THE HAN IN A SPACESUIT: A THREAT IN BEING

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The deeper you go into space, the more you realise the less you know.

— Dax

INTRODUCTION

Since ages, space has been, and will be for the near future, a mysterious and awe-inspiring, gravityless vacuum, inaccessible to humans, barring a few exceptions. Unidentified Flying Objects (UFOs), aliens, distant civilisations, Star Wars are still within the realm of fantasy or make believe. Space has also always been about dual use: civilian research and military uses go hand-in-hand. The last two decades have seen some of the fastest growth in movement towards outer space, with China and India leaping into the black yonder with renewed zeal. Utilisation of space has always been about national prestige, with the space race shot off by then USSR, with the launching of the Sputnik-1 into space, followed by the entry of Cosmonaut Yuri Gagarin into space four years later. This incensed the pride of the Americans and they finally managed to salvage it by sending, first,

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France has already conducted a military exercise called 'AsterX' **to fulfil its ambition to become the third largest space power after the US and China. The objective of the exercise was to defend the country's space assets from any threat. The US Space Force and German Space Agency were also part of the exercise.**

Astronaut Alan Shepard into space soon after, and then much later, Neil Armstrong, to the Moon. This was followed by a race for space between the two world powers, subsiding a bit only when the USSR collapsed. It wasn't too long before the Chinese jumped into the fray and rapidly started gaining space in space. The Indians were not to be left behind and like the proverbial tortoise, slowly and steadily, proved their calibre in space.

Presently, the space race seems to be a contest between the US and Chinese. Militarisation of space which was a taboo, now appears to be a *fait accompli,* with countries creating space forces amongst the military hierarchy. France has already conducted a military exercise called 'AsterX' to fulfil its ambition to become the third largest space power after the US and China. The objective of the exercise was to defend the country's space assets from any threat. The US Space Force and German Space Agency were also part of the exercise. The US conducted the 'Red Skies' Orbital Warfare (OW) exercise in December 2023. "Hosted by the Space Training and Readiness Command (STARCOM) through the 392nd Combat Training Squadron (CTS), the OW-focused exercise provided training for the Guardians from the Space Operations Command (SpOC). The overarching objective of the exercise series aimed to equip the Guardians with the skills necessary to respond to potential attacks on US satellite systems".[1] Other countries are expected to follow suit, and this will lead to increasing militarisation of space, even though this goes against the essence of the Outer Space Treaty of 1967. The US has already formalised the Artemis Accords as a counter to Chinese plans to place armed personnel/troops on the Moon by 2026-27.

1. https://www.starcom.spaceforce.mil/News/Article-Display/Article/3624641/inaugural-exercise-red-skies-elevates-ussf-readiness/#:~:text=RED%20SKIES%20represents%20the%20U.S.,flight%20to%20Space %20Force%20 operations. Accessed on January 3, 2024.

"The stated aims of the Artemis Accords are to land the first woman and first person of colour on the Moon, make new scientific discoveries, and explore more of the lunar surface than ever before for the benefit of all".[2] "NASA (National Aeronautics and Space Agency), in coordination with the US Department of State, established the Artemis Accords in 2020, together with seven other founding member nations. The accords reinforce the commitment by the United States and signatory nations to the Registration Convention, the Rescue and Return Agreement, as well as best practices and norms of responsible behaviour that NASA and its partners support, including the public release of scientific data".[3]

The purpose of the Artemis Accords is a common vision with the USA and other countries via principles, guidelines and best practices so that we could supplement each other's activities for peaceful purposes with transparency and also work together for avoiding harmful activities.

"During a ceremony at the Willard Intercontinental Hotel in Washington on Wednesday, June 21, 2023, India became the 27th country to sign the Artemis Accords".[4] Explaining to the media, Union Minister of State (Independent Charge) Science and Technology Dr Jitendra Singh said,

> The purpose of the Artemis Accords is a common vision with the USA and other countries via principles, guidelines and best practices so that we could supplement each other's activities for peaceful purposes with transparency and also work together for avoiding harmful activities. On the other hand, the joint mission to the International Space Station, which is separate of signing of the Artemis Accords, will develop a framework for joint mission to the International Space Station in 2024, which the USA envisages as a possibility for closer cooperation between the space

2. https://www.nasa.gov/artemis-accords/. Accessed on December 28, 2023.
3. Ibid.
4. https://www.nasa.gov/news-release/nasa-welcomes-india-as-27th-artemis-accords-signatory/#:~:text=India%20is%20the%2027th%20country,participating%20in%20NASA's%20Artemis%20program. Accessed on December 28, 2023.

