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Lessons for Europe and Italy from Other Space Powers: The Civil-Military Interconnection

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The study examines how five space powers – China, Russia, the United States, India and Japan – structure the civil-military interconnection in space, focusing on governance models, strategic priorities, the role of private actors and implications for security and technological competitiveness. The case studies show different patterns: China and Russia rely on more centralised and security-driven approaches, while the United States, India and Japan combine civilian, military and commercial dimensions in different ways. For Europe and Italy, the report highlights the need for stronger strategic coherence, better institutional coordination, stable investment and closer integration between research, innovation and security. The main challenge is not to replicate other space powers' models, but to build a less fragmented European architecture able to support strategic autonomy and balanced international partnerships.

1. Hybrid frontiers: The logic of military-civil fusion in China's space governance

by ***Mélusine Lebret***[1]

China's rise in space activities has evolved from the launch of *Dong Fang Hong 1* in 1970 into an integrated enterprise spanning satellite navigation, deep-space exploration, orbital infrastructure and defence-related operations. Unlike the more compartmentalised Western approach, China's space governance operates through a vertically aligned structure: the Communist Party of China (CPC) directs policy down through state conglomerates, military research institutions and affiliated private actors. Civilian, commercial and military functions are synchronised within a unified system aimed at technological sovereignty and comprehensive national security.

This political system is underpinned by a people-oriented principle (*yi ren wei ben*), through which the CPC presents scientific and technological advancement as serving national welfare and social modernisation.[2] Yet under the framework of military-civil fusion (MCF) (*junmin ronghe*), operational officially since 2015, popular participation and commercial innovation also feed into strategic and defence goals, reflecting China's model of hybrid development where civilian and military dimensions are deliberately merged.

Published in late October 2025, the CPC's latest Five-Year Plan's overview (2026-2030) places national rejuvenation and security at the heart of China's space development agenda.[3]

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2 Huang, Guowen and Ruihua Zhao, "Harmonious Discourse Analysis: Approaching Peoples' Problems in a Chinese Context", in *Language Sciences*, Vol. 85 (May 2021), Article 101365, DOI 10.1016/j.langsci.2021.101365.

3 The 15the Five-Year Plan has been published in March 2026. See Green, Erik and Olivia Parker, "China's 15th Five-Year Plan", in *IISS Online Analysis*, 23 March 2026, https://www.iiss.org/online-analysis/online-analysis/2026/03/

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The national rejuvenation principle embodies China's transformative pursuit of renewed strength, prosperity and global standing through comprehensive modernisation across political, economic and technological spheres. In this picture, space is considered as an enabler to restore China's glory. Similarly to the last two plans, the 15th edition envisions technological innovation, data integration and progress in emerging sectors as foundations for a robust and cohesive space ecosystem, while underscoring the need for financial resilience and structural stability to sustain long-term innovation ambitions.[4]

China's rapid ascent is reflected in the steadily increasing number of space launches that reached sixty-eight in 2024 and positioned the nation second only to the United States.[5]

This chapter explores how military-civil fusion (MCF) operates as a central organising principle, linking the nation's people-centred governance, technological aspirations and evolving conception of hybrid warfare, thereby positioning space as a pivotal arena for the projection and consolidation of integrated national power in China.

1.1 Military-civil fusion and China's implicit dual-use doctrine

The directives of the 14th Five-Year Plan already explicitly elevated space infrastructure and exploration frameworks as key national infrastructure for main sovereign security priorities.[6] They merge scientific innovation with national security planning under what Beijing has described, notably in international fora, as exploration, innovation and peaceful use.[7] This codification underscores how space now functions as an inter-ministerial area – integrating industrial modernisation, information dominance and global prestige into a single planning circuit.[8]

The CPC model rests upon an implicit dual-use doctrine designed to preserve strategic ambiguity, enabling the seamless alignment of civilian innovation with latent military capability while obscuring the boundaries between the two. Under MCF, projects designated as scientific are deliberately engineered to yield both civilian and military benefits. Space, therefore, is not managed as a compartmentalised sector but as a strategic vector within China's unified national power system.

Despite not having a standalone, official Space Strategy document, China articulates its long-term space vision primarily through a series of Space Activities and National Defence white papers and Five-Year Plans. Those documents chart a shift from capacity building to global leadership in space by emphasising projects promoting capability deployment in-orbit, on the Moon and Mars, as well as the development of missile-warning and reconnaissance satellite constellations. Initiatives highlighted across the 2016, 2019 and 2022 white papers include the BeiDou navigation system, Gaofen Earth observation network, Shijian experimental satellites plans for reusable launch vehicles, deep-space exploration and satellite Internet mega constellations.[9] Together, these lay out the systematic pursuit of: 1) scientific advancement (i.e. robotic lunar missions, Mars, asteroid and planetary research);[10] 2) infrastructure

chinas-15th-five-year-plan.

4 "Recommendations of the Central Committee of the Communist Party of China for Formulating the 15th Five-Year Plan for National Economic and Social Development", in *Xinhua*, 28 October 2025, https://english.www.gov.cn/news/202510/28/content_WS6900adb9c6d00ca5f9a07216.html.

5 Space Stats, *Orbital Launches in 2024*, updated May 2026, https://spacestatsonline.com/launches/year/2024.

6 As stated in the summary of the 15th Five-Year Plan, China's ambition to become a "spacefaring nation" reflects its strategic focus on space infrastructure development.

7 United Nations, *Report of the Committee on the Peaceful Uses of Outer Space* (A/79/20), 30 August 2024, https://www.unoosa.org/oosa/oosadoc/data/documents/2024/a/a7920_0.html.

8 NDRC, *The Outline of the 14th Five-Year Plan for Economic and Social Development and Long-Range Objectives through the Year 2035 of the People's Republic of China*, 2021, https://en.ndrc.gov.cn/policies/202203/P020220315511326748336.pdf.

9 China State Council Information Office, *White Paper on China's Space Activities in 2016*, 27 December 2016, http://english.scio.gov.cn/whitepapers/2017-01/10/content_40535777.htm; *China's National Defense in the New Era*, July 2019, https://www.chinadaily.com.cn/specials/whitepaperonnationaldefenseinnewera.pdf; *China's Space Program: A 2021 Perspective*, 28 January 2022, https://www.cnsa.gov.cn/english/n6465684/n6760328/index.html.

10 The CAS Long-Term Science and Technology Strategy also mentions spaceflight and space science as core enablers of China's development; "Ten Years of Charging: Towards the Goal of a Powerful Country in Science and Technology" (in Chinese), in *Science and Technology Daily*, 24 June 2026, https://www.cas.cn/cm/202506/t20250624_5074209.shtml.

modernisation (i.e., telecommunication satellites, heavy lift launch vehicles); 3) national security enhancement, stressing space-based intelligence and communications as part of strategic deterrence; 4) international cooperation framed within "peaceful use" and "common development".[11]

The CPC treats space development as a manifestation of sovereign revitalisation – a means to demonstrate technological independence and strategic maturity. Official plans such as Made in China 2025[12] tie space innovation directly to industrial modernisation and defence readiness, while broader Science and Technology (S&T) blueprints like the Medium- and Long-Term Plan for Science and Technology Development (2006-2020)[13] institutionalise research support for propulsion, materials, robotics and quantum communication.

Since the 13th and 14th Five-Year Plans, space has explicitly served as a testing ground for China's vision of "informatised" and "intelligentised" warfare, as is apparent in the 15th Five-Year Plan.[14] Government directives link orbital infrastructure development to the State Plan for Informatisation (2016), designed to deliver global broadband and secure information networks through LEO and GEO constellations. These strategies underscore a doctrinal evolution toward information dominance – leveraging AI-enhanced data processing, quantum encryption and autonomous decision-making as enablers of resilience and command precision.

1.2 Civil and military space programmes: Governance and approaches

At the ministerial level, responsibility for the civilian programme rests with the China National Space Administration (CNSA) under the Ministry of Industry and Information Technology (MIIT).[15] CNSA formulates policy, negotiates international agreements and oversees flagship projects such as: 1) the Chinese Lunar Exploration Programme (CLEP, also known as Chang'e Project), including orbital, landing and sample-return missions;[16] 2) the Tianwen Planetary Exploration Programme;[17] 3) the Tiangong Modular Space Station, which has been operational since 2022; 4) national Earth observation (EO) and communications constellations.

Execution of these projects is carried out primarily by state conglomerates, government-owned large corporate groups that control multiple businesses across sectors, operating under state supervision to advance national economic and strategic goals: China Aerospace Science and Technology Corporation (CASC) – prime contractor for Long March launch vehicles and spacecraft production;[18] China Aerospace Science and Industry Corporation (CASIC) – developer of defence-related aerospace systems;[19] and subordinate academies such as

11 Chinese Foreign Ministry, *Position Paper of the People's Republic of China for the Summit of the Future and the 79th Session of the United Nations General Assembly*, 19 September 2024, https://www.fmprc.gov.cn/eng/zy/wjzc/202409/t20240920_11493896.html.

12 China State Council, *Notice of the State Council on the Publication of "Made in China 2025"*, May 2015, https://cset.georgetown.edu/publication/notice-of-the-state-council-on-the-publication-of-made-in-china-2025.

13 China State Council, *The National Medium- and Long-term Program for Science and Technology Development (2006-2020)*, 2006, https://www.itu.int/en/ITU-D/Cybersecurity/Documents/National_Strategies_Repository/China_2006.pdf.

14 Black, James et al., *Multi-Domain Integration in Defence. Conceptual Approaches and Lessons from Russia, China, Iran and North Korea*, Santa Monica, RAND, January 2022, http://www.rand.org/t/RRA528-1.

15 See the official website: https://www.cnsa.gov.cn/index.html.

16 Spacecraft and Vehicles website: *The Chan'E Program*, https://spacecraftandvehicles.com/?p=5864.

17 China's Tianwen Planetary Exploration Programme is a far-reaching series of deep-space missions – spanning from Mars and asteroids to Jupiter – designed to advance the scientific understanding of the Solar System's origin, evolution and potential for life, through ambitious undertakings such as Tianwen-1's Mars landing, Tianwen-2's asteroid sample return and Tianwen-3's planned Mars sample retrieval. China's Tianwen Mars Exploration Program – encompassing the successful Tianwen-1 orbiter, lander and rover mission and the planned Tianwen-3 sample-return mission – aims to reveal Mars's geological evolution, past habitability and potential signs of life through increasingly sophisticated exploration and direct sample recovery.

18 Seibo, Riko, "Chinese Long March Rockets Make International Debut at Paris Air Show", in *Space Daily*, 30 June 2025, https://web.archive.org/web/20250801213731/https://www.spacedaily.com/reports/Chinese_Long_March_Rockets_Make_International_Debut_at_Paris_Air_Show_999.html.

