroid Bennu landing, NASA photo here

II. NAPSNET SPECIAL REPORT BY NAMRATA GOSWAMI

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Introduction

The Asia-Pacific is a key region in international relations today. Host to major powers like China, India, Japan, South Korea, Indonesia and Singapore, the combined Gross Domestic Product (GDP) purchasing power parity (PPP) of the region was estimated to be the largest in the world in 2020, pre-pandemic assessments.[1] Interestingly, despite the COVID 19 pandemic, China has seen positive growth rates as the largest contributor to Asian economic vibrancy.[2] By 2030, the region is forecasted to contribute 60 per cent of global growth.[3] Among the major space faring nations in the Asia-Pacific, China will become the world's largest economy by 2050, according to PricewaterhouseCoopers, followed by India at number two and the United States (U.S.) at number three.[4] Indonesia is forecasted to be the fourth largest economy; South Korea will be 14th in overall world ranking.[5] Among those forecasted to lead, China and India are Great Powers, followed by major powers like Japan, South Korea, and Indonesia. China, India, and Japan are major space faring nations with independent capacity to launch into space, with ambitions for space settlement and

space resource utilization. South Korea has had its own space agency since 1992: the Korea Aerospace Research Institute.[6] The context within which the current space activities of space faring nations are occurring has changed as well. Unlike during the Cold War, when the focus was on 'Great Power Competition' for prestige and ideological reputation, with 'flags and footprints' missions, today, the focus is on space utilization and development, of which prestige is but a minor part. One can gauge this in the articulated space ambitions of the United States,[7] China,[8] India,[9] Japan,[10] and South Korea.[11]

Given the emergent space power focus in the Asia-Pacific, this report highlights the space power capabilities of the two Great Powers in space in Asia (China and India). This is followed by a section on horizontal and vertical proliferation of space warfare capabilities.[12] The report discusses the institutional and legal regimes and constraints on space weaponization, explains certain worst-case militarization scenarios, and presents alternative space demilitarization pathways.

Defining Space Power

Power is the ability that Country A wields over Country B to get Country B to do something, which Country B would not otherwise do. It is the ability to influence others to do what you want them to do.[13] It also implies an ability to prevent others from doing what they want, especially if it is not in your interest. Sometimes, such power is wielded to prevent others from including agendas in discussions that may not be in your interest.[14] An example of this is the ability of the permanent members of the United Nations Security Council (UNSC) to pressurize and prevent other countries from discussing issues that are detrimental to their or their allies' interest. Therefore, power, in international relations, is the capability to influence, persuade or coerce others to do what is in one's own interest. By extension, spacepower is an extension of comprehensive power: the ability of Country A to persuade or coerce Country B to behave in a manner in space that is beneficial to Country A's interests. It includes the ability to deter harmful behavior, either by denial or by punishment. Brent Ziarnick in *Developing National Power in Space A Theoretical Model* defines spacepower as "the ability to do something in space."[15] Ziarnick develops his definition from Brigadier General "Billy" Mitchell's 1925 definition of airpower "as the ability to do something in the air."[16] Ziarnick quotes Colonel David Lupton, who defines spacepower as "the ability of a nation to exploit the space environment in pursuit of national goals and purposes and includes the entire astronautical capabilities of a nation."[17] The US Space Force's Capstone Doctrine, published in 2020, states that "national spacepower is the totality of a nation's ability to exploit the space domain in pursuit of prosperity and security."[18] The Capstone Doctrine identifies four instruments of national power: diplomatic, informational, military, and economic (DIME). "Military spacepower enables a nation to protect and defend space-based sources of economic power. Military operations exist in space to preserve and advance all equities of national spacepower."[19] It is critical to realize that while there are generalizable definitions of spacepower, when operationalized within the context of a particular country, the concept of strategic culture has an impact on how states behave/will behave in outer space. Strategic culture can be defined as a sum of a *nation's assumptions about its reality* (threats, opportunities) based on which policy choices are preferred over others. These policy choices are informed by the state's political culture reflecting both continuity and change over time.[20] Political Culture is "a short-hand expression for a 'mindset' that has the effect of *limiting attention to less than the full range of alternative behaviors, problems* [emphasis added], and solutions which are logically possible."[21] For instance, from a strategic culture perspective, China's aim is to win the competition for influence and power projection, especially with the help of outer space, and without bloodshed so that its value system (especially that guided by President Xi Jinping's thought), is established and legitimized.[22] Given that space has such deep consequences for how society is run today, including via the civilian, commercial, and military uses of space, "the purpose of space strategy is to ensure access to and use

of space."[23] To maintain access requires space capacity. It is therefore important to examine the profile of the space powers' capabilities.

Profile of Each Space Power's Capabilities

This section offers an assessment of the Great Powers in space (China and India) and their space capacities.

China-Civil-Military-Commercial Space Capabilities

China has one of the most ambitious space programs in the world. Funded annually with a budget of approximately $8 billion, China has ambitions to establish a permanent space station by 2022, a lunar research outpost by 2036, a Solar Power Satellite (SPS) transmission capacity from geostationary orbit (GEO) by 2050, and to establish itself as the world leader in space by 2050.[24] China has invested in developing its military space capacity to augment its information warfare capacity for military command and control (CnC), precision navigation, and timing (PNT) for independent missile launch and tracking as well as sea-based launch for avoiding detection. In the commercial sphere, Chinese private companies like OneSpace have already launched to space in 2019 and have plans for developing reusable rockets. Within the last two years (2018 onwards), China has seen investments of up to $2 billion in its private space sector.