agencies of the two countries to get closer to the realities of the Moon and subsequently to Mars and other planets.[5]

This implies that there are two blocs of space coalitions forming up, the first comprising Russia and China along with North Korea, Iran and Pakistan (subsidiary players), and the second comprising the 27 signatories of the Artemis Accords which include major space players viz. the US, UK, France, Germany, other European Union (EU) nations, Saudi Arabia, Australia, Japan and India. This also conforms to the concept of The Eastern Crescent (TEC) wherein non-democratic, autocratic nations' interests converge against democratic nations. "The TEC is an emerging coalition of Turkey, Iran, Pakistan, China, North Korea and Russia".[6]

With China emerging as a contender for the top space power in the coming decades and being part of the TEC, it becomes imperative for Indian strategists to study the development of Chinese space capabilities. Even the US is feeling threatened by the developments in China and has set up various research groups and agencies to analyse such developments. This paper endeavours to dissect the various aspects of the evolution of the Chinese space, infrastructure, doctrines and capabilities, with a view to gain a deeper understanding of the impact of such developments.

EVOLUTION OF CHINESE SPACE PROGRAMME

China started its space programme in the form of missile research in the 1950s and in collaboration with the USSR to access the latter's R-2 rocket technology. "In 1955, Qian Xuesen, the world-class rocketry scientist, returned to China from the United States. On October 8, China's first missile research institute, the Fifth Research Academy under the Ministry of National Defense, was established with less than 200 staff, most of whom were recruited by Qian. The event was later recognized as the birth of China's

5. https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1934838. Accessed on December 28, 2023.
6. Shirish Dhakate, "Emerging Technology Paper", *Air Power Journal,* vol 17, no. 4, December 2022, pp. 24-25.

space program".[7] After the launch of mankind's first artificial satellite, the Sputnik 1, by the Soviet Union on October 4, 1957, Mao Zedong decided, during the National Congress of the Chinese Communist Party (CCP) on May 17, 1958, to make China an equal of the superpowers: ''We too need satellites", by adopting Project 581 with the objective of placing a satellite in orbit by 1959 to celebrate the 10th anniversary of the founding of the People's Republic of China (PRC). This goal would soon prove unrealistic, and it was decided to focus on the development of sounding rockets first.[8]

China launched its first sounding rocket, the T-7M, on February 19, 1960, an event celebrated in China for the success of the rocket programme, even though the rocket reached a height of 8 km only. With the dissolution of the Russo-Sino Accord in the 1960s, China began an independent space research programme and started constructing its first missile test site in the Gobi Desert of Inner Mongolia, which later became the famous Jiuquan Satellite Launch Centre (SLC). After a failed attempt in March 1962, multiple improvements, and hundreds of engine firing tests, the DF-2 achieved its first successful launch on its second attempt on June 29, 1964, in the Jiuquan SLC. It was considered a major milestone in China's indigenous missile development history. On October 27, 1966, as part of the "Two Bombs, One Satellite" project, the Dongfeng-2A, an improved version of the DF-2, was successfully launched and detonated a nuclear warhead at its target.[9] The development of various rockets/missiles like the Dongfeng-4, Dong Fang Hong-1, Long March-1, Shijian-1, Shuguang-1 progressed with an added impetus given by Mao to fructify China's own crewed space programme.

This was followed by the DF-5, the first Intercontinental Ballistic Missile (ICBM), Long March-2 and Feng Bao-1 crossing the payload threshold of one metric tonne. With the CZ-2, China became the third country in the world with the capability to recover a satellite back to Earth on November 26, 1975. These rockets paved the way for the subsequent Long March series. The Third Front projects led to the further development of space projects, including the

7. https://en.wikipedia.org/wiki/Chinese_space_program. Accessed on December 28, 2023.
8. Ibid.
9. https://en.wikipedia.org/wiki/Chinese_space_program. Accessed on December 28, 2023.

building of the Xichang Satellite Launch Centre and the Taiyuan Satellite Launch Centre.

With the focus shifting to economic development in the mid-1970s, the demand grew for communication satellites and, thus, came Project 331, with the launch of the Dong Fang Hong-2. "Given that communication satellites operate in the geostationary orbit, which is significantly higher than the range achievable by existing carrier rockets, launching communications satellites has emerged as a major hurdle for the Chinese space program."[10] The Long March-3, a 3-stage cryogenic engine and Xichang SLC (low latitude suitable for such launches) were chosen for the task. However, due to a glitch in the cryogenics, the satellite could reach only an apoapsis of 6,480 km using the satellite's own propulsion system. Within three months, China achieved success using the same configuration and placed the DFH-2 into a Geosynchronous Transfer Orbit (GTO), becoming the fifth country in the world to do so. In the 1990s, a bevy of commercial satellites was launched by China, including for international customers.