19 "IndoDefence 2025: China Promotes CM-401 Anti-Ship Missile as Coastal Defense for Foreign Customers", in *Defense News Army*, 12 June 2025, https://www.armyrecognition.com/news/army-news/2025/indodefence-2025-china-promotes-cm-401-anti-ship-missile-as-coastal-defense-for-

the China Academy of Space Technology (CAST), China Academy of Launch Vehicle Technology (CALT) and Shanghai Academy of Spaceflight Technology (SAST) provide specialised engineering capability.[20]

With regards to military space governance, the space military counterpart operates within the People's Liberation Army Strategic Support Force (PLASSF). This apparatus, formed in 2015 and dissolved in 2024, aimed at integrating emerging warfighting domains such as space, cyber and electronic warfare. In charge of critical national infrastructure, the PLASSF controlled reconnaissance satellites, missile-warning sensors and secure communications networks, supplying strategic data for joint operations across the land, sea, air and cyber domains.

In 2024, China undertook a major organisational transition, establishing the People's Liberation Army Information Support Force (ISF) to replace the earlier Strategic Support Force (SSF). Alongside the Information Technology, Joint Logistic Support and Cyberspace Forces, this shift elevated the Aerospace Force (ASF) as the principal enabler of the ISF's strategy, together with its operational component, chiefly because its control of space-based reconnaissance systems and counterspace capabilities, fused with cyber and electronic assets, forms the basis of integrated information dominance. All in all, this military reorganisation signalled an overall decisive reorientation of the PLA toward integrated information warfare – spanning cyber, electronic and space domains.[21] This reform establishes space command centres, rather than a formal "Space Command", as core command and control (C2) hubs integrating orbital assets into China's defence architecture. Facilities such as the Beijing Aerospace Flight Control Centre[22] manage satellite operations and information flows that support strategic space access and space-based communications, enhancing China's ability to shape information environments, perception and decision-making in and beyond conflict. Within this framework, the PLA pursues information dominance located below the threshold of conflict by closely fusing space, cyber and electronic warfare operations. Its exercises routinely feature electromagnetic jamming, laser dazzling and spoofing techniques designed to degrade adversary satellite communications (SATCOM), EO/intelligence, surveillance and reconnaissance (ISR) and positioning, navigation and timing (PNT) systems, including networks such as the Global Positioning System (GPS) and Galileo.[23]

In practice, civilian agencies and the PLA share technical infrastructure, laboratories and occasionally personnel. The BeiDou Navigation Satellite System epitomises this overlap: marketed globally as a commercial and civil navigation service yet providing encrypted, anti-jam links for the PLA's C2 capabilities.[24] Technological cooperation occurs directly between corporate and academic units. For instance, broadband constellation projects under China Satellite Network Group share ground stations with military communications networks, as is the case for the *Guowang* mini constellation launched in 2025.[25] Such arrangements yield seamless transfer of data and technology between civilian and defence programmes.

Ultimate control lies with the State Council[26] and the CPC Central Committee, advised by party commissions on science, technology and defence. Decisions flow vertically through MIIT and the Central Commission for Science and Technology

foreign-customers.

20 CAST website: https://www.cast.cn; CALT website: https://www.catl.com; SAST website: http://www.sast.cn.

21 China appears to recognise an additional "information" domain alongside NATO's five traditional domains of land, sea, air, cyber and space. Indeed, PLA documents identify four main services – Ground, Navy, Air and Rocket Forces – and a specialised Information Support Force that integrates space, cyber and electronic operations, suggesting "information" constitutes a distinct operational domain.

22 This complex, inside the Aerospace City of Beijing, is formerly known as the Beijing Aerospace Command and Control Center.

23 Lebret, Mélusine et al., "Cross-Cutting Technologies in Chinese Space Activities: Raising the Risk of Hybrids Threats", in *Hybrid CoE Papers*, No. 22 (December 2024), https://www.hybridcoe.fi/wp-content/uploads/2024/12/20241212-Hybrid-CoE-Paper-22-Cross-cutting-technologies-in-Chinese-space-activities-WEB.pdf.

24 BeiDou website: http://en.beidou.gov.cn.

25 Jones, Andrew, "China Launches New Group of Guowang Satellites from Commercial Spaceport", in *SpaceNews*, 30 July 2025, https://spacenews.com/?p=537474.

26 The State Council is composed of a premier, vice premier, state councillors, ministers of ministries and commissions, as well as auditor and secretary generals. They are all representatives embedded in the CPC, even if they differ from the party's Central Committee.

down to corporate and academic actors. This vertical structure ensures unity of effort and rapid mobilisation but limits transparency, since critical military and commercial programmes are coordinated through non-public directives rather than legislative scrutiny.

1.3 Budget and resource allocation

Quantifying China's space spending is difficult because funding is spread across multiple ministries, provincial governments and state-owned enterprises (SOEs). Estimates by international organisations suggest that China spends about 8-11 billion US dollars per year on civil space programmes and 13-15 billion US dollars, including defence projects.[27] Presumably, government space funding rose sharply from around 12 billion US dollars in 2022 to 14 billion in 2023 and 19 billion US dollars in 2024, placing China second globally – behind the United States but ahead of Russia, Europe and Japan.[28]

As highlighted in the 2016 and 2019 Space Activities White Papers, rapid growth reflects heavier investment in launch vehicle development, spacecraft manufacturing, deep-space missions, crewed flight and experimental technologies such as artificial intelligence, quantum communication and on-orbit servicing.[29] Regional clusters (e.g., Beijing-Tianjin-Hebei, Shanghai and Xi'an) supplement national budgets by offering local financial R&D incentives.

A China-based source projects a national space industry reaching 1.7 trillion US dollars within a decade and the commercial space market surpassing 390 billion by 2025. In contrast, a UK-based source offers a more conservative outlook, estimating a 900 billion US dollars commercial space sector by 2029 from a 7.3 billion baseline in 2024. Despite these differences, both highlight China's sustained investment and ambition to secure global space leadership by 2045.[30]

Central funding follows the planning-economy tradition rather than annual appropriations: each programme sits within multi-decade roadmaps, with strategic milestones fixed in successive Five-Year Plans. This mode, complemented by local financial injections, privileges capacity-building and industrial synergy over fiscal transparency, embedding space in the same long-range structures that support national high-tech priorities.

1.4 Engagement of private actors, academia and research centres

Beginning in 2014, private participation was formally permitted by CPC for satellite operations and launch services. This has generated a growing cadre of New Space companies:

- LandSpace, i-Space, Deep Blue Aerospace, Galactic Energy and ExPace, a CASIC subsidiary, all developing reusable, liquid-propellant rockets competing with state launchers.[31]
- Chang Guang Satellite Technology, managing commercial EO systems.
- Enterprises exploring on-orbit data platforms and satcom services under state supervision.

While notionally independent, these firms operate within a quasi-state ecosystem: financing derives largely from government grants or state-bank credit, and strategic oversight mainly remains centralised through the National Development and Reform Commission (NDRC)[32] and MIIT classification systems for "strategic emerging industries".[33] Private innovation thus

27 Statista, *Government Expenditure on Space Programs in 2022 and 2024, by Major Country*, 2026, https://www.statista.com/statistics/745717.

28 Abdullah, Umar, *Analysing China's Ascension in Space Exploration*, Centre for Strategic and Contemporary Research (CSCR), 16 September 2024, https://cscr.pk/explore/themes/politics-governance/analysing-chinas-ascension-in-space-exploration.

29 China State Council Information Office, *White Paper on China's Space Activities in 2016*, cit.; *China's National Defense in the New Era*, cit.

30 Interesse, Giulia, "China's Space Economy: Unlocking Opportunities in Aerospace and Commercial Space Industries", in *China Briefing*, 4 February 2025, https://www.china-briefing.com/news/chinas-opportunities-in-aerospace-and-commercial-space-industries.

31 LandSpace website: https://www.landspace.com; i-Space website: https://www.i-space.com.cn; Deep Blue Aerospace website: https://www.dbaspace.com; Galactic Energy website: https://www.galactic-energy.cn; ExPace/CASIC, https://www.newspace.im/launchers/casic-expace.

32 The National Development and Reform Commission (NDRC) is a macroeconomic management agency under China's State Council, composed of departments overseeing economic and social development, and responsible for formulating national strategies, coordinating industrial and investment policies and guiding overall economic planning.

33 NDRC et al., *Guiding Opinions on Expanding Investment*

complements rather than replaces governmental objectives.

Universities and institutes play a bridging role between pure research and defence technology. Beihang University, Harbin Institute of Technology and laboratories under the Chinese Academy of Sciences (CAS) conduct fundamental work in spacecraft autonomy, remote sensing, propulsion and materials.[34] Many researchers hold dual appointments linked to defence programmes, implementing MCF by way of shared funding and tasking.

For more than a decade, national R&D programmes, such as the 863 Programme in applied high-tech and the 973 Programme in basic science, have been critical in nurturing those capabilities.[35] Initiatives through the National Natural Science Foundation of China and the Ministry of Science and Technology sustain frontier research in robotics, quantum physics and artificial intelligence.

Joint research ventures between universities and missile-design academies emphasise dual-use devices – optical sensors, radar arrays and artificial intelligence (AI) algorithms that can serve either civil imaging or strategic targeting functions. These yield integrated innovation pipelines but blur boundaries of intellectual property and commercial independence.

1.5 International cooperation and partnerships

China expands its space diplomacy through organisations and multilateral programmes. Notably, the Asia-Pacific Space Cooperation Organization (APSCO), headquartered in Beijing, enables joint satellite development through a data-sharing network (e.g., Joint Small Multi-Mission Satellites (SMMS) Constellation Programme) and personnel training for regional members. Those include Turkey, Mongolia, Thailand, Pakistan, Peru, Iran and Bangladesh.[36] The China-UN Collaboration on Space Exploration and Innovation offers payload opportunities on the Tiangong station to global partners, reinforcing China's image as a cooperative actor in space science.[37] Additionally, China is currently engaged in the UN Committee on the Peaceful Uses of Outer Space (COPUOS) and the International Telecommunication Union (ITU) for normative dialogue.[38]

In terms of bilateral partnerships, Beijing's space strategic cooperation is strongest with Russia, where joint ventures include a proposed International Lunar Research Station and shared EO networks, which could concretise themselves as early as 2031-2035. A prominent example is the China-Russia Consortium Space Weather Centre, established in Beijing in 2021, which provides joint research and forecasting on solar activity affecting civil aviation and orbital assets. This initiative crystallised further amid intensified Sino-Russian experimentation with space-defence capabilities during 2024 and early 2025, through the Service Platform of Chinese-Russian Satellite Navigation Monitoring and Assessment initiative, demonstrating the extension of military-civil cooperation into collaborative space science and meteorological intelligence.[39]

Additionally, the China-Brazil Earth Resources Satellite (CBERS) programme remains one of China's oldest joint missions.[40] In Africa and the Middle East, China builds satellite

in Strategic Emerging Industries and Cultivating Strengthened New Growth Points and Growth Poles, 29 September 2020, https://cset.georgetown.edu/publication/new-chinese-ambitions-for-strategic-emerging-industries-translated.