Civilian Capability

China has an independent space launch capability and has a demonstrated human presence in Low Earth Orbit (LEO) via its Tiangong space station. China has achieved humanity's first landing on the lunar far side, and it has also launched its second independently conceived Mars mission. As of April 1, 2020, China has 363 satellites, the US has 1,327, Russia 169, and India 118.[25] On June 23, 2020, China launched the 55th satellite of its BeiDou Navigation System (BDS) according itself a fully independent, self-reliant Global Navigation Satellite System (GNSS) as an alternative to the US Space Force-maintained Global Positioning System (GPS). With this launch, "China is now able to extend influence in a multidomain environment (land, sea, and space) via its BeiDou space system, which provides navigation to aircraft, submarines, missiles, as well as commercial services dependent on such navigation."[26] This Chinese information infrastructure consists of undersea cables, (in which China is dominant), space-supported links, and other Earth-based links. China's National Development and Reform Commission (NDRC) determined in April 2020 that services like space information, and associated incorporated services like 5G, satellite broadband, artificial intelligence (AI), blockchain, and the Internet of Things (IoT) are part of its "New Infrastructures" list.[27] BeiDou offers an alternative to GPS, enabling China to further consolidate its hold on global infrastructure and rulemaking, form partnerships and alliances and to control the standards for information technology, mobile devices, 5G, self-driving cars and drones, and the broader IoT. It offers China an influence mechanism whereby countries dependent on BeiDou would hesitate to criticize China on political issues such as Tibet, the South China Sea (SCS), or Taiwan. This increases China's ability to coerce and compel. Wang Jingang, the chief deputy designer of the BDS-3 satellites, has described his work as a "rare chance to devote my intelligence to a symbolic national project." He points out that "people still mainly depend on navigation by GPS, supplemented by BDS," but hopes that "in a few years, people can be navigated mainly by BDS."[28] In January 2019, China established its first state-funded Space-Based Solar Power (SBSP) plant in Chongqing, a concept supported by Li Ming, the vice president of the China Academy of Space Technology (CAST).[29] The base plant is being constructed under the guidance of the Chongqing Collaborative Innovation Research Institute for Civil-Military Integration (CCIRICMI) in Southwestern China in partnership with researchers from Chongqing University, CAST's Xi'an Branch in Shaanxi province, and Xidian University. An initial investment of $15 million has been

made by the Bishan district government for the SBSP plant. Technologies being tested include SBSP satellites in GEO using automated assembly and wireless power transmission.[30] Xie Gengxin, Deputy Head of CCIRICMI, has stated that:

> We plan to launch four to six tethered balloons from the testing base and connect them with each other to set up a network at an altitude of around 1,000 meters… these balloons will collect sunlight and convert solar energy to microwave before beaming it back to Earth. Receiving stations on the ground will convert such microwaves to electricity and distribute it to a grid… if everything goes well, a Chinese solar power station will be put into orbit about 36,000 kilometers above Earth and start generating power before 2040.[31]

China is also investing in its space launch capacity. Its latest rocket, the *Long March 5* (which is capable of launching 14 metric tons to geostationary orbit (GEO), 25 tons to low earth orbit (LEO), and 8.2 tons to trans lunar injection) successfully launched in December 2019. The success of this launch was critical given the China Mars Mission (Tianwen) was launched on the Long March 5 on July 23, 2020. Also, the Long March 5 launched China's *Chang'e 5* lunar sample return mission in November 2020 and sunsequently will launch China's eleven planned missions to construct its permanent space station (Tiangong) by 2022. In addition, China is developing the *Long March 9*, which is designed to carry a payload of 140 metric tons to LEO, a 50-ton spacecraft to a lunar transfer orbit, and a 44-ton payload to Mars transfer orbit.[32] Importantly, in its justifications for the *Long March 9*, China listed three goals: to launch a Mars robotic exploration mission requiring 41 tonne payloads; to launch manned Mars and deep space missions; and to construct an "orbital solar power plant with 10,000 MW capacity, massing some 50,000 tonnes, requiring 620+ launches."[33]