> China's space development system formerly centred on the Ministry of Aerospace Industry, but in June 1993, the China National Space Administration (CNSA) was established directly under the State Council. In addition, the implementation sector for space activities was separated from the government and transferred to the state-owned enterprise China Aerospace Corporation (CASC). Following further reorganization and name changes, CNSA ceased to be under the State Council and was placed under the Committee on Science and Technology Industry for National Defense (COSTIND). The China Aerospace Corporation was divided into the China Aerospace Corporation (CASC) and the China Aerospace Science and Industry Corporation (CASIC).[11]

10. Ibid.
11. https://nistep.repo.nii.ac.jp/record/6320/files/NISTEP-STT014E-92.pdf. Accessed on December 28, 2023.

From 1996 to 2011, in a span of 15 years, China achieved 102 consecutive successful space launches. "From 2001 to 2003, China conducted three uncrewed Shenzhou spacecraft test flights, validating all the systems required by human spaceflight".[12] Finally, on October 15, 2003, the first Chinese Taikonaut Yang Liwei was launched aboard the Shenzhou-5 from the Jiuquan Satellite Launch Centre into space, marking a milestone in China's space programme and making it the third country in the world to put an astronaut into space independently. This opened up a succession of manned multiple crew, multiple days missions into space.

In 2007, the Chang'e-1 was introduced in the Moon orbit on November 7, becoming China's initial artificial satellite of the Moon; with the satellite carrying out a hard landing on the Moon's surface on March 1, 2009, at the end of its life. In the early 21st century, the Chinese economy grew to become the world's second largest economy by Gross Domestic Product (GDP). From 2010-22, China launched more than 30 Gaofen satellites for high-resolution Earth observation. This was followed by the Beidou Nav Satellite constellation which was declared completed by Xi Jinping on July 31, 2020.

"China's space station, Tiangong, orbits Earth at an altitude between 217 and 280 miles (340 to 450 km), approximately the same orbital height as the International Space Station (ISS)".[13] The Tiangong-1 was launched to practise space rendezvous and docking operations, with the spacecraft doing its first manual docking with the Shenzhou-9 in June 2012. The Tiangong-2 was the first real space laboratory of China and this paved the way for the Chinese space station. "The Chinese Manned Space Agency (CMSA) built and launched Tiangong, which means 'heavenly palace' in low Earth orbit, launching each of the three modules that make up the station between 2021 and 2022".[14] The Chinese space station assembly began with the launch of the Tianhe core module on April 29, 2021, followed by the Wentian Lab module on July 24, 2022, and the third and final module, the Mengtian Lab module on October 31, 2022, completing the T-shaped space station.

12. Ibid.
13. https://www.space.com/tiangong-space-station. Accessed on December 28, 2023.
14. Ibid.

In 2018, China carried out more launches than any other nation in the world. The Chinese space programme is progressing at a lightning pace and meeting most of its objectives in time.

China has also been successful in lunar sample return missions, with spacecraft returning safely to Earth from the lunar surface. Other successes involve the Tianwen-1 entering the Mars orbit on February 10, 2021, and becoming China's first operational Mars probe. The Tianwen-1 ('questions to heaven,' or 'questioning the heavens') is China's first Mars mission, consisting of an orbiter and a rover named Zhurong. It entered the Mars orbit in February 2021 and Zhurong landed on May 14, 2021".[15] In May 2021, China became the second country in the world to land on the Mars surface, with the rover driving on the Mars surface on May 25, 2021.

In 2018, China carried out more launches than any other nation in the world. The Chinese space programme is progressing at a lightning pace and meeting most of its objectives in time. In some fields, China is possibly surpassing US capabilities like Rendezvous and Proximity Operations, Hypersonic Vehicles, Directed Energy Weapons and Fractional Orbital Bombardment System (RPOs, HSVs, DEWs and FOBS).