34 Australian Strategic Policy Institute (ASPI), *The China Defence Universities Tracker*, 25 November 2019, https://www.aspi.org.au/?p=45866.

35 "'863 Plan': The Foreson of High-Tech Development" (in Chinese), in *China News*, 19 August 2025, https://www.chinanews.com.cn/gn/2025/08-19/10467435.shtml; "How Can the '973 Plan' Help China's Basic Research Achieve Breakthroughs?" (in Chinese), in *Science Net*, 04 June 2025, https://news.sciencenet.cn/htmlnews/2025/6/545226.shtm.

36 APSCO website: https://www.apsco.int.

37 Seibo, Riko, "China Expands Space Capabilities with New Lunar and Deep Space Milestones", in *Space Daily*, 21 October 2025, https://web.archive.org/web/20251108044654/https://www.spacedaily.com/reports/China_expands_space_capabilities_with_new_lunar_and_deep_space_milestones_999.html.

38 China Ministry of Foreign Affairs, *China and the United Nations: Position Paper of the People's Republic of China for the 74th Session of the United Nations General Assembly*, 18 September 2019, https://www.mfa.gov.cn/eng/zy/gb/202405/t20240531_11367393.html.

39 NATO Allied Command Transformation (ACT), *Evolution of Sino-Russian Partnership* (Annex A to ACT/SPP/SF/TT-8689/SER:NU), 28 February 2025, https://www.act.nato.int/wp-content/uploads/2025/03/20250121_ESRP_ExecSum.pdf.

40 National Institute for Space Research website: *CBERS*, https://www.gov.br/inpe/pt-br/programas/cbers.

infrastructure and training facilities under the Belt and Road's Space Information Corridor, extending launch services and BeiDou navigation to partner states, such as Egypt, where China has supported the construction of the Satellite Assembly, Integration and Test Centre (AIT) near Cairo.[41] Through these projects, including the Digital Silk Road and the envisioned Space Silk Road, China embeds its space technology and data systems abroad, enhancing economic and defence influence while gaining leverage in global strategic competition.[42]

Since 2024, China has been maintaining targeted space partnerships with both established and nascent spacefaring nations. For instance, it developed with France the SVOM mission, a joint satellite project to study gamma-ray bursts and other high-energy astrophysical phenomena.[43] With Pakistan's space agency, SUPARCO, it is currently collaborating on satellite development and orbital launch support to build the country's domestic space capacity.[44] This strategy reflects China's pursuit of diversified collaboration to expand technological influence and sustain its leadership in global space governance.

These relationships combine science with geopolitics. A cooperative rhetoric (i.e., win-win development) aligns with China's broader goal of positioning itself as a provider of global public goods while simultaneously cultivating technological dependencies. Western restrictions, such as US prohibitions on National Aeronautics and Space Administration (NASA) cooperation through the Wolf Amendment and the wider US Chips Act, have reinforced Beijing's commitment to self-reliance and accelerated domestic capability consolidation.[45]

1.6 MCF in the evolution of space power

China's space programme illustrates a deliberate integration of scientific progress and military capability. This reflects the CPC's guiding principle of "one star, many uses"[46] that governs space capability development and China's general aim to balance strategic and commercial objectives.

This civil-military integration operates on three levels: personnel and organisational overlap within MCF structures; shared R&D and manufacturing facilities managed by CASC/CASIC and affiliated academies; unified strategic doctrine, viewing space as both a domain of peaceful development and a theatre of potential confrontation.

The approach maximises resource efficiency and maintains political alignment, though external actors often cite it as a challenge for transparency and trust in China's peaceful use narrative.

China's expanding technological base creates complex hybrid threats through integrated space, cyber and electronic warfare capabilities. Guided by the PLA's system-destruction doctrine,[47] these efforts span cyber-attacks on C4ISR networks, electronic jamming and deception, dual-use orbital robotics (e.g., *Shijian-21*) and tests of fractional orbital bombardment systems with a hypersonic glide vehicle – together enhancing China's cross-domain deterrence potential. Emerging space technologies bolster resilience but also heighten systemic risks, prompting the PLA to pursue stealth manoeuvres, orbital redundancy and civilian backups to safeguard operations amid debris and fratricide threats.[48]

41 Miltersen, Rob, "Chinese Aerospace Along the Belt and Road", in *China Aerospace Studies Institute Articles*, 15 June 2020, https://www.airuniversity.af.edu/CASI/Display/Article/2215343; "Space for All: Egyptian Space City: A Model for Cooperation with China", in *CGTN*, 25 April 2025, https://news.cgtn.com/news/2025-04-25/VHJhbnNjcmlwdDg0MTg5/index.html.

42 "Spotlight: China, Arab States Eye Closer Cooperation on Satellite Navigation to Build 'Space Silk Road'", in *Xinhua*, 2 April 2019, http://www.xinhuanet.com/english/2019-04/02/c_137941496_15.htm.

43 CNES website: *SVOM*, updated 21 May 2026, https://cnes.fr/projets/svom.

44 Quillen, Stephen, "Pakistan Launches Its First Hyperspectral Satellite", in *Al Jazeera*, 19 October 2025, https://aje.io/fgn4w8.

45 US Congress, *H.R.4346 - CHIPS and Science Act*, https://www.congress.gov/bill/117th-congress/house-bill/4346; "Wolf Amendment: Time for a Rethink on US-China Space Relations", in *Verdict*, 5 July 2024, https://www.verdict.co.uk/?p=368728.

46 NDRC et al., *National Medium- to Long-Term Civilian Space Infrastructure Development Plan (2015-2025)*, 26 October 2015, https://cset.georgetown.edu/publication/national-medium-to-long-term-civilian-space-infrastructure-development-plan-2015-2025/.

47 The PLA system-destruction warfare doctrine is China's military strategy that seeks to paralyse an adversary by targeting and disabling the critical networks – such as command, communication, intelligence and space-based systems – that enable its overall operational effectiveness, rather than simply destroying individual weapons or forces.

48 "Wolf Amendment: Time for a Rethink on US-China

1.7 Conclusion

China's space governance model differs sharply from liberal market systems. Its strengths include the ability to mobilise national resources rapidly for grand projects (e.g., Tiangong station, lunar base planning); central coherence in technical standards, procurement and long-term vision; as well as an ongoing integration of commercial innovation into national strategies. Its weaknesses stem from opacity and limited external collaboration: independent research diversity can suffer, and dual-use secrecy hampers international scientific exchange. This system is state-led, security-oriented and commercially participatory within defined political limits.[49]

Equally significant are the dual-use implications of China's technological convergence.[50] The latter, which combines artificial intelligence and quantum networking,[51] supports data integration across orbital and terrestrial systems and introduces new dimensions of cybersecurity risk. These developments are increasingly viewed by China's competitors as factors influencing strategic stability and crisis management.[52]

China's space programme has become a cornerstone of national power, weaving together science, industry and defence within the overarching framework of MCF. Even without a single overarching space strategy, coordination through white papers and Five-Year Plans gives the effort a coherent direction, balancing modernisation goals with national security aims. Civil and military bodies, including the CNSA, CASC, CASIC and the PLA ISF, work through joint mechanisms overseen by the Chinese Communist Party, ensuring unified leadership.

Behind this structure lies an extensive, though often opaque, budget that sustains long-term planning and supports one of the largest space portfolios in the world. Private companies and universities add innovative capacity, but they operate firmly within the state's orbit. Through MCF, progress in civilian science strengthens defence capabilities, while military investment pushes industrial and technological growth, creating a tightly connected ecosystem that drives rapid expansion. In turn, international partnerships – from Belt and Road initiatives to multilateral forums – extend China's global reach.

Space Relations", cit.

49 Fuller, Douglas B., *Paper Tigers, Hidden Dragons. Firms and the Political Economy of China's Technological Development*, Oxford, Oxford Academic, 2016, p. 189-208.

50 In this context, technological convergence means blending or integration of different technologies – such as artificial intelligence, telecommunications and others – into combined systems that can serve both civilian and military purposes.

51 Quantum networking involves connecting quantum devices to share and transmit quantum information securely across distances.

52 Policy responses such as the 2024 NATO's Revised AI Strategy, 2023 EU AI Act and the 2022 US Satellite Cybersecurity Act reflect broader efforts to enhance resilience and foster responsible use of emerging technologies.

2. Russia's approach to space: Civil stagnation and military consolidation

by ***Karolina Muti***

The Russian space programme is deeply rooted in its Soviet-era legacy as a space superpower. During the Cold War, Moscow played a pioneering role in space, in the context of the great power confrontation with the United States. A series of unprecedented space achievements obtained by the country in the period 1954-1969 put Russia at the absolute forefront of the space era, starting with the launch of Sputnik, the first artificial satellite in 1957, followed the same year by the first living creature in orbit, the dog Laika.[1] In 1961, Yuri Gagarin became the first human in space in a mission that marked the first manned flight and Valentina Tereshkova the first female astronaut and the first woman in space in 1963.[2] Two years later, Alexei Leonov performed the first spacewalk,[3] whereas the Mir space station, launched in 1986, was the first modular space station in orbit around Earth.[4] This golden age of USSR space achievements, marked as the "Soviet firsts", became an integral part of the Soviet and Russian national identity. Even today, when Russia's civil space programme suffers from structural problems, reduced ambition and an unclear direction, the glorious space past and the era of Soviet firsts are continuously recalled as elements of national pride. Over the past two decades, Moscow's space sector has remained one of the few domains where cooperation with the West – particularly the United States and Europe via ESA – has endured despite deteriorating geopolitical relations. Russia's invasion of Ukraine in February 2022 represented a watershed moment for the country's space policy, putting an end to a decades-long mutually beneficial space cooperation, with long-term consequences for Russia's space industrial and technological complex, and research and scientific institutions.

2.1 Russia's space programme as an element of national identity and foreign policy

Russia's civil space policy is currently experiencing a prolonged phase of diminished ambition, hampered by systemic challenges, frequent leadership changes and an overall lack of a clear strategic direction.