One of the core missions for China in civil space is its China Lunar Exploration Program (CLEP). Following the successful landing of the *Chang'e 4* on the far side of the moon on January 3, 2019, Wu Yanhua, deputy head of the China National Space Administration (CNSA) announced that by 2019 year-end, China will launch *Chang'e-5*, to bring lunar samples back to Earth (accomplished December 2020). This would be followed by *Chang'e-6*, aimed at bringing samples from the South Pole; *Chang'e-7*, which will survey the South Pole for evaluating its composition; and *Chang'e-8,* which will test key technologies, like 3D printing, to lay the groundwork for the construction of a scientific base on the moon.[34] Critically, scientists at the Technology and Engineering Center for Space Utilization of the Chinese Academy of Sciences (CAS) have tested 3D printing technology in micro-gravity by successfully completing a ceramic testing technology in 2018.[35] According to Wang Gong, Director of the CAS Key Laboratory of Space Manufacturing Technology, this will build a Chinese capability to construct bases on the moon and Mars, as well as in-situ resource utilization and space manufacturing with space-based resources.[36] Using ceramics is instructive as it is similar in composition to lunar silicate particles. China tested growing life organisms like cotton seeds, Arabidopsis, and potatoes on the lunar surface with its 3kg bioregenerative life support system aboard the *Chang'e 4*, with only the cotton seed sprouting. This is in pursuance of building human capacity to settle and survive on the lunar surface. China's CLEP is not only aimed at lunar scientific missions, but it is also a long-term space presence development strategy to incrementally build capacity for lunar and asteroid mining. The Moon offers the best chance of building space-faring capacities on a planetary body because it is not difficult to reach from Earth. This aspect is recognized by Wu Weiren, the chief scientist at CLEP. He states that, "our short-term goal is to orbit the Moon, and land on the Moon, and take samples back from the Moon…our long-term goal is explore, land and settle. We want our manned lunar landing to stay for longer periods and establish a research base."[37] China also developed its relay satellite in May 2018, with the *Queqiao*, or Magpie Bridge, being placed in the L2 Halo orbit to serve as a communication relay satellite from the *Chang'e 4*.[38] *Queqiao* can peer into the Lunar polar craters, enabling future landing zones for

China's probes in the shadowed regions. Lieutenant General Zhang Yulin, former deputy commander of China's Manned Space Program and former Deputy Chief of the Armament Development Department of the Central Military Commission (CMC), now with the Strategic Support Force (SSF), specified the significance of the Moon in 2016 when he stated that, "the earth-moon space will be strategically important for the great rejuvenation of the Chinese nation."[39] Yulin indicated in that same interview that China will be investing in building capacity to generate solar power in space. He was clear on what China's space program's focus should be in the long term, "The future of China's manned space program, is not a moon landing, which is quite simple, or even the manned Mars program which remains difficult, but continual exploration of the earth-moon space with ever developing technology."[40]

Military Space Capacities

China is developing its military space capacity. China's space program is directed by the State Administration on Science, Technology and Industry for National Defense (SASTIND), which functions under the direction of the Ministry of Industry and Information Technology (MIIT).[41] Consequently, China appreciates the vital role that space plays for CnC, PNT, informatized warfare, space access and presence, space-based communications systems, and developing counter-space capabilities via-a-vis the adversary. In 2007, China tested its anti-satellite (ASAT) capability. Such ASAT technologies have been further refined in 2010, 2013, and 2014, enhancing their capabilities (without generating space debris as did its 2007 test). Open sources report that the SSF is training with ASAT missiles aimed at US satellites. These ASAT systems include a variant of the HQ-19 surface-to-air missile (utilized in tests in 2007 and 2010), the DN-2 (2013), and the DN-3 (in the tests of 2015, 2016, and 2017). According to the National Space and Air Intelligence Center (NASIC) report, *Competing in Space*:

> China has military units that have begun training with anti-satellite missiles. Russia is probably also developing an anti-satellite missile. These missiles can destroy U.S. and allied space systems in low Earth orbit, making intelligence, surveillance, reconnaissance, and communications satellites vulnerable.[42]

In 2015, China institutionalized a separate space service with the establishment of the People's Liberation Army Space Force (PLASSF). The PLASSF, for the first time, brings together China's growing military space assets into a single unit, aimed at dominance across the spectrum of air, space, and cyber. An independent BDS adds to China's military CnC as well. China can now independently guide missiles and bombs onto fixed targets without fear that the United States would turn off navigation services. China can now also guide its missiles very close to the target, after which a terminal seeker can provide active guidance for precise targeting. BeiDou augments independent military CnC by allowing precise knowledge of the location of one's own forces, and the ability to precisely target and provide navigation for military forces and strikes. This capability strengthens China's ability to coerce or compel others within its sphere of interest, such as on issues like the South China Sea, Taiwan, or Hong Kong. An independent BDS coupled with 5G means real-time military CnC and devastatingly accurate automated weapons systems.[43] China's military space capacity is geared towards building an independent capability to build into a system of comprehensive power with ASAT capability, informatized warfare, orbital presence, deep space missions, and lunar missions. It encompasses both military and civilian assets into one ideological mooring.

Commercial Space

In the past few years, China has been developing its commercial space capacity. Under the direction of President Xi Jinping, China has been enabling the development of its private space sector. This

was made a priority in 2014 when the State Council of the Communist Party of China (CPC) released Document 60 to encourage China's private space sector.[44] Since then, there have been larger investments in China's private space sector as well as a focus on civil-military integration.[45] Since 2016, China's private funding has seen an increase to about $2 billion annually.[46] Private space companies have already achieved orbital launch and are investing in developing critical technologies like reusable space launch capacity. Amongst the known private space companies, Onespace is one of the first companies to successfully launch to sub-orbit,[47] followed by attempts made by Linkspace and Landspace. In August 2019, Linkspace experimented with the first Chinese reusable launch vehicle, when its rocket reached a height of 300 meters above ground and then landed back intact.[48] Beijing Interstellar Glory Space Technology Ltd or iSpace launched its rocket *Hyperbola 1* into orbit in July 2019, marking the first such successful orbital launch by a Chinese private company.[49] In January 2021, iSpace attempted (and apparently failed) to launch into orbit China's first reusable rocket, the *Hyperbola-2*.[50]

India's Space Capacity

India, like China, views space as part of its grand strategy and as a tool to defend and expand its power. Like China, India has an independent space launch capacity, has launched missions to the Moon and Mars, and tested an ASAT capability. India has also established a separate space service with the establishment of the Defense Space Agency in 2019. Some of India's civilian, military, and commercial space capacities are detailed in the next section.