CHINESE PLANS FOR MILITARISATION OF SPACE

The space programme of China is deeply embedded in its national objective. Apart from prosperity (or the Chinese dream, *fuqiang*), the Chinese national objective also emphasises 'war-fighting and winning.' Space increasingly plays a pivotal role in its national security strategy. In China's assessment, the overwhelming space capabilities of the US gives it an undue advantage and that needs to be neutralised before China can re-take lost territories within the first island chain and dominate the second island chain and beyond into the Pacific. China also sees space as another area where it must establish its presence and eclipse the US in an all-out competition. The third

15. https://www.planetary.org/space-missions/tianwen-1. Accessed on December 28, 2023.

most important aspect is the exploitation of space resources. All these are to be achieved before the 2049 deadline set by Xi Jinping for the *fuqiang*.[16] "The PRC's goal is to become a broad-based, fully capable space power. Its rapidly growing space program—second only to the United States in the number of operational satellites—is a source of national pride and part of Xi's '*China Dream*' to establish a powerful and prosperous China".[17]

In 2007, China successfully conducted its first direct ascent ASAT, targeting a defunct Chinese weather satellite. It further worked on development of microsatellites which are capable of damaging a satellite at high speeds.

The Gulf War in 2001 shook the Chinese to the core and they started to study Anti-Satellite (ASAT) capabilities to nullify the US supremacy in infomation operations based in space. In 2007, China successfully conducted its first direct ascent ASAT, targeting a defunct Chinese weather satellite. It further worked on development of microsatellites which are capable of damaging a satellite at high speeds. China is also on the way to develop a functional Directed Energy (DE) space-based laser weapon to dazzle satellites in space. "China is also working on space-based microwave jammers that would interfere with communication payloads of enemy satellites, and chemical sprays that could damage sensors or solar panels thereby making satellites inoperative. China claims that it has developed a powerful Klystron amplifier, which generates high-power microwaves, that can be used in co-orbital payloads to jam the signals of an adversary's satellites".[18]

In August 2021, China tested a new class of space-based weapons, the hypersonic Fractional Orbit Bombardment System (FOBS). Though the

16. Sridharan Subramanyam, "China's Militarisation and Weaponisation of Space"", November 23, 2022 https://www.hindustantimes.com/ht-insight/international-affairs/chinas-militarisation-and-weaponisation-of-space-101669187458960.html. Accessed on December 28, 2023.
17. Michael Sheetz, Pentagon's Annual Report to Congress, https://www.cnbc.com/2023/10/26/investing-in-space-the-pentagon-sizes-up-chinas-military-strength/. Accessed on December 28, 2023.
18. Ibid.

> August 2021 test by the Chinese missed the target by some margin (24 miles), a similar test conducted earlier this year was successful. The FOBS weapon hardly gives a few minutes of window for ABMs to react, unlike in the case of traditional ICBMs.[19]

Another area of development comprises the Rendezvous and Proximity Operations (RPOs) which use techniques for docking, cost-effective satellite refuelling and space debris removal. "The same technology can also be used to inspect and gather intelligence about enemy space assets. Robotic arms can be used for mission extension of satellites or space debris removal, as China's ShiJian-21 satellite demonstrated in January 2022 when it grabbed a defunct BeiDou navigation satellite in GEO and placed it in a graveyard orbit far above",[20] thereby functioning as a 'space tug'. The US OTT series 'Space Force' depicts the scenario of a Chinese satellite tugging and removing a US satellite from its orbit. Such capabilities can be employed for offensive space purposes against other nations' satellites.

> The private firm Leolabs, which provides space situational awareness data through its global network of radars for tracking objects in low Earth orbit, said its analysis found evidence of what appeared to be at least two and possibly three capture/docking operations with a co-orbiting object. China has released very little information about the project, but clues indicate the spacecraft is somewhat similar to the Boeing X-37B. The U.S. Space Force's 18th Space Defense Squadron tracking data revealed an object in a closely-matching orbit to the spaceplane (NORAD ID 54218 (2022-093J COSPAR ID)). This companion subsatellite was then used in a series of Rendezvous and Proximity Operations (RPOs) with the spacecraft, with at least two and possibly three capture/docking operations, according to Leolabs.[21]

19. Ibid.
20. Ibid.
21. Jones Andrews, https://spacenews.com/chinas-spaceplane-conducted-proximity-and-capture-maneuvers-with-subsatellite-data-suggests/. Accessed on December 28, 2023.