Against this backdrop, the superpower past of the Soviet era, notably in the sector of space exploration, is still systematically used by the political leadership in a celebratory rhetoric.[5] Space has been an element of nation-building and an important component of the USSR's foreign policy,[6] more than for any other space power. Presidential speeches during Cosmonautics Days through the years underlined a deeper, even spiritual dimension of the Soviet and Russian space programme but tended to be quite vague in terms of policy content.[7] At the latest Cosmonautics Day on 12 April 2025, the speech by the President of the Russian Federation, Vladimir Putin, made no exception. Putin referred to the complex tasks faced by the national launchers and space complex, mentioning not only the need to strengthen the technical and scientific potential, developing ground-based infrastructure and new generation technologies, but also the implementation of important defence programmes, including in relation to the conduct of the "special military operation" in Ukraine.[8] He underlined that the space sector should become one of the drivers of the national economy, ensuring technological sovereignty and improving the quality of life in all regions of Russia. The President recognised

1 "Top 10 Soviet and Russian Space Missions", in *Space.com*, 9 November 2011, https://www.space.com/9703-top-10-soviet-russian-space-missions.html.

2 Betz, Eric, "11 Female Astronauts Who Pioneered Spaceflight", in *Astronomy Magazine*, last updated on 14 March 2025, https://www.astronomy.com/?p=44760. In 1963, at just 26 years old, she piloted the Vostok 6 spacecraft around Earth alone, orbiting our planet for 48 hours.

3 Naone, Erica, "Alexei Leonov, First Person to Walk in Space, Dies at 85", in *Astronomy Magazine*, last updated on 18 May 2023, https://www.astronomy.com/?p=45378.

4 ESA, *Honourable Discharge for Mir Space Station*, 5 March 2001, https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Honourable_discharge_for_Mir_space_station.

5 Eriksson, Johan and Roman Privalov, "Russian Space Policy and Identity: Visionary or Reactionary?", in *Journal of International Relations and Development*, No. 24 (2021), p. 381-407, DOI 10.1057/s41268-020-00195-8.

6 Ibid.

7 Ibid.

8 Russian Presidency, *Greetings on Cosmonautics Day*, 12 April 2025, http://en.kremlin.ru/events/president/news/76677.

that in order to gain a leading position in the global space competition, it is important to advance together with industry, science and research centres by augmenting the production of satellites, adopting new materials and digital and nuclear technologies, as well as developing crewed spacecraft and launchers.

2.2 The role of Roscosmos and private actors in a state-led space ecosystem

The Russian Federal Space Agency, Roscosmos, was established in 2015 as a state public corporation, with three key functions: regulating and managing the functioning of the national space industrial complex both technically and legally, allocating contracts and funding, and representing the state as the owner in state-owned companies, or those with a state participation.[9] The Agency directly manages a complex of 75 companies employing almost 180,000 personnel. The highly centralised, top-down space governance model and the hybrid role of Roscosmos resulted in the promotion of conflicting objectives and schizophrenic policies, blocking from the outset the emergence of a dynamic, private space sector in Russia. Structural problems, such as systemic indebtedness, covered financially by the Government, and corruption scandals, limited the effective management and development of the Russian space programme. The Agency changed eight directors in the last decade, reflecting the volatility of both the civil space governance and the weakly articulated prospects of the space programme.

2.3 The civil-military interconnection: A civil stagnation and a military blooming

Historically, Russia could count on solid and advanced capabilities and expertise in both the civil and the military dimensions of its space programme. In recent years, however, a growing distance emerged in terms of quality and capacity between the civil and the military components, with a tendency for the latter to absorb the former. In the last three decades, Moscow's civil space programme experienced a stagnating mode, focusing on not lagging behind with respect to emerging space powers and technological disruptions in the global space sector, rather than on leading the next frontier. The turbulent political and economic instability of the 90s post-USSR era left the sector underfunded. When ambitions re-emerged with the 2005 Space Strategy – envisioning new missions, a new space station, lunar return, robotic exploration and advanced launch systems – the 2008-09 global financial crisis and sharp decline in oil prices curtailed them once again.[10]

The military space programme, in contrast, has experienced continuity and has been a constant priority for the Kremlin, in line with the dominance of security and defence considerations on Russia's foreign and economic policy. The invasion of Ukraine in 2022 accentuated this trend, reorienting part of the civil space sector to military outcomes. The strong political endorsement of "Space for Defence" by the current Russian administration and the priority given to developing counterspace capabilities, together with the solid Soviet legacy in this field and continuity of investment in the military, position Moscow at the forefront in this sector. As stated in the Security Foundation 2026 Global Counterspace Capabilities Report, Russia possesses a whole set of counterspace capabilities: from rendezvous and proximity operations assets to co-orbital and direct ascent ASAT capabilities, to an advanced range of electronic warfare (EW) assets and direct energy weapons.[11] What is, however, even more relevant in Moscow's approach is that it has demonstrated the willingness to use such assets in both theory and practice, through its current military operations, as part of an offensive strategy.

In November 2021, Russia successfully demonstrated a DA-ASAT capability against a LEO satellite, resulting in more than 1,500 trackable

9 Vidal, Florian and Roman Privalov, "Russia in Outer Space: A Shrinking Space Power in the Era of Global Change", in *Space Policy*, Vol. 69 (August 2023), Article 101579, https://doi.org/10.1016/j.spacepol.2023.101579.

10 Mcclintock, Bruce and Mélusine Lebret, "Russian Space Strategy and Capabilities: A Tale of Decline", in Alessandro Gili (ed.), *The Sky Is Not the Limit. Geopolitics and Economics of the New Space Race*, Milan, Ledizioni, 2024, p. 131-143.

11 For a detailed overview of Russia's counterspace capabilities please see: Samson, Victoria and Kathleen Brett (eds), *2026 Global Counterspace Capabilities Report*, April 2026, https://www.swfound.org/publications-and-reports/2026-global-counterspace-capabilities-report.

debris.[12] In a number of recent military operations, Russia has jammed satellite communications user terminals, GNSS and SAR satellites, and often uses counterspace EW capabilities.[13] EW is particularly important in Russia's military and space strategy, with a plan to incorporate it through the Armed Forces to protect its space-enabled capabilities and degrade or deny those of the adversary.

Russia's Space strategy is jointly defined by Roscosmos and the Ministry of Defence, but some observers point to the fact that the Ministry of Defence (MoD) has gained an increasingly leading role in this process.[14] Roscosmos is responsible for the supervision of the space industry (both civil and military) and for the civil space activities. In 2015, Russia reorganised its Armed Forces, combining space, air and missile defence functions under the authority of the Russian Aerospace Force (RAF), which is operationally in charge of conducting space launches, ensuring early warning in ballistic missile defence and managing space surveillance and air defence.[15] A separate branch of the RAF, the Russian Space Forces (*Kosmicheskie voyska Rossii*), operates the Plasetsk Cosmodrome in Mirny in the Arctic Region, the military satellites launch site.[16] Despite Russia's space governance having established a clear division of tasks between Roscosmos and the Ministry of Defence, the latter benefited from the deterioration of relations with Western partners, as the two institutions compete for controlling strategic national space assets, and for prevailing in the definition of the national space strategy.[17] First, sanctions drastically reduced Roscosmos' commercial launch contracts. Second, resources were redirected towards the MoD and Armed Forces priorities driven by the demands stemming from the conflict in Ukraine. Third, Russia's shift to a war economy – dominating Vladimir Putin's political agenda – further prioritised military needs over civil programmes. This dynamic was amplified by Roscosmos former Director Dmitry Rogozin (2018-2022), whose overt military rhetoric following Russia's invasion in February 2022, combined with his highly politicized approach, created significant tensions on the ISS.[18]

2.4 The space programme's budget

In June 2025, the Presidential Council for Strategic Development approved the new national/federal programme for space, "Kosmos", envisaging a budget of 4.4 trillion rubles (47.8 billion euros) up to 2036, 2.2 trillion rubles of which to be spent by 2030.[19] The programme has been endorsed by President Putin personally. Within this financial outlook, Roscosmos plans to boost the share of private investments in the space sector from the current 5 per cent share in 2024, to 20 per cent in 2030 and 35 per cent by 2036.[20] By 2036, Russia plans to launch over 1100 satellites into orbit, including a set of 365 satellites in LEO to provide broadband coverage across Russia ("Rassvet"), allocating 515 billion rubles (5.6 billion euros) to the latter. The overall programme is divided into eight federal projects, each with a planned budget:

- Satellite communications and Earth observation, with an expected budget of 301.9 billion rubles (3.3 billion euros) by 2030 and 1.031 trillion rubles (11.2 billion euros) by 2036;
- Navigation and Timing – with an expected budget of 139.1 billion rubles (1.5 billion euros) by 2030 and 381 billion rubles (4.2 billion euros) by 2036;
- Manned spaceflight – with an expected budget of 584.6 billion rubles (6.4 billion euros) by 2030 and 998.2 billion rubles (10.9 billion

12 La Rocca, Giancarlo, "Russia and China: West's Systemic Rivals on Orbits", in Alessandro Marrone and Michele Nones (eds), "The Expanding Nexus between Space and Defence", in *Documenti IAI*, No. 22|01 (February 2022), p. 50-61, https://www.iai.it/en/node/14669.

13 Samson, Victoria and Kathleen Brett (eds), *2026 Global Counterspace Capabilities Report*, cit.

14 La Rocca, Giancarlo, "Russia and China: West's Systemic Rivals on Orbits", cit.

15 Samson, Victoria and Kathleen Brett (eds), *2026 Global Counterspace Capabilities Report*, cit.

16 Vidal, Florian and Roman Privalov, "Russia in Outer Space", cit.

17 Ibid.

18 Foust, Jeff, "Rogozin Removed as Head of Roscosmos as Seat Barter Agreement Signed", in *SpaceNews*, 15 July 2022, https://spacenews.com/?p=129621.

19 "Putin Approved the National Project 'Space' with a Budget of 4.4 Trillion Rubles until 2036" (in Russian), in *Kommersant*, 18 June 2025, https://www.kommersant.ru/doc/7800640.

20 "Exorbitant Spending Is Being Put into Budgets" (in Russian), in *Kommersant*, 18 June 2025, https://www.kommersant.ru/doc/7800562.

euros) by 2036;
- Sovereign Competitive Access to Space – with an expected budget of 280.3 billion rubles (3.1 billion euros) by 2030 and 810.1 billion rubles (8.8 billion euros) by 2036;
- Space Science – with an expected budget of 228.7 billion rubles (2.5 billion euros) by 2030 and 669.7 billion rubles (7.3 billion euros) by 2036.

The remaining three federal projects on the Development of Russian Space Nuclear Energy, the Production and Technological System, and Personnel for Space, are expected to receive a combined 201.7 billion rubles by 2030 and 499.3 billion rubles by 2036.

Despite this ambitious programme for the next decade, serious doubts persist on whether this plan can be realistically achieved. At least part of the envisaged programmes includes long-overdue projects that were promised to be funded in the previous decade.[21] It is the case of a multifunctional SATCOM system for LEO that was announced already in 2022, or of the transport spacecraft due in 2021. Inflation will also play a role in limiting the extent of investments.