Civilian Space Capacities

India possesses civilian space launch capacities, which are cost effective, not due to reusability but to lower manufacturing costs. This includes the Polar Satellite Launch Vehicle (PSLV) and the Geosynchronous Satellite Launch Vehicle (GSLV). India has the capacity to launch multiple payloads, including a record breaking 104 satellites, which were launched on a single mission in 2017, [51] a record since broken by SpaceX in January 2021 with the launch of 143 satellites on a single rocket.[52] In another record for India, 29 satellites were launched to three different orbits in 2019.[53] India launched its first Moon mission in 2008 with its *Chandrayaan 1* lunar orbiter mission. This mission included NASA's Moon Mineralogy Mapper (M^3), which helped confirm the presence of water ice on the lunar surface.[54] In 2014, India successfully sent a Mars orbiter, *Mangalyaan*, at a low cost of US $74 million.[55] In September 2019, while India failed with its lunar lander, it did succeed with its *Chandrayaan 2* lunar orbiter entering lunar orbit in August 2019 to map the lunar poles.[56] India's ambition to scale higher in outer space was evidenced in 2018 when Prime Minister Modi announced that India would send a man or woman into LEO by 2022, in a mission called *Gaganyaan*.[57] Subsequently, four Indian astronauts began a year-long training exercise in Russia's Gagarin Cosmonaut Training Center (GCTC), but the mission has been delayed by the Covid-19 pandemic.[58] India's civilian space capacity is utilized in other sectors as well, like the geospatial information system, Prospective Fishing Zones (PFZs), accurate weather forecasts, financial and telecommunication services, as well as tele-education services. [59]

Military Space Capacities

India's military space sector took off after India had to reckon with 'intelligence failure' during the Kargil War of 1999 against Pakistan, when Indian agencies failed to pick up intelligence on infiltrators crossing the Himalayan border. Consequently, India developed its first Technology Control Satellite (TES) in 2001. In 2004, in order to collate intelligence within a single body, India established the National Technical Research Organisation (NTRO). In 2008, as a response to China's ASAT test in 2007, India established a separate Integrated Space Cell within the Integrated Defence Services Headquarters, followed by the Space Security Coordination Group (SSCG) under the

National Security Adviser. RISAT-2, which was launched in 2008, was India's first dedicated military satellite, [60] followed by the GISAT-7 in 2013. [61] India's NavIC (Navigation Indian Constellation), which is part of the global navigation satellite system (GNSS) and has been identified as an 'allied system' by the 2020 US National Defense Authorization Act (NDAA) under section 1601, subtitled, Space Activities.[62] In March 2019, India launched its *Mission Shakti* ASAT test against its own target satellite Microsat-R.[63] The ASAT test demonstrated India's capability to hit adversary objects (interdict and intercept) in space. The test was described by the Indian Prime Minister Narendra Modi as a deterrent asset against attack on India's space infrastructure.[64] In a tweet on March 27, 2019, the Prime Minister stated, "#MissionShakti is special for 2 reasons: (1) India is only the 4th country to acquire such a specialized & modern capacity. (2) Entire effort is indigenous. India stands tall as a space power! It will make India stronger, even more secure and will further peace and harmony."[65] Following the test, Prime Minister Modi directed National Security Adviser Ajit Doval to work on a space power doctrine and to set up the contours of a Defense Space Agency and a Defense Space Research Organisation.

Commercial Space

As in China, India's commercial space sector has taken off, with companies like Bellatrix[66] working on rocket propulsion, R-beam working on wireless transmission, Blue Sky Analytics[67] working on space-based Intelligence, Surveillance and Reconnaissance (ISR) for pollution monitoring, Dhruva Space[68] building small SATS, Satsure[69] mapping supply chain infrastructure, and TeamIndus[70] focusing on building spacecraft and lunar landers. Another company, Exseed Space, is the first private Indian space start-up to succeed in building and launching its own satellite on a *SpaceX* Falcon 9 international commercial launch.[71] In light of this, the Indian Department of Space has established NewSpace India Limited (NSIL) – a state funded and controlled enterprise – to further commercialize and privatize India's space capacities.[72] It remains to be seen if, like China, India's new space companies are able to build their own space launch systems and develop reusability as a key feature.

The next section highlights trends in horizontal and vertical proliferation of space warfare capacities with plausible probes to include countries like Japan, Iran, Pakistan, the United States, Russia, and Australia.