In the field of Intelligence Surveillance and Reconnaissance (ISR), amongst other series, "the Yaogan satellites, also known by their military nomenclature Jianbing, are a large number of assorted satellites which employ Synthetic Aperture Radars (SARs), and Electro-Optical (EO) sensors. The SAR Yaogans usually operate in polar orbits and provide better than one metre resolution. The Yaogan-30 Ocean Surveillance Satellites are launched in triplets in close proximity to each other to locate Carrier Battle Groups (CBGs) through signal intelligence and triangulation. These satellites cue the ground-launched DF-21D/DF-26B missiles and ship-launched YJ-21 Anti-Ship Ballistic Missiles (AShBM) to their target, and are their backbone to implementing the Anti-Access/Area Denial (A2/D2) in the first and second island chains. It is believed that China will eventually operate 18 triplets of these important satellites, which would provide a constant surveillance of the Pacific and the Indo-China Sea in order to defeat the aircraft carriers".[22] The Electronic Intelligence (ELINT) satellites, namely the TJS-series (Tongxin Jishu Shiyan), are located in Geosynchronous Earth Orbit (GEO) for sustained ELINT operations while other early-warning systems can detect missile launches with their Infra-Red (IR) seekers.

PLASSF

China established a Strategic Support Force (PLASSF) in the People's Liberation Army (PLA) in late 2015. The envisaged role of the PLASSF is to provide security for the growing Chinese interests and capabilities in space and in the associated electro-magnetic, cyber and psychological domains by reducing their vulnerability. The establishment of this force would contribute to collective development of the PLA's space, SIGINT, cyber, electro-magnetic and psychological operations capabilities. This institutionalisation may enable more optimal use of resources for developing these capabilities. The integration of PLASSF capabilities into

22. Subramanyam, n.16.

> the PLA regional theatre operations may also enhance the effectiveness of the PLA joint operations.[23]
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> In late December 2015, the Strategic Support Force (PLASSF) of China's People's Liberation Army (PLA) was established. China's military analysts claim that the primary mission and task of the PLASSF is to provide strategic battlespace support to enable PLA local superiority on the aerospace, outer space, network or internet, electro-magnetic spectrum and psychological warfare battlefields in war. These analysts also state that PLASSF operations would be integrated seamlessly with those of the PLA (PLA), PLA Navy (PLAN), PLA Air Force (PLAAF) and PLA Rocket Force (PLARF) and run throughout the war. PLASSF thus constitutes a critical force of the PLA for fighting and winning a war.[24]

"Like other PLA services, the PLASSF has a headquarters that consists of theatre-leader-grade line commanding officers including a commander, a political commissar and their deputies. It also has four internal staff departments including the staff, political work, logistics and armament departments. These four departments offer staff support to the line commanding officers in planning and making decisions on force construction and operations. Some analysts suggest that the headquarters of the PLASSF consists of six major departments, including the two additional Space Systems Department and Network Systems Department".[25] These two departments make up the operational forces of the PLASSF, offering battlespace support. In contrast to the other four departments, they aren't assigned with the direct responsibilities of planning and decision-making by line commanding officers at the PLASSF Headquarters (HQ). These two

23.. https://research.nus.edu.sg/eai/wp-content/uploads/sites/2/2021/09/EAIBB-No.-1606-PLASSF-and-Regional-Security-exsum.pdf. Accessed on December 23, 2023.
24. https://docplayer.net/amp/234742472-The-new-strategic-support-force-of-the-chinese-military-and-implications-for-regional-security.html. Accessed on December 23, 2023.
25. John Costello and Joe McReynolds, "China's Strategic Support Force", in Phillip C Saunders, https://ndupress.ndu.edu/Portals/68/Documents/stratperspective/china/china-perspectives_13.pdf. Accessed on December 23, 2023.

forces are pitched at the national level into two departments because they are not regionally concentrated. They conduct remote and 'soft' kills through operations in environments considered outside conventional warfare.

The PLASSF is led by three-star flag officers. It is under a dual-command system where "it is commanded by a Commodore (Cdr) and a Political Commissar (PC). The PC shares the same bureaucratic grade as the Cdr and, therefore, has the power to cosign orders with the commander".[26] The introduction of the new PLASSF service enhances the arsenal of technological tools available to the senior leadership, aiming to diminish perceived threats to their security. However, these advancements primarily unfold within the constrained spheres of the PLA organisation and technology, without fundamentally altering China's military stance.