Prime Minister Mikhail Mishustin has identified three main pillars for the development of the space sector in Russia: the deployment of multi-satellite constellations, the acceleration of the construction of a Russian domestic space/orbital station and a significant reduction of the launch cost per payload.[22] The latter, together with the estimated increase in the number of launches per year from 46 in 2025 to 66 in 2030 and 113 in 2036, is expected to augment Russia's share of the global launch services market from 6.5 to 14 per cent by 2030, and 28 per cent by 2036.[23] The construction of the Amur launch system, with a medium-class launch vehicle powered by liquefied natural gas (LNG) and a reusable first stage, as well as the modernisation and construction of ground infrastructure at the Vostochny and Plesetsk cosmodromes, are functional to this objective. The federal programme wants to encourage a transition towards space services exploitation by the national space sector. However, this entails expanding the provision of services in a context in which the demand for space services is still very limited. Within the federal programme, five billion rubles are allocated for the acquisition of space data by Russia's public administration in order to increase space data exploitation by the state as a customer.[24] Additional resources (7 billion rubles) are dedicated to "Personnel for Space" in 2026-2028,[25] to ensure a future availability of qualified human capital.

2.5 Sino-Russian relations: From pragmatic cooperation to a reluctant strategic partnership

China-Russia space cooperation dates back to the 1950s and 1960s, when the Soviet Union and Maoist China, aligned under a shared communist ideology, sought to counterbalance the United States globally, including through transfers of technology and know-how with military, civil and dual-use applications.[26]

After the end of the Cold War, the two countries re-launched their space cooperation on a less ideologically driven and more pragmatic basis. Russia's post-Soviet economic situation, which led to substantial cuts to its space programme, pushed Moscow to seek new partnerships with Beijing, which at the time was eager to develop a modern space programme by acquiring space-related know-how, expertise and capabilities in exchange for much-needed financial resources that China, thanks to its rapid economic growth, could readily provide. Russia, drawing on its extensive and sophisticated space expertise as a space superpower, remained technologically and industrially advanced but faced acute budgetary constraints.[27] Russia's competencies

21 "The National Project 'Space' Has Been Approved" (in Russian), in *Glonass Herald*, 2 July 2025, http://vestnik-glonass.ru/~lETa8.
22 Ibid.
23 "Exorbitant Spending Is Being Put into Budgets" (in Russian), cit.
24 Russian Government, *Government Meeting*, 6 November 2025, http://government.ru/en/news/56846.
25 TAdviser, *Cosmos (National Project)*, 1 October 2025, https://tadviser.com/index.php/Article:Cosmos_(national_project).
26 Manov, Boris, "Russian-Chinese Space Reciprocity", in *Bulgarian Journal of International Economics and Politics*, Vol. 2, No. 1 (2022), p. 12-30, https://bjiep.unwe.bg/en/journalissues/article/25047.
27 Durrani, Sheza, "Space Competition and Warfare: China-Russia Space Cooperation and Its Implications on US Strategic, Technological, and Economic Administration", in

excelled in human spaceflight, space science, power propulsion, launchers, and China was ready to learn. These conditions created a strong complementarity between Beijing and Moscow: China primarily as a customer and collaborator, and Russia gradually as a junior partner to China's rapidly expanding space programme. This pattern of cooperation persists today and has been further reinforced by Russia's international isolation and the economic sanctions affecting its space industrial complex after the invasion of Ukraine, especially in the context of investment-heavy, long-term space exploration missions.[28]

In 1996, the two countries signed a Memorandum of Understanding on Cooperation in Global Navigation Satellite Systems, paving the way for increased interoperability between China's BeiDou and Russia's GLONASS systems.[29] This cooperation was deepened in 2020 with a bilateral Satellite Navigation Interoperability Agreement aimed at enhancing collaboration on ground-station data and next-generation atomic clocks. Training agreements and technical exchanges have continued in areas such as ground stations, microgravity experimentation, propulsion systems and launch vehicles. In 2010, the two governments signed a Framework Agreement on Cooperation in Human Spaceflight, envisaging joint astronaut training. One of the most visible – and geopolitically and symbolically significant – steps in strengthening ties between Moscow and Beijing was the 2016 MoU on Joint Lunar Exploration, followed in 2021 by an agreement to build the International Lunar Research Station (ILRS).

The station is planned to be operational by 2035, with long-term human presence by 2045, and precursor missions starting in 2026.[30] The project is framed as a multinational endeavour open to international participation, with more than 10 states having joined the project.[31] It is nonetheless clear that the ILRS is intended as an international alternative to the widely subscribed US-led Artemis lunar exploration programme, further entrenching geopolitical fault-lines in space.

Cooperation in defence-related space subsectors, such as counterspace and ASAT capabilities, SSA, or on-orbit servicing, exists but is more complicated and sensitive. In particular, for Russia, sharing or transferring information, technology, know-how and expertise could result in giving up a precious advantage in niche areas over the partner, and make the uneasy power balance between the two countries even more strongly disproportionate in favour of China. It is therefore likely that cooperation in militarily sensitive sectors will encounter a threshold that at least one of the two counterparts may be very reluctant to cross.[32]

2.6 Conclusion

Despite the ambitious timeline and budget announced for Moscow's space programme, a number of enduring structural challenges within the Russian space sector risk jeopardising the Kremlin's plans. Firstly, since Russia's illegal annexation of Crimea in 2014 and the full-scale invasion of Ukraine in 2022,[33] international sanctions on technological components have limited Moscow's ability to access the necessary technology. For decades, Russia's civil space sector has developed based on a systemic scientific and technological cooperation and exchange with Europe and the United States, from NASA to ESA,[34] in a mutually beneficial relationship. Even

Advance Social Science Archive Journal, Vol. 4, No. 1 (July-September 2025), p. 270-282, https://assajournal.com/index.php/36/article/view/524.

28 Suess, Juliana and Jack Crawford, "Russia and China Reaffirm Their Space Partnership", in *RUSI Commentaries*, 12 April 2024, https://www.rusi.org/explore-our-research/publications/commentary/russia-and-china-reaffirm-their-space-partnership.

29 Durrani, Sheza, "Space Competition and Warfare", cit.

30 Jones, Andrew, "Senegal among New Members of China's ILRS Moon Base Project", in *SpaceNews*, 5 September 2024, https://spacenews.com/?p=505450.

31 Azerbaijan, Belarus, Egypt, Kazakhstan, Nicaragua, Pakistan, Senegal, Serbia, South Africa, Thailand and Venezuela joined the ILRS. See ibid.

32 Azad, Tahir, "The Limits of the China–Russia Strategic Partnership in Military Space Cooperation," in *Small Wars Journal*, 30 January 2026, https://smallwarsjournal.com/?p=147274.

33 For an assessment of the Implications of Russia's invasion of Ukraine in the space domain, please see: Muti, Karolina and Maria Vittoria Massarin, "The Space Domain", in Alessandro Marrone (ed.), *Russia-Ukraine War's Strategic Implications*, Rome, IAI, February 2024, p. 45-55, https://www.iai.it/en/node/18118.

34 ESA website: *International Cooperation*, https://

if Moscow reacted to sanctions by augmenting technological cooperation with China and through an autarchic shift to boost domestic production and self-sufficiency, the country's space sector was heavily hit and will likely experience more backlashes and delays, since it relied on global supply chains. The difficulties were also proved by the fact that in the last three years, the number of launches operated by Russia steadily decreased,[35] in an overall context where other space powers augmented their launch ratio. Secondly, Russia's invasion of Ukraine led to a halt of space cooperation with its Western partners, with the exception of the ISS, resulting in a decrease of revenues stemming from, for instance, launch services offered by Moscow. It is worth reminding that the family of Russian Soyuz launchers is considered one of the most reliable ones,[36] and was systematically used by Russia's partners in the West, notably in a period in which Europeans experienced issues with their own launch systems and lacked autonomous access to space.[37] Thirdly, some experts point out both Roscosmos and Russia's space industry's economic inefficiency, as well as shrinking personnel and a lack of turnover.[38] Such systemic challenges are problematic for the realisation of an ambitious space programme.

www.esa.int/Enabling_Support/Space_Transportation/International_cooperation.

35 Statista, *Number of Space Launches by Roscosmos in Russia from 2010 to 2024, by Outcome*, 2026, https://www.statista.com/statistics/1322678.

36 NASA, "Dawn Docking, New Discoveries: NASA and Russian Crew Begin Space Station Mission", in *SciTechDaily*, 9 April 2025, https://scitechdaily.com/?p=468576.

37 Muti, Karolina and Michele Nones (eds), "European Space Governance and Its Implications for Italy", in *Documenti IAI*, No. 24|12 (December 2024), https://www.iai.it/en/node/19300.

38 Luzin, Pavel, "Russia's Space Program after 2024", in *FPRI Reports*, July 2024, https://www.fpri.org?p=41571.

3. The United States Space Programme civil-military integration

by ***Gaia Ravazzolo*** and ***Andrea Grillo***[1]

3.1 Strategies, approaches, models and specific characteristics

The United States space policy consists of four main pillars, which define its principles, objectives and priorities:[2] 1) Presidential directives, the oldest component, developed since 1957[3] through a coordination process among agencies of the executive branch; 2) Congress legislation, including both foundational laws and periodic authorisation and appropriation acts; 3) Presidents' public statements concerning specific programmes or issues; 4) treaties and international conventions ratified by the US.

The 1961 US Space Program of the Kennedy Administration already outlined the main reasons that have since guided US activities in outer space: "scientific, commercial/civilian, military, [and] national prestige".[4] The document was then renamed National Space Policy (NSP),[5] evolving in both structure and level of detail.

The NSP issued by President Trump in 2020[6] is the overarching strategic document defining principles, objectives and policy directions of all US

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2 Hall, R. Cargill, "The Evolution of U.S. National Security Space Policy and Its Legal Foundations in the 20th Century", in *Journal of Space Law*, Vol. 33, No.1 (Summer 2007), p. 1-103, https://web.archive.org/web/20100610014357/http://www.spacelaw.olemiss.edu/JSL/Back_issues/JSL%2033-1.pdf; Weeden, Brian C., *Case Study of the Interagency Process for Making Presidential Policy Decisions on Dual-Use Space Technology: The Global Positioning System and Space Traffic Management*, Thesis, George Washington University, 2017, https://scholarspace.library.gwu.edu/concern/gw_etds/z890rt36k.

3 United States, *National Space Program*, declassified in 1977, https://csps.aerospace.org/sites/default/files/2021-08/National%20Space%20Program%20report%201957.pdf.

4 Johnson, Lindon B., *Memorandum for the President*, 8 May 1961, https://csps.aerospace.org/sites/default/files/2021-08/LBJ%20memo%20to%20JFK%208May61.pdf.