Trends in Horizontal and Vertical Proliferation of Space Warfare Capabilities

Given the increase in space power projection capacities for Asian Great Powers, China and India, what can we anticipate in terms of horizontal and vertical proliferation in space warfare capacities? To clarify, the concepts of horizontal and vertical proliferation have been drawn from the literature on nuclear weapons proliferation and generalized into the literature on space weapons systems. "Horizontal" proliferation refers to nation-states or nonstate entities that do not have, but are acquiring, nuclear weapons or developing the capability and materials for producing them.[73] To extend this explanation to space weapons, horizontal proliferation would mean the acquisition of space capabilities by nation states and non-state entities that do not have them and that "are acquiring…or developing the capability and materials for producing them." "Vertical" proliferation refers to nation-states that possess nuclear weapons and are increasing their stockpiles of these weapons, improving the technical sophistication or reliability of their weapons, or developing new weapons."[74] By extension, space weapons-related vertical proliferation would mean proliferation of space weapons and additive missiles by nation-states that already possess space warfare capacities and are "increasing their stockpiles of these weapons, improving the technical sophistication or reliability of their weapons, or developing new weapons."[75]

Horizontal Proliferation of Space Warfare Capabilities in Asia

Is there an increase in horizontal proliferation of space warfare capacities in Asia? That is, are more nation states and non-state entities that do not have space capacities planning on acquiring these space capacities to include warfare capacities? Given the growing economic dependence of societies on space-based assets, it is more or less likely that states will be increasingly looking to harden their space assets and to create mechanisms of both deterrence and compellence if an adversary nation or entity threatens its space assets.

Japan, which has historically (1969) mandated its space assets for purely civilian purposes, is waking up to the defensive and military implications of space. In 2018, Japan's then Prime Minister, Shinzo Abe, highlighted the priority of space to modern military systems and the added requirement to develop Japan's military space capacities. Since 2008, under Japan's basic space law, the use of space for military purposes was allowed under strict guidance. Creating a robust Space Situational Awareness (SSA) in partnership with the United States, Australia, and Europe was highlighted as a critical need.[76] In April 2020, the Japanese Diet passed a bill that established the Space Domain Mission Unit (SDMU) within the Japan Air Self-Defense Force (JASDF). The SDMU is aimed to be fully functional by 2023. Yuka Koshino relates:

> In 2017, the JSDF began operating its first X-band communication satellite as part of the modernisation of its command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) infrastructure. In 2019, its naval ships began to use precision timing signals from Japan's Quasi-Zenith Satellite System (QZSS)—satellite navigation constellation—as a back-up for the US Global Positioning System. Japan is also developing a space-based ballistic-missile early-warning system.[77]

Japan is developing a ground-based deep space radar that can monitor satellites in Geostationary Orbit (GEO). With China testing its first Anti-Satellite (ASAT) weapon in 2007 and further improvement of such a capacity, Japan is now developing a SSA satellite with a fitted optical telescope that can carry out the dual activities of watching for space debris and conducting ASAT missions. Japan is also working on developing a satellite interceptor, primarily to counter satellite threats from China, with a final decision still pending as of the date of this writing. Japan's National Defense Guidelines of 2019 and Medium-Term Defense Program (2019-2023) highlight the importance of space for Japan's strategic thinking and deterrence capabilities. Japan's Self-Defence Forces (JSDF) are tasked with carrying forward the country's space capacities.[78] The linkage between ASATs and ballistic missiles underscores the ability of such systems for both offense and defense. Japan has its "own multi-tier defense system against ballistic missile attacks, by such means as installing ballistic missile defense capability to the Aegis-equipped destroyers and deploying the Patriot Advanced Capability-3 (PAC-3)."[79] Japan is building radars at a cost of $1 billion by Lockeed Martin, while at the same time focusing on developing an integrated air and missile defense (IAMD), and not limited to Aegis Ashore, two sites of which it cancelled in June 2020 due to costs.[80] Japan's sense of urgency is driven by geo-political factors, including tensions over the disputed islands in the East China Sea. Japan's 2019 White paper on defense identified China as a threat for the first time, based on China's fast military modernization. [81]

Japan is a maritime nation that has approximately 6,800 remote islands as part of its territory and the sixth largest territorial waters/exclusive economic zone (EEZ). In order to respond to various contingencies in the seas and airspace around Japan promptly and seamlessly, the MOD/SDF vessels and aircraft habitually engage in warning and surveillance activities. Particularly in the East China Sea, there have been an increasing number of cases in which foreign vessels conduct activities by unilaterally asserting the rights of their country based on claims that are incompatible with the existing order of international law. Thus, the necessity for constant and continuous monitoring and surveillance by destroyers and other vessels is increasing.[82]

Consequently, interceptor missiles like the SM-3 are under development in collaboration with the United States as a new feature of Japan's Ballistic Missile Defense (BMD) system.[83] This is being built with the DPRK's missile capabilities in mind. Of note, Japan has an advanced space program with independent space launch capacities spearheaded by the Japan Aerospace Exploration Agency (JAXA).[84]

The Democratic People's Republic of Korea (DPRK) is another country to watch for the horizontal proliferation of space capable weapons systems. While the DPRK has not yet demonstrated anti-satellite capabilities, it has developed jamming capacities within a particular geographic area. That said, ballistic missiles can evolve into a counter space capacity, so missile developments need to be closely monitored. In 2017, DPRK tested its first intercontinental ballistic missiles (ICBM), Hwasong 14 (8, 500 -13, 000 km and the Hwasong 15 (13, 000 km). More critically, these ICBMs were developed by its space launch program, Unha (Taepo-Dong 2). Some of the other DPRK operational missiles are the Pukguksong-3 (KN-26)-1900 km-Submarine Launch Ballistic Missiles (SLBM), Pukguksong-2 (KN-15)-1, 200-2,000 km Medium Range Ballistic Missile (MRBM), No-Dong, MRBM-1, 200 km-1, 500 km, and Taepodong-2 (SLV)-4,000 km-10, 000 km.[85] In 2016, the DPRK claimed that it had successfully put an Earth observation satellite, *Kwangmyongsong-4*, into orbit with a lift off from the Sohae launch facility in western DPRK.[86] In July 2019, the DPRK also demonstrated a "newly-developed large-caliber multiple launch guided rocket system," with a range of about 250 km.[87] All these developments point to horizontal proliferation with potential for space weapons systems.