An examination of the former General Armaments Department (GAD), General Staff Department (GSD), and new Strategic Support Force (SSF) units indicates that it is highly likely that not all counter-space weapons will be operated by the SSF. There are equally strong arguments that, on the one hand, centralising counter-space weapons under the SSF was never the PRC's intention, and, on the other, that PLA thinking on integrating weapon developers and operators has impacted decisions regarding the actual PLA operators.[27] Indeed, limited experimental space-based counter-space weapons are probably operated exclusively by the SSF's Space System Department (SSD). PLA Theatre Command (TC) commanders may have more ease in tasking low-powered directed energy counter-space weapons and some network-electromagnetic spectrum weapons than terrestrially-based satellite electronic jammers.[28]. There is limited publicly available information to support the fact that the SSF is the Service training with Direct-Ascent Anti-Satellite (DA-ASAT)

26. https://research.nus.edu.sg/eai/wp-content/uploads/sites/2/2021/09/EAIBB-No.-1606-PLASSF-and-Regional-Security-exsum.pdf. Accessed on December 23, 2023.
27. Burke Kristin, "PLA Counter Space Command and Control", December 23, https://www.airuniversity.af.edu/CASI/Articles/Category/15282/. Accesed on December 29, 2023.
28. Ibid.

missiles. Rather, there is more information to suggest that these missiles may be operated by other PLA Services.[29]

SPACE FORCE

The Space Systems Department (SSD) functioning under the PLASSF, commands the entire military space-related forces and capabilities since its formation in 2015. Colloquially known as the Chinese Space Force, the forces under it are commanded by one-star generals after being under the now defunct PLA General Armaments Department (GAD).

The reallocated units control the following space launch and control capabilities:

- Jiuquan Satellite Launch Centre (Base 20).
- Taiyuan Satellite Launch Centre (Base 25).
- Xichang Satellite Launch Centre (Base 27).
- Wenchang Space Launch Centre, Hainan.
- Space telemetry, tracking and control capabilities:
  - Beijing Aerospace Flight Control Centre.
  - Xian Satellite Control Centre (Base 26).
  - China Satellite Maritime Tracking and Control Department (Base 23) which maintains a fleet of Yuanwang space tracking ships.

- Other major departments in the PLA overseeing the space-based satellite reconnaissance, communications and navigation capabilities which were moved to the SSD are:
  - Aerospace Reconnaissance Bureau of the former GSD Intellligence Department.
  - Satellite Communications General Station of the former GSD Information Department.
  - Satellite Positioning General Station of the former GSD Operations Department.

29. Ibid.

- PLA Aerospace Engineering University of the former GAD Armaments Institute.

Military operations to compete for 'aerospace superiority', according to China's military analysts, entail two major types:[30]

- The first is aerospace information operations, which are based on the view that aerospace operations now exhibit greater integration with network and cyber operations, whilst network operations are increasingly linked to Electronic Warfare (EW). Aerospace information operations, thus, involve EW, network operations and psychological operations.
- The second type of military operations comprise aerospace joint firepower strikes.
  - "To degrade and disable the rival's aerospace operations capabilities, co-orbital counter-space weapons could be employed to conduct 'soft kills', including accompanying and circling the rival's satellites to block, clog and shield their microwave and electro-optical sensors. Miniature intelligent spacecraft may also be attached to the rival's satellites for their capture, control and use".[31]
  - The other option of 'hard kills', involves the use of directed energy weapons such as lasers, particle beams and microwaves as well as kinetic energy weapons to attack and destroy the space-based targets of the rival. They also involve the use of land-based, direct-ascent counter-space missiles to attack these targets. Moreover, air, missile and special operations may be conducted to attack the rival's land-based facilities that support aerospace operations. These facilities include space launches and landing bases, space early warning and monitor installations, space flight control centres and space information support centres.

30. https://docplayer.net/amp/234742472-The-new-strategic-support-force-of-the-chinese-military-and-implications-for-regional-security.html. Accessed on December 23, 2023.
31. Ibid.

"China operates a fleet of 586 satellites out of which 290 are Intelligence, Surveillance and Reconnaissance (ISR) satellites, as of March 2022. The Pentagon emphasized that most of those Chinese satellites can support monitoring, tracking, and targeting of U.S. and allied forces worldwide, especially throughout the Indo-Pacific region".[32] China has plans to increase these numbers exponentially over the next five years.

The operationalisation of the PLASSF has moved China another step closer to the strategic use of satellites for military purposes. However, the entire control may not rest with the PLASSF. Some of the control has been divested to theatre commanders. The consent of the Central Military Commission (CMC)for the use of other types of counter-space weapons seems to depend on whether the weapons' effects go beyond the theatre of use. Theatre commanders can probably readily task low powered directed energy satellite dazzling, cyber attacks, and radio frequency delivered malware weapons, assuming they achieve only in-theatre, target-specific effects. In the case of beyond theatre effects, such as other spectrum enabled cyber attacks or spoofing, a CMC controlled unit of the Strategic Support Force (SSF) is probably the primary operator. The CMC probably directs cyber attacks on satellite ground stations in-theatre, especially attacks to deliver malware to adversary satellites, because of the beyond-theatre effects. The growing Chinese capabilities of ASAT and RPO makes Space Situational Awareness (SSA) increasingly imperative for India to protect its space assets.