5 White House, *National Space Policy*, July 1982, https://csps.aerospace.org/sites/default/files/2021-08/National%20Space%20Policy%20Jul82.pdf.

6 White House, *National Space Policy of the United States of America*, 9 December 2020, https://trumpwhitehouse.archives.gov/wp-content/uploads/2020/12/National-Space-Policy.pdf.

space activities. The policy aims at stimulating the commercial space sector, extending human space exploration and economic activity to the Moon and Mars, advancing responsible behaviour and peaceful utilisation, and ensuring Washington's freedom of action. Subsequently, cross-sectoral and sectoral guidelines – commercial, civil and national security – assign specific responsibilities to the competent agencies for the achievement of these objectives.

Alongside the NSP, the US Government employs Space Policy Directives (SPDs)[7] to address particular issues, such as the SPD-1 (2017),[8] which formally sets out the objective of human long-term exploration and utilisation of the Moon with commercial and international partners, leading to the Artemis Accords in 2020, or the SPD-2 (2018),[9] which instructed various executive branches and agencies to undertake a bureaucratic simplification review to support the growth of the commercial space sector.

The Biden administration has maintained continuity with the previous administration, retaining the existing strategic documents and pursuing its objectives. Early in its term, however, it also adopted the US Space Priorities Framework,[10] which emphasised climate efforts, responsible, peaceful and sustainable exploration and utilisation of outer space, and a commitment to global space governance. Indeed, after Russia's 2021 destructive direct-ascent anti-satellite (DA-ASAT) test, the Administration committed to refraining from conducting similar tests, promoting such an approach as a new international norm for responsible behaviour.[11]

During its second term, the Trump administration, as clearly highlighted by the 2026 budget proposal, has placed particular emphasis on space exploration through the return and establishment of a permanent human presence on the Moon, thus subordinating scientific research to national prestige and leadership in space.[12] Strong emphasis is also placed on the military dimension of space: following the creation of the US Space Force (USSF), with the SPD-4 (2019)[13] and the designation of space as a warfighting domain.[14] This focus has been further reinforced through one of the very first Executive Orders[15] on January 27th, 2025 for the Golden Dome initiative,[16] which, aiming to build a multilayered space-based missile defence architecture, includes also the deployment of space-based interceptors – first of their kind –, reviving and expanding upon President Reagan's Strategic Defense Initiative and thus contributing to the weaponisation of outer space.[17]

The development of the NSP, as well as SPDs, occurs through an interagency coordination process[18] that takes place within the framework of various Councils part of the Executive Office of the

7 White House, Presidential Memorandum on Reinvigorating America's Human Space Exploration Program, 11 December 2017, https://trumpwhitehouse.archives.gov/presidential-actions/presidential-memorandum-reinvigorating-americas-human-space-exploration-program.

8 White House, *Space Policy Directive-2, Streamlining Regulations on Commercial Use of Space*, 24 May 2018, https://trumpwhitehouse.archives.gov/presidential-actions/space-policy-directive-2-streamlining-regulations-commercial-use-space.

9 White House, *United States Space Priorities Framework*, December 2021, https://apps.dtic.mil/sti/citations/AD1155604.

10 White House, *Vice President Harris Advances National Security Norms in Space*, 18 April 2022, https://www.presidency.ucsb.edu/node/355482.

11 Interview, 30 and 31 October 2025.

12 White House, *Text of Space Policy Directive-4: Establishment of the United States Space Force*, 19 February 2019, https://trumpwhitehouse.archives.gov/presidential-actions/text-space-policy-directive-4-establishment-united-states-space-force.

13 For a detailed overview of the US approach to the military dimension of space please see: Muti, Karolina, "The New US Military Approach to Space", in Alessandro Marrone and Michele Nones (eds), "The Expanding Nexus between Space and Defence", cit., p. 15-24.

14 White House, *The Iron Dome for America*, 27 January 2025, https://www.whitehouse.gov/presidential-actions/2025/01/the-iron-dome-for-america.

15 US homeland defence programme seeking to build a multilayered missile-defence system – including space-based sensors and interceptors – designed to intercept everything from drones to nuclear missiles before they can strike. Wilson, Robert S., "FY 2026 Defense Space Budget: Emergence of Golden Dome", in *CSPS Budget Briefs*, August 2025, https://csps.aerospace.org/node/662; US Department of War, *General Guetlein to Lead the Office of Golden Dome for America*, 22 July 2025, https://www.war.gov/News/Releases/Release/Article/4251596; Defense Intelligence Agency, *Golden Dome for America: Current and Future Missile Threats to the U.S. Homeland*, May 2025, https://www.dia.mil/Portals/110/Documents/News/golden_dome.pdf.

16 Swope, Clayton and Melissa Dalton, "Does the Golden Dome Create Strategic Instability or an Opportunity with China and Russia?", in *CSIS Commentaries*, 23 October 2025, https://www.csis.org/node/119065.

17 Interview, 31 October 2025.

18 White House Office of Science and Technology Policy website: *NSTC*, https://trumpwhitehouse.archives.gov/ostp/nstc.

President (EOP), including the National Science and Technology Council (NSTC),[19] the National Security Council (NSC),[20] and the National Space Council.[21] Here, representatives from the relevant executive branch departments and agencies, such as NASA or the Department of Defense (DoD), sit together.[22] This whole-of-government approach enables the resolution of potential conflicts and coordination issues concerning space policy and its implementation within a forum that horizontally involves all relevant agencies. Should these issues remain unresolved, they will be taken forward at higher levels, up to the President if necessary.

Therefore, the drafting process produces a clear policy that defines specific objectives, divided between a civil and a military dimension whose implementation is entrusted to the respective government agencies, which outline the means to achieve the objectives through additional, specific strategic documents – e.g., DoD "Directive 3100.10 Space Policy"[23] or NASA "Moon to Mars Strategy and Objectives"[24] – and doctrinal publications – e.g., USSF Space Doctrine Publications.

3.2 The US "whole-of-Government" approach

The US has always recognised the interconnection between the civil and military dimensions of space. Nevertheless, it deliberately chose to keep the two sectors strictly separate from an organisational standpoint, aimed both to facilitate international partnerships, which appeared more difficult under a military-led programme, and to promote the peaceful development of space science and exploration.[25] Distinct, yet interconnected, responsibilities have been assigned across multiple federal agencies, accompanied by a corresponding division of duties: NASA was established in 1958 to manage civil space programmes, representing the public face of the US in space, with a mission devoted to peaceful research, scientific discovery and exploration, while the DoD was entrusted with leadership over military space activities, referred to in official documents as "national security space".[26] Nevertheless, US policy has always encouraged cooperation, technology sharing and the rationalisation of operations between the two programmes, which has been recently institutionalised through the NASA-USSF memorandum of understanding (MoU).[27] The MoU builds upon the longstanding collaborative tradition between NASA and the DoD, succeeding the prior NASA-US Air Force Space Command agreement. The NASA-USSF MoU underscores that, while the two organisations pursue "distinct and different" missions, their respective goals can be more effectively achieved through cooperation

19 National Security Council, *U.S. Policy on Outerspace*, 17 December 1959, https://aerospace.csis.org/wp-content/uploads/2019/02/NSC-5918-US-Policy-on-Outer-Space.pdf; National Security Council, *Preliminary U.S. Policy on Outer Space*, 18 August 1958, https://csps.aerospace.org/sites/default/files/2021-08/NSC-5814-1%20Space%20Policy%20Aug58.pdf.

20 White House, *Presidential Executive Order on Reviving the National Space Council*, 30 June 2017, https://trumpwhitehouse.archives.gov/presidential-actions/presidential-executive-order-reviving-national-space-council/. The National Space Council is responsible for advising and assisting the President on matters of national space policy and strategy and it is composed of: "The Vice President, who shall be Chair of the Council; (ii) The Secretary of State; (iii) The Secretary of Defense; (iv) The Secretary of Commerce; (v) The Secretary of Transportation; (vi) The Secretary of Homeland Security; (vii) The Director of National Intelligence; (viii) The Director of the Office of Management and Budget; (ix) The Assistant to the President for National Security Affairs; (x) The Administrator of the National Aeronautics and Space Administration; (xi) The Director of the Office of Science and Technology Policy; (xii) The Assistant to the President for Homeland Security and Counterterrorism; (xiii) The Chairman of the Joint Chiefs of Staff; and (xiv) The heads of other executive departments and agencies (agencies) and other senior officials within the Executive Office of the President, as determined by the Chair".

21 Weeden, Brian C., *Case Study of the Interagency Process for Making Presidential Policy Decisions on Dual-Use Space Technology*, cit.

22 US Department of Defense, *Space Policy*, 30 August 2022, https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/310010p.PDF.

23 NASA website: *Moon to Mars Strategy and Objectives*, https://www.nasa.gov/?p=733050.

24 Space Training and Readiness Command (STARCOM), *Strategic Vision*, January 2026, https://www.starcom.spaceforce.mil/Resources/Digital-Library.

25 Interview, 31 October 2025. It has been said that, because of its primarily military role, there is a "stigma" attached to the DoD which will make international cooperation difficult or impossible. See United States, *National Space Program*, declassified in 1977.

26 US Department of Defense, *Commercial Space Integration Strategy*, April 2024, https://www.war.gov/News/Releases/Release/Article/3728370.

27 The memorandum of understanding outlines 11 areas of cooperation. NASA and USSF, *Memorandum of Understanding between the National Aeronautics and Space Administration and the United States Space Force*, September 2020, https://www.nasa.gov/wp-content/uploads/2015/01/nasa_ussf_mou_21_sep_20.pdf.