Iran has been attempting to launch its satellite into space for some time now. In February 2020, it failed to launch its Zafar 1 communications satellite into orbit. On April 22, 2020, the Aerospace Forces of the Islamic Revolutionary Guards Corps (IRGC) successfully launched its first military satellite, *Noor* (light) into LEO, on its rocket *Qased* (messenger), from the secretive Guard Base near Shahroud, 400 km from Tehran. General Hossein Salami, the Head of the IRGC stated, "today, the world's powerful armies do not have a comprehensive defense plan without being in space, and achieving this superior technology that takes us into space and expands the realm of our abilities is a strategic achievement."[88] The IRGC claimed the satellite reached an orbit of 425 km above Earth. Again, this can be directly linked to space launch and counter-space capacities. Iran has a ballistic missile program, with the Shabab-3, having a range of 1,000-1,300 km. According to Steven Hildreth:

> Longer range versions of the Shahab-3, variously referred to as Shahab-3 variants, the Shahab-3A, Shahab-3B, and Shahab-4, and a BM-25, may have range capabilities of 1,500-2,500 kilometers. These missiles potentially could reach targets throughout the Middle East, Turkey, and into southeastern Europe. Some have reported that perhaps several dozen or more of these missile types may be deployed and operational. Some Chinese, DPRK, or Russian involvement is suspected. In 2006, Iran announced the successful test of a Fajr-3 MRBM comparable to the Shahab-3, although U.S. and Israeli intelligence analysts reportedly expressed skepticism.[89]

The Shahab-3-MRBM-1, 300 km, Ghadr-1-MRBM-1, 950 km, Soumar-cruise missile-2,000 km-3,000 km, and Sejill-MRBM-2,000 km are some of the operational missiles.[90] There are reports that Iran may also possess Short Range Ballistic Missiles (SRBMs)-ranges less than 1000 km developed with the help of China, DPRK, and Russia.[91] Iran is also known to have passed on missiles to non-state entities like Hezbollah and Yemen's Houthi rebels.[92] Waller says that:

> The type of ballistic missile technology used to launch this satellite could deliver nuclear, chemical, or even biological weapons to "wipe Israel off the map," attack U.S. bases and allies in the region, and even US and NATO installations as far away as Western Europe. One

> particular concern about Iran having nuclear weapons and long-range ballistic missiles is the fact that it creates a deterrent umbrella under which the jihadist regime *would have a free hand to continue and even escalate their sponsorship and direct support for terrorism around the world* [emphasis added]. Countries with such a deterrent are less concerned about punitive or retaliatory strikes because of that capability.[93]

Australia is another country in the Asia-Pacific that has recently established a space program. The Australian Space Agency is focused on securing satellite communications, weather forecasting, and now has a roadmap till 2028 on securing Australian space assets.[94] Australian strategic thinker, Malcolm Davies, urges Australia to establish its own space command. Davies argues:

> Ideally, we need to reorganise Defence in a manner that recognises that space is an operational domain in its own right, just like air, sea, land and cyber. It's not merely an enabling adjunct…Does that mean Australia needs its own space force? Certainly, the ADF [Australian Defense Forces] needs a 'space command' within the RAAF in which space operations, doctrine and capability development are managed by a cadre of space professionals. Defence also needs an unclassified space strategy that informs those functions in an accountable way. These would be good steps to formally embrace in the next defence white paper.[95]

Already ADF joint doctrine recognizes the critical importance of space, especially as a 'center of gravity' in information-based military systems. Given the expansion of China and Russia's counter-space capabilities, and Australia's dependence on space for reconnaissance, command and control, navigation, and precision guidance, analysts are urging Canberra to develop its own counter space capabilities..[96]

Pakistan is another country to watch with regard to horizontal proliferation. Pakistan is a nuclear weapons state with advanced missile capacity. Pakistan's Space & Upper Atmosphere Research Committee (SUPARCO) launched its first sounding rocket, Rehbar-1, in 1961. Badr-1 and Badr-B, two experimental satellites were launched in 1990 and 2001.[97] Given its rivalry with a Great Space Power like India, Pakistan is likely to utilize its relationship with China to develop its space capacity, as it has in its nuclear weapons program.[98] Given the connections between space capabilities and a country's missile development, some of Pakistan's missiles to watch are the Shaheen -3-MRBM of 2, 750 km range, Haft 6 (Shaheen) 2-MRBM-of 1,500-2,000 km range, and Haft 5 Ghauri-MRBM of1,250-1,500 km range.[99]

As a thought experiment, the following trajectories can be noted with regard to horizontal escalation in space:

> 1. In warfare: Country A attacks Country B's aircraft carrier; Country A funds unconventional war in Country B; Country A attacks Country B's satellites—Country B attacks Country A's launch facilities.
>
> 2. In an arms race: Country A acquires hypersonic missiles; Country B acquires a space-based missile defense system.
>
> 3. In a crisis: Country A blockades Country B's port—Country B blockades Country B's Moon base.