"China's first overseas government facilities (outside of embassies and consulates) were space tracking centers established in Swakopmund, Namibia (2001), and Kiribati in the South Pacific (1997). Other facilities to support the manned space effort have been established in Malindi, Kenya, and Karachi, Pakistan. In addition, China has negotiated access to Swedish and Chilean space observation networks, as well as leased facilities in Australia".[33] A major initiative launched by the Asia-Pacific Space Cooperation Organisation

32. Sheetz, n.17.
33.. Cheng Dean, CASI, https://www.airuniversity.af.edu/Portals/10/CASI/Conference-2020/CASI%20 Conference %20China%20Space%20and%20Foreign%20Policy-%20Cheng.pdf?ver=tXD5KaN9JfGMNNf -oqH-Yw%3D%3D. Accessed on January 3, 2024.

(APSCO, based at Beijing) has been APOSOS (the Asia-Pacific Ground-Based Optical Space Object Observation System). "This space situational awareness network can monitor objects in both low Earth and geosynchronous orbits. By binding it to APSCO, it has allowed China to deploy telescopes to Iran, Pakistan, and Peru, with the eventual goal of telescopes and other space-tracking systems available in every member country. China has also deployed sensors to Brazil, Ukraine, and Mexico, as part of APOSOS. The resulting data is managed by the Chinese Academy of Science's National Astronomical Observatory".[34]

IMPERATIVES FOR INDIA

Over the last 66 years, 15,946 objects have been launched into space. "As of January 3rd 2024, the satellite tracking website 'Orbiting Now' lists 8,377 active satellites in various Earth orbits. A deeper insight into the numbers of satellite that are in space reveals how small satellites have come to dominate low Earth orbits. In the three main categories of Earth orbits, small satellites dominate LEO while large satellites dominate GEO. The occupancy rate is GEO 12%, MEO 3% & LEO 84%".[35]

> The top five countries controlling the greatest number of satellites are; United States with 4,511 satellites, China with 586 satellites, United Kingdom with 561 satellites, Russia with 177 satellites and, finally, India with 62 satellites. The number of satellites is only going to increase at an ever faster pace. Indian Space Research Organisation (ISRO) chief S Somanath, on Thursday, said that India is planning to launch 50 satellites in the next five years for geo-intelligence gathering. The initiative involves the creation of a layer of satellites in different orbits with a capacity to track the movement of troops and image thousands of kilometers of area".[36]

34. Ibid.
35. https://nanoavionics.com/blog/how-many-satellites-are-in-space/. Accessed on January 3. 2024
36. https://www.businesstoday.in/latest/in-focus/story/isro-plans-to-launch-50-satellites-in-five-years-for-intelligence-gathering-s-somanath-411218-2023-12-29. Accessed on January 3, 2024.

Even that may not be adequate, considering the Chinese capabilities. The Chinese space budget is US$ 8 billion while that of India is just US$ 17 million. Much more allocation is required to fuel the progress of our space capabilities. Space-based ISR capabilities need a quantum jump from the present numbers.

The PLA seems to be in the process of setting up a dedicated unit to conduct defensive and offensive orbital warfare, like the US Space Force Delta 9, and also conduct orbital warfare exercises like the US Red Skies. Are there plans in India to set up such a force? The first step would be to enhance the Defence Space Agency (DSA) to a command level force with dedicated forces/units.

Any conflict would, in most cases, be triggered by a minor incident at the border, escalating into a sectoral conflict, and then may spiral out of control to engulf a complete front. Timelines between each phase may be short, in terms of days not weeks. Hence, there is a need to look at the Launch on Demand (LoD) capabilities to overcome the present shortfall in ISR coverage. LoD, involving micro-satellites needs to meet realistic operational timelines.

Indian military planning for missile defence from the threat of DA-ASAT missiles should include considerations that the PLA's DA-ASAT missiles may be deployed from SSF, PLA Air Force (PLAAF), or PLA Rocket Force (PLARF) bases and positions. Therefore, the area of interest has grown exponentially for the Indian Air Force (IAF). While DA-ASAT missiles potentially could be deployed from a multitude of locations, the PLA's primary intention for the missiles is likely to be a credible deterrent, and only the CMC would cautiously approve their use.