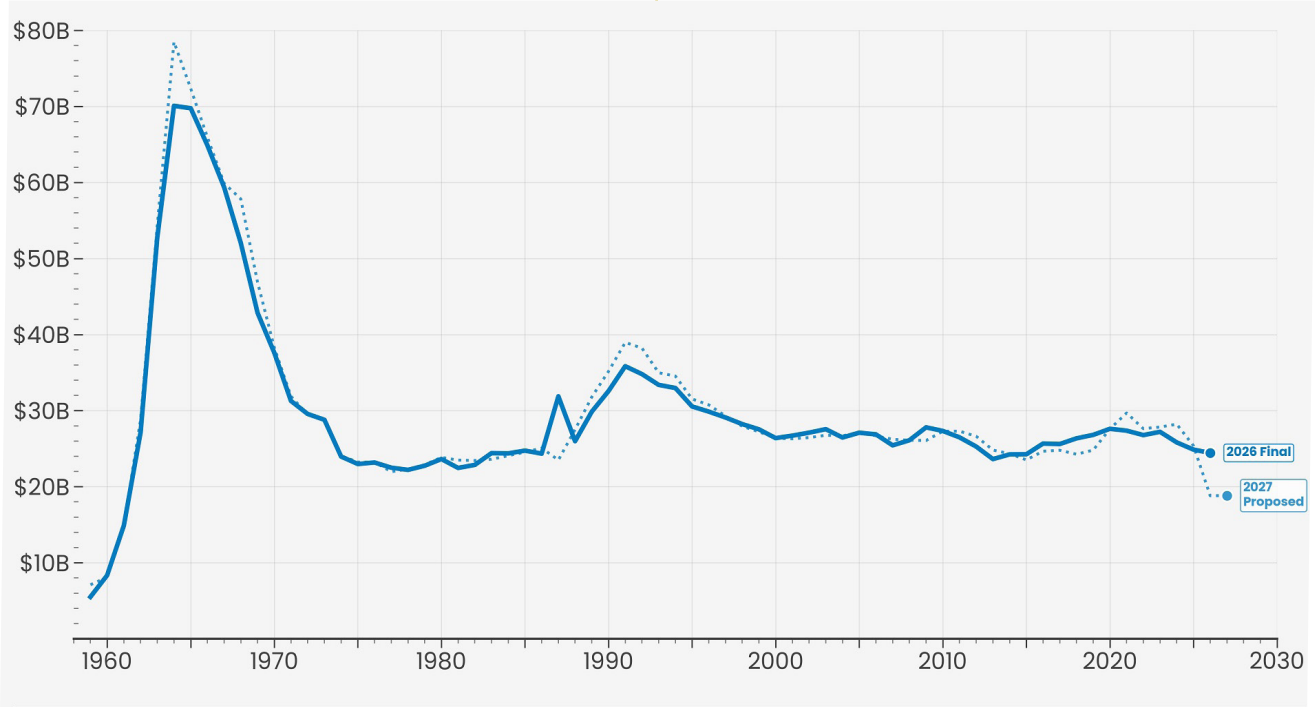

FIGURE 1 **Chart of NASA's annual congressional appropriations since its inception, adjusted for inflation**
Source: The Planetary Society website: Your Guide to NASA's Budget, https://planetary.org/space-policy/nasa-budget.

in areas of shared interest. Given both the USSF expansion of its operational sphere from Earth orbit to cislunar space and NASA's Lunar mission, the primary area of interest is identified as space domain awareness (SDA), which entails overlapping technological and operational requirements.[28]

A central tenet of the US's approach to space is recognition of the role of the commercial space industry.[29] Current national strategies – the abovementioned 2020 NSP, the 2022 National Security Strategy,[30] the 2022 National Defense Strategy,[31] the 2022 National Military Strategy[32] – instruct federal agencies to procure services from the commercial sector whenever possible, rather than acquiring the asset to achieve equivalent outcomes. The objective is to make commercial systems an integral component of the national security space architecture.

The NASA Strategic Plans,[33] published every four years, have also aligned with executive directives by fully embracing this new paradigm, as evidenced by the Artemis programme.[34] In addition to NASA, civil space governance involves other mission-specific government agencies, such as the National Oceanic and Atmospheric Administration (NOAA), an agency of the Department of Commerce that manages environmental, meteorological and oceanic monitoring through satellite systems; the Federal Aviation Administration (FAA), which regulates and licenses commercial launches, spacecraft re-entries and civil space operations; and the Federal Communications Commission (FCC), which deals with commercial telecommunications.[35]

3.3 The US space budget: Civil, defence and commercial dimensions

While global government space investments

28 Ibid.
29 Interview, 31 October 2025.
30 White House, *National Security Strategy*, October 2022, https://www.hsdl.org/c/view?docid=872036.
31 US Department of Defense, *2022 National Defense Strategy of the United States of America*, 27 October 2022, https://www.hsdl.org/c/view?docid=872444.
32 US Office of the Chairman of the Joint Chiefs of Staff, *National Military Strategy*, 2022, https://www.hsdl.org/c/view?docid=901112.
33 NASA, *NASA Strategic Plan*, 2022, https://www.nasa.gov/?p=546420.
34 NASA website: *Artemis*, https://www.nasa.gov/?p=128477.
35 Croshier, Rose, *Handbook for Space Capability Development*, Washington, Center for Global Development, March 2023, p. 60, https://www.cgdev.org/node/3132113.

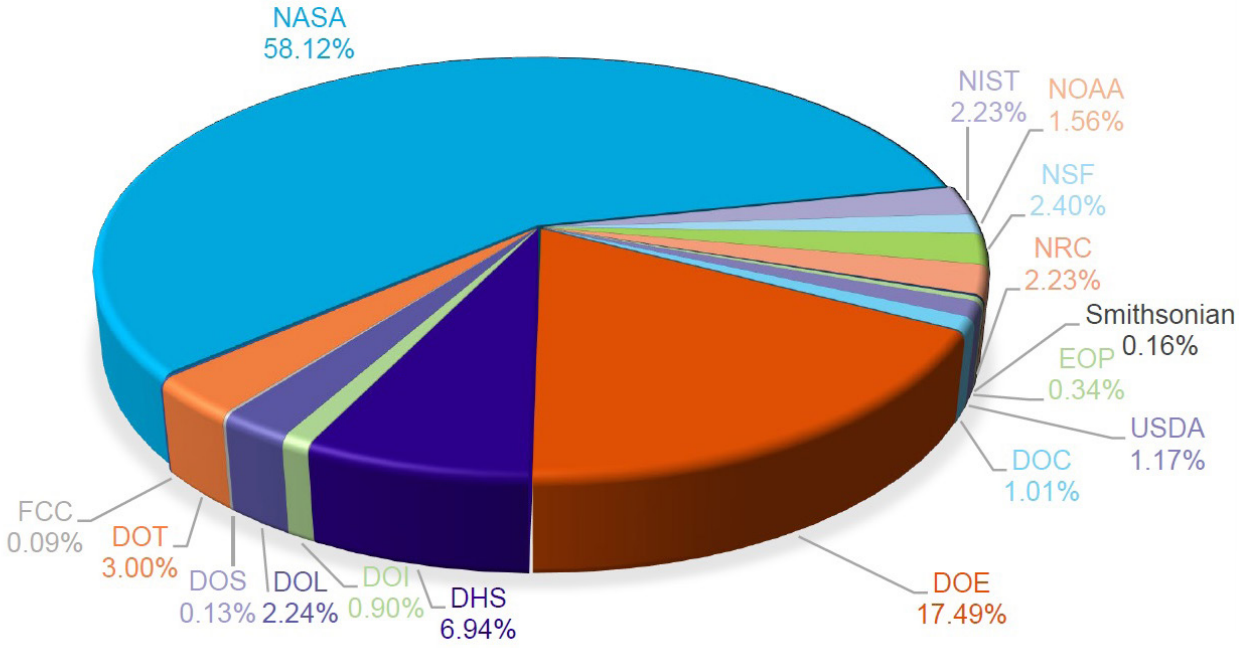

FIGURE 2 **The federal civil space budget for FY25, organised by department and agency**
Note: Due to the level of detail available in budget requests, some line items used in this estimate are not solely devoted to space-related activity, and, in other cases, line-item values were not found.
Source: DeMarchi, Lindsay, "A Comprehensive Guide to the U.S. Federal Civil Space Budget", in *CSPS Reports*, June 2025, https://csps.aerospace.org/node/655.

grew by 10 per cent in 2024 compared to 2023, the US share has declined from over 75 per cent in 2000 to 59 per cent in 2024. This reduction, however, does not imply reduced US investment but rather the rise of China, India and the EU member states' budgets. In 2025, the Trump administration proposed to cut NASA's Fiscal Year (FY) 2026 budget by about 24 per cent.[36] In response, Congress – through the House and Senate Appropriations Committees – advanced draft budget bills rejecting the proposed cuts and keeping NASA's funding at levels broadly comparable to FY2025.[37] NASA's budget formation follows a well-defined, multi-stage process: the White House submits the proposal to Congress, which then amends and enacts it through annual appropriations legislation.[38] NASA's funding has also reflected changing political and strategic priorities, peaking during the Apollo era, then declining to an average of 0.3-0.4 per cent of federal spending since the 2010s, including 0.37 per cent in 2024.[39]

However, NASA's budget represents only a portion of America's broader civil space portfolio. "Projects that support, enable, or leverage space activities for civil purposes are found in more than 100 individual line items spread across 17 federal departments and agencies".[40] When aggregated, civil space appropriations total approximately 44 billion US dollars in FY2025, of which NASA constitutes roughly 58 per cent.[41]

36 Kluger, Jeffrey, "What Trump's Proposed NASA Budget Cuts Really Mean for the Space Agency", in *Time*, 6 May 2025, https://time.com/7283206/what-trump-proposed-nasa-budget-cuts-mean-for-space-science. Some science lines faced a reduction of up to 47 per cent, see Schiff, Adam et al., *Sen. Schiff, Colleagues Demand End to Illegal Cuts at NASA, Reassert Congress' Sole Power to Authorize Science Funding*, 1 August 2025, https://www.schiff.senate.gov/?p=10553.

37 Mervis, Jeffrey, "Senate Spending Panel Would Rescue NSF and NASA Science Funding", in *ScienceInsider*, 10 July 2025, https://www.science.org/content/article/senate-spending-panel-would-rescue-nsf-and-nasa-science-funding; Smith, Marcia, "House Appropriators Approve FY2026 Budget for NASA, in *SpacePolicyOnline*, 11 September 2025, https://spacepolicyonline.com/?p=83901.

38 "The White House provides a detailed budget proposal to Congress every February, which kicks off an annual legislative process known as appropriations". See The Planetary Society website: *Your Guide to NASA's Budget*, https://planetary.org/space-policy/nasa-budget.