Vertical Proliferation of Space Warfare Capabilities in Asia

"Vertical" proliferation refers to nation-states that do possess nuclear weapons and are increasing

their stockpiles of these weapons, improving the technical sophistication or reliability of their weapons, or developing new weapons. By extension to space weapons proliferation, this would mean proliferation of space weapons, and missiles, by nation states that do possess space warfare capacities and are "increasing their stockpiles of these weapons, improving the technical sophistication or reliability of their weapons, or developing new weapons."[100]

China

China**,** as mentioned before, is acquiring new military space capabilities and improving its existing capacities. More importantly, China's military space capacities are directed by its civil-military fusion strategy. This space capacity is augmented by the establishment of the PLASSF, which is a theatre command-level enterprise. The PLA is also in control of China's space program. China's 2019 defense white paper described space as a "critical domain in international strategic competition" and stated the security of space provided strategic assurance to the country's national and social development.[101] Space forms an integral part of China's comprehensive national power and military strategy. Securing China's outer space assets is a key priority. While the aim is to bring informational warfare capacities together, President Xi Jinping has urged the PLASSF to prepare a doctrine for a future that sees China dominating the cislunar space[102] and beyond. Prioritizing the network-centric warfare approach, China is committed to developing its ASAT capacities in LEO and GEO.[103] Key bodies are the Space Systems Department, which is in charge of PLA space operations, from launch, surveillance, and missile tracking, to space warfare doctrine and concepts. The space capacities that China is developing for countering adversaries are kinetic kill, direct ascent, co-orbital inspection satellites, electronic warfare (satellite jammers), ground-based lasers, space robotic capacities including a robotic arm, and reconnaissance and surveillance—all of which will help create space access for itself and deny access to adversaries in times of conflict. As stated earlier, the PLASSF is training with ASAT capabilities, and China's missile systems create added value. The SC-19, which is modeled on the DF-21C ballistic missile, is China's primary ASAT weapon, with a range of 2150 -2, 500 km.[104] Besides, China possesses the DF-26 IRBM, a land-attack and anti-ship missile, the DF-21A and DF 21E (nuclear tipped), and is predicted to possess 375 MRBM/IRBM missiles by 2025, up from 250 in 2020.[105] Most critically, about 75 of those missiles will be equipped with 'hypersonics,' especially the DF-17.[106] China has also increased their nuclear warheads, from 290 (2019) to 320 (2020).[107] From these developments, it is clear that China is increasing its stockpile and refining its military space capacities.

India

As mentioned earlier, India has invested in developing its military space capacities to include an ASAT test in March 2019, establishing a Defense Space Agency, and calling for the establishment of a Defense Space Research Organization aimed at developing counter space and counter value (attacking critical infrastructure) capacities. In June 2019 and September 2020, India conducted hypersonic tests with the launch of its hypersonic technology demonstrator vehicle (HSTDV), which reached a speed of Mach 6 (2 km per second). The HSTDV was launched on the Agni missile solid proponent rocket motor. The 2020 test utilized an indigenously built scramjet engine. The next step would be to develop long range hypersonic cruise missiles. The Brahmos supersonic cruise missile (which is being developed with Russian assistance) reaches a speed of 2.8 Mach with a range of 400 km.[108] India has 150 nuclear warheads (2020 estimate). It has an array of missiles, including the Prithvi II and Agni I- surface-to-air Short Range Ballistic Missiles (SRBM) with a range of 350-700 km.[109] The Agni III is an IRBM with a range of 3,000 km to 5000 km. The Agni V is an Intercontinental Ballistic Missile (ICBM) with a range of 5,500 km. The Dhanush submarine launch ballistic missile (SLBM) has a range of 300 km. The K-15 (Sagarika or B-05) was deployed in 2017 and has a range of 700 km.[110] India has launched an indigenously built long-range cruise missile,

Nirbhay, a nuclear-capable, solid fuel missile that can reportedly reach top speeds of 0.6-0.7 Mach and can strike land targets at a distance of up to 1,000 kilometers. According to reports, it can be launched from multiple platforms, has loitering capability, and the first test of the air-launched variant is expected to take place in 2021.[111]

Some of the trajectories based on insights from the section above on vertical escalation could be as follows:

1. In warfare: Country A kills Country B's PNT satellite; Country B kills two of Country A's PNT satellites.

2. In an arms race: Country A acquires 1 ASAT, Country B acquires 5 ASATS.

3. In a crisis: Country A puts its space forces on alert, Country B puts its space forces on alert.

Linked Conflict Systems; Linked Security Dilemmas

Proliferation and escalation in Asia are characterized by linked conflict systems and linked security dilemmas[112] between pre-existing competing dyads: China-Japan, China-India, Japan-South Korea, DPRK-South Korea, and India-Pakistan.

China seeks to secure itself from a U.S. military intervention by acquiring an ASAT capability and a Strategic Support Force. India and Japan feel threatened by China's capabilities. In response, India develops an ASAT and defense space organization. Japan follows its ally, the United States, and begins developing a dedicated defense space organization and counter-space capabilities.