> Military and security imperatives have also gained greater prominence in the Indian thinking about space utilization. Although New Delhi does not have a detailed space policy document, except the recently promulgated Indian Space Policy 2023, which is primarily an overarching, composite and dynamic framework to implement the reform vision approved by the Cabinet. The growing military orientation can be gleaned from official

> statements in the Indian Parliament and from organizations such as the United Nations.[37]

On the other hand, the space orientation in the military hierarchy is yet to reach the desired levels. Much greater focus on space related training may be required to provide the future decision-makers with the tools of space control. The IAF has the structure, mindset and doctrine that are inherently capable of mutual ascription to the space domain. The progression from an air force to an aerospace force should be viewed from the holistic lens as a natural evolution. But the IAF has to demonstrate an unpretentious but symbiotic and obsessive embrace of space operations to progress from an inchoate space force to a dyadic aerospace player.

> India should also partner with the QUAD on Space Domain Awareness (SDA), which is essentially the capacity to track the space environment for threats, including naturally occurring events and intentional attacks. The United States is the most capable state in this regard, but growing space insecurity, especially acute among Indo-Pacific states, points to the need for more comprehensive coverage of the Southern hemisphere.[38]

India needs to partner with other nations for setting up space tracking, telemetry and observation centres to avail opportunities for global control of its assets. Some steps have presumably been taken in this direction in the Asian region. Expansion of this network to other continents may become indispensable in the future.

IndSpaceEx, a table-top exercise, was conducted by the Ministry of Defence on July 25 and 26, 2019.

> The exercise assessed threats in space from a military perspective and India's current capability. It took stock of the military space assets of the

37. Rajeswari Pillai Rajagopalan, https://carnegieendowment.org/2022/09/01/india-s-space-priorities-are-shifting-toward-national-security-pub-87809. Accessed on January 3. 2024.
38. Ibid.

> US, Russia and China. The country's armed forces along with DRDO, ISRO, academia, including IIT-Mumbai, think-tanks such as ORF and private industry were part of the exercise. Within the community of strategic thinkers, Beijing poses a major threat to India's security interest – satellites and other assets. This first of its kind exercise, at this level, was to help gain a better understanding of space-related security issues.[39]

This now needs to become an annual affair to propagate the imperatives of space operations for military usage.

India's space economy is expected to grow to $40 billion by 2040, according to Union Minister Jitendra Singh. He emphasised the country's progress in foreign satellite launches, with revenue of EUR 230-240 million from European satellites and $170-180 million from American satellites.[40] "As per IN-SPACe's projection, India's space economy has the potential to reach ₹35,200 crore ($44 billion) by 2033 with about 8 percent of the global share".[41] There is general consensus that facilitating the private sector would boost the Indian share to 8-9 percent. The focus on reaching close to 10 percent share needs to be sustained with adequate government facilitation and intervention to ensure a robust web of space assets. The military, on its part, needs to evolve a *modus vivendi* to vigorously collaborate with the private players also since all space usage comprises dual use.

"The Indian Space Policy 2023 provides a framework that prioritises private players' involvement in the space sector. The private sector's participation will help India increase its share in the global space economy from about 2 per cent to 9 percent by 2030".[42]

There is no contention over the fact that space is going to be the next frontier of contest and nations which enjoy space supremacy will enjoy

39.. Air Marshal Anil Chopra, https://www.indiandefencereview.com/news/militarisation-of-space-imperatives-for-india/. Accessed on January 3, 2024.

40. https://www.livemint.com/news/india/indias-space-economy-to-soar-to-40-billion-by-2040-union-minister-jitendra-singh-11700977122020.html. Accessed on January 3, 2024.

41. Ibid.

42. https://pwonlyias.com/editorial-analysis/privatization-of-indian-space-sector/#:~:text=Policy%20 Framework%20 and %20Goals%3A%20The,involvement%20in%20 the%20space%20sector. Accessed on January 3, 2024.

dominance in terrestrial warfare also. Space capabilities take decades to achieve and require steadfast perseverance, matching resources with our adversaries is a long-shot as of now; there is no other option but to wrest the initiative. Even our *Vedas* sequence space ahead of air, fire, water and Earth. "*Kham Vayur Jyotiraphah Prithivi Vishvasya Dharini*". "The *Prakriti* is upheld by Space (*Kham*), Air (*Vayu*), Fire (*Jyoti*), Water (*Apah*), and Earth (*Prithvi*)." The worth lies in the specific sequence in which these elements are mentioned.