39 Ibid.

40 Ibid.

41 DeMarchi, Lindsay, "A Comprehensive Guide to the U.S. Federal Civil Space Budget", in *CSPS Reports*, June 2025,

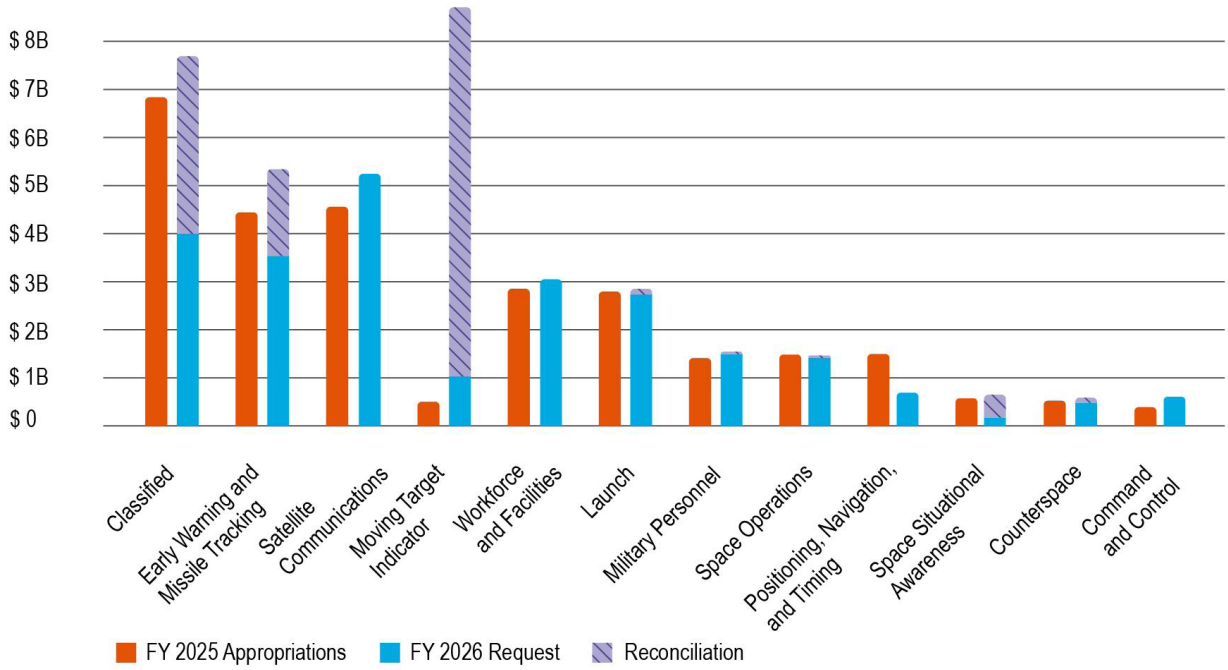

FIGURE 3 **Budget distribution by capability, comparing FY2025 appropriations with potential FY2026 totals**
Source: Wilson, Robert S., "FY 2026 Defense Space Budget: Emergence of Golden Dome", in *CSPS Budget Briefs*, August 2025, p. 3, https://csps.aerospace.org/node/662.

In June 2025, the Trump administration submitted a 26.3 billion US dollar budget request for the USSF.[42] In parallel, Congress passed a sweeping reconciliation measure – the One Big Beautiful Bill Act – which authorised 153.4 billion US dollars in national security funding from FY2025 through FY2029, of which 21.6 billion is dedicated to space-focused projects within the DoD.[43]

This reconciliation process, distinct from annual appropriations, allows the administration to advance policy priorities through an expedited legislative mechanism requiring only a simple majority vote in both chambers. The administration indicated that it plans to spend most of the reconciliation funds in FY2026, specifically 13.8 billion US dollars for USSF programmes. When combined with the 26.3 billion US dollars appropriations request, this would yield a total of 40.2 billion for defence space activities – a nearly 40 per cent increase over FY2025.[44]

These measures represent the largest expansion of US defence space spending since the USSF's creation, showing how Congress strategically uses appropriations and reconciliation to rapidly secure major funding for space-based national security initiatives.

NASA remains the cornerstone of exploration and science through the Artemis programme, but its prominence has diminished vis-à-vis defence and commercial priorities. The USSF's expanding portfolio reflects the redefinition of space as an operational domain, while private actors have become essential partners for NASA and the

https://csps.aerospace.org/node/655; Novaspace Market Intelligence Hub, *Government Space Programs*, December 2025, https://nova.space/hub/?p=4591.

42 Wilson, Robert S., "FY 2026 Defense Space Budget: Emergence of Golden Dome", in *CSPS Budget Briefs*, August 2025, https://csps.aerospace.org/node/662.

43 Ibid.

44 The main driver of this increase is the Golden Dome initiative, which accounts for about three-quarters of the newly authorised space defence funds; the remainder supports Indo-Pacific Command capability upgrades, satellite protection and SSA enhancements. The recently released FY2027 Defense Budget Request of President Trump envisages a record defence expenditure of 1.5 trillion US dollars, marking a 42 per cent increase over the previous year. Within this framework, 75 billion is earmarked for the USSF, almost doubling the resources allocated in FY2026. For additional information, see: Ibid.; and US Departement of War, *Department of War Releases the President's Fiscal Year 2027 Budget*, 21 April 2026, https://www.war.gov/News/Releases/Release/Article/4466038.

Pentagon, providing launch capacity, satellite constellations and on-orbit services.

In this evolving framework, the US space budget functions less as a single pool of funds and more as an integrated ecosystem spanning civil, defence and commercial sectors. The interplay of public funding, fiscal mechanisms and private investment shows that the US is not merely maintaining its space leadership but embedding it as a lasting element of national power.

3.4 The role of private actors, academia and research centres

Historically, the space sector's high-risk and capital-intensive nature positioned the government as the primary driver of technology development, but over the past four decades, a profound shift has occurred toward decentralisation and commercialisation.[45] The government's motives extend beyond cost reduction – since being a client of services proves to be less expensive than acquiring the asset[46] – to include technology transfer, innovation diffusion and the stimulation of new commercial activities aligned with national interests. US agencies such as NASA, the Space Development Agency (SDA) and the Defense Advanced Research Projects Agency (DARPA) have progressively transitioned from acting as asset purchasers to functioning as service customers or partners, co-funding projects and purchasing services from private operators. This evolution resulted in the private sector not only sharing development costs but also assuming greater financial risks and technological responsibility.[47] Nevertheless, such a commercial integration in USSF capabilities still faces difficulties due to high-level classification and export obstacles for military technology.

The alignment of defence and commercial space efforts is codified in the 2024 DoD Commercial Space Integration Strategy.[48] This framework incorporates private entities into planning, wargaming and simulation exercises to refine both technology and operational concepts. Contractual and policy tools are used to accelerate the fielding of commercial technologies, attract private investment and streamline regulatory processes, while protecting the intellectual property of private contributors.[49] The document seeks to synchronise departmental efforts and foster a more effective incorporation of commercial space solutions. This approach marks a shift towards "a 'buy' and 'exploit' model and away from a primary 'build' model".[50] The US Space Command Commercial Integration Strategy (2022 and 2025)[51] and USSF Commercial Space Strategy (2024) adopt the approach to "exploit what we have, buy what we can, and build what we must".[52] Achieving this shift requires a change in institutional mindset within the DoD, ensuring that collaboration with industry is carried out in all 13 national security space "mission areas"[53] to enhance resilience, deny adversaries the benefits of attacks on national security space systems and contribute to a "safe, secure, stable, and sustainable space domain", while maintaining space superiority.[54]

45 OECD, "Evolving Public-Private Relations in the Space Sector", in *OECD Science, Technology and Industry Policy Papers*, No. 114 (June 2021), https://doi.org/10.1787/b4eea6d7-en.

46 Cunniffe, Peter et al., "Buy before You Build: A Decision Framework for Purchasing Commercial Space Services", in *Hudson Institute Reports*, July 2023, https://www.hudson.org/node/47257.

47 OECD, "Evolving Public-Private Relations in the Space Sector", cit.

48 US Department of Defense, *Commercial Space Integration Strategy*, April 2024, https://www.war.gov/News/Releases/Release/Article/3728370.

49 Ibid.

50 US Space Force, *U.S. Space Force Commercial Space Strategy*, 8 April 2024, https://www.spaceforce.mil/Portals/2/Documents/Space%20Policy/USSF_Commercial_Space_Strategy.pdf.

51 US Space Command, *Commercial Integration Strategy*, March 2025, https://www.spacecom.mil/Portals/57/Commercial%20Integration%20Strategy%20Final%2025%20Mar%202025.pdf.

52 US Space Force, *U.S. Space Force Commercial Space Strategy*, cit., p. 13.

53 The 13 mission areas for national security space are: Combat Power Projection; command and control (C2); cyberspace operations; electromagnetic warfare (EW); environmental monitoring (EM); intelligence, surveillance and reconnaissance (ISR); missile warning (MW); nuclear detonation detection (NUDET); positioning, navigation and timing (PNT); space access, mobility and logistics (SAML); satellite communications (SATCOM); space domain awareness (SDA); spacecraft operations. Each mission area is composed of a range of distinct operational and technical functions that must be performed to provide capability to the Joint Force. See US Department of Defense, *Commercial Space Integration Strategy*, cit.

54 Ibid., p. 1.

Concrete examples illustrate the new role of private actors: NASA's Commercial Orbital Transportation Services (COTS) and Commercial Resupply Services (CRS) programmes invited firms like SpaceX and Northrop Grumman to develop and operate cargo transport systems to the International Space Station (ISS), generating billions in contracts while embedding private capital and innovation in public missions.[55] Further initiatives such as NASA's "Tipping Point" and "NEXTStep" programmes promote co-investment, with industry contributions ranging from 25 to 30 per cent of total project costs.[56] These schemes, along with Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programmes, have institutionalised support for entrepreneurial actors and smaller research ventures. Meanwhile, DARPA and the DoD have extended a collaborative ethos to dual-use technology development. Through mechanisms like the Defense Innovation Unit (DIUx), TechStars Defense and AFWERX, the government connects startups and universities to defence needs in areas such as robotics, cybersecurity and space systems, accelerating the integration of commercial innovation into national defence architectures.[57]

The acquisition of capabilities by the USSF may therefore occur through traditional procurement, involving development contracts with leading defence contractors; through the SDA, which employs a more agile and rapid acquisition model for proliferated LEO constellations (pLEO) of low-cost satellites; through the Commercial Augmentation Space Reserve (CASR)[58] framework, which enables establishment of pre-negotiated contracts with commercial companies that can be activated during times of crisis or conflict to provide additional space capabilities; or through Other Transaction Authorities (OTAs)[59] allowing federal agencies to enter into agreements with non-traditional defence contractors.

US universities and research centres also play a pivotal role in the national space strategy by providing skilled personnel through the NASA Office of STEM Engagement[60] and the National Space Grant College and Fellowship Project.[61] In the national-security domain, the DoD also relies on selected University Affiliated Research Centers (UARCs)[62] to sustain essential long-term research and engineering capabilities; among them, the US Space Force-sponsored[63] Space Dynamics Laboratory (SDL)[64] provides mission-engineering and space-systems expertise that supports defence space activities.

3.5 US international space partnerships

The US uses the Artemis programme as a form of space diplomacy, leveraging the Accords to unite over 50 nations around shared principles for peaceful and sustainable space exploration.[65] Indeed, beyond traditional allies, the US has expanded engagement with Saudi Arabia[66] and partners across Africa and the Americas, also promoting a broader participation in the Artemis Accords.[67] The Accords (2020) and the

55 OECD, "Evolving Public-Private Relations in the Space Sector", cit.
56 Ibid.
57 Uppal, Rajesh, "Geopolitics Now Encompasses Military, Economic, Technological, to Industry Domains", in *IDST Montly*, 5 November 2021, https://idstch.com/?p=28777.
58 US Space Force, *U.S. Space Force Commercial Space