Similarly, because U.S. conventional forces pose an existential threat to the DPRK and Iranian regimes, these regimes have strong incentives to develop missiles,[113] ASATs, and single-strike catastrophic deterrents such as High-Altitude Electro-Magnetic Pulse (HEMP) and High-Altitude Nuclear Detonation weapons.[114]

Because conflict systems are linked, we can expect horizontal proliferation specifically where competition is pre-existing in dyads.[115] Japan's counterspace capabilities will encourage development of counter-space capabilities by the DPRK. Already incentivized to create an ASAT to deter the United States, the DPRK will accelerate to keep pace with any South Korean counter space developments. Pakistan, seeking parity and deterrence with India, and contesting leadership in the Islamic world, has incentives to develop ASAT capabilities.[116]

One could imagine initiation and escalation to space conflict in virtually any of the dyads. The DPRK and South Korea, both with relatively fewer satellites, might jam each other's satellites in a period of hostility, and one of them might take the step of escalating with a kinetic ASAT attack.[117] Similarly, a China-Japan skirmish over the Senkaku/Diaoyu islands could involve jamming or lasing each other's reconnaissance or communications satellites, or might result in dangerous practices of close approaches of co-orbital inspection satellites.

Were the DPRK to be suspected of orbiting a HEMP satellite, we could imagine Japan feeling forced to shoot it down or to attack it co-orbitally, as that might pose an existential threat to Japan.

Tensions between Pakistan and India would likely result in jamming, dazzling, or lasing of each other's reconnaissance and communication satellites with escalation incentivizing ever greater demonstrations of resolve, potentially including a limited kinetic exchange. The lead-up to such an event might see China siding with Pakistan and conducting close inspections of India's satellites to encourage a sense of vulnerability to a two-front war.[118] Alternately, India's fears of a two-front

war with China over its eastern and western disputed borders could cause a heightened sense of alert, sending indications and warnings to China that India was postured for a pre-emptive strike in space, encouraging China to make similar moves.

Finally, Japan and South Korea are likely to participate in the U.S. Artemis program, and thereby have national assets on or in the vicinity of the Moon. At some point India will also have a space station and likely operations on the Moon. China is likely to be able to project power over cislunar distances, and its history of imposing pressure on the geographic periphery suggests that China might hold these targets at risk directly or through plausibly-deniable grey forces to express displeasure, or to expose vulnerability, as happens with the harassment by fishing and coast-guard vessels.

Legal Implications and Concluding Thoughts

This section highlights some of the legal implications of horizontal and vertical space proliferation and offers some concluding thoughts. The foremost document that lays out the legal parameters for state behavior in outer space is the "Treaty On Principles Governing The Activities Of States In The Exploration And Use Of Outer Space, Including The Moon And Other Celestial Bodies," commonly referred to as the Outer Space Treaty (OST) signed in 1967. OST Article III stipulates that "States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding."[119]

More specifically, Article IV of the OST states:

> States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.
>
> The moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited.[120]

The OST in Article VII holds states liable for damages caused:

> Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air or in outer space, including the moon and other celestial bodies.[121]

The 1972 Convention on International Liability for Damage Caused by Space Objects builds upon OST Article VII specifying that "a launching State shall be absolutely liable to pay compensation for damage caused by its space objects on the surface of the Earth or to aircraft, and liable for damage due to its faults in space. The Convention also provides for procedures for the settlement of claims for damages."[122] There are other international mechanisms that limit and constrain the usage of nuclear weapons in space and/or transfer of missile technology. These are "Treaty Banning Nuclear

Weapon Tests in the Atmosphere, in Outer Space, and Under Water" signed between the U.S. and the erstwhile U.S.S.R in 1963.[123] The Comprehensive Test Ban Treaty (CTBT)[124] signed by the U.S. and China but not ratified by either (Russia has ratified it) and the Missile Technology Control Regime (MTCR).[125] There is also a stipulation of noninterference with national technical means (i.e. reconnaissance and commercial satellites).[126]

That said, if we are to tackle the challenges of horizontal and vertical proliferation of military space capacities, especially keeping in mind the escalation scenarios outlined above, how would these treaties/regime help deescalate the conflict? On one hand, treaty obligations can be cited. On the other hand, states face no consequences for creating debris (for example, caused by ASAT tests by China, the United States, Russia, or India), where national security of critical infrastructure trumps international obligations with no enforcement mechanisms in place. International U.N. backed sanctions against either China or Russia for ASATS and other space militarization acts will be vetoed by China and Russia, using their permanent member privilege in the U.N. Security Council. The space future that we need to anticipate besides orbital presence and support for terrestrial military forces is countries developing military power projection capacities beyond GEO to cislunar space and the Moon. This is a realistic scenario given the United States, China, Russia, and Japan are aspiring to establish human presence on the lunar surface by 2040. This changes the dynamic of space. Already, the PLA SSF leadership highlights the significance of the Earth-Moon space for China's national rejuvenation. The United States has identified the Moon and extraction of resources as a vision. Japan has plans to establish a lunar settlement by 2040. Russia announced plans to establish a lunar presence by 2040 as well.[127] China and Russia signed a Memorandum of Understanding (MoU) in March 2021 to jointly establish a lunar base.[128] Given these changes in space discourse from purely tactical to strategic, we need to factor such scenarios into our assumptions of status and space behavior by space faring nations in the Asia-Pacific.

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III. NAUTILUS INVITES YOUR RESPONSE

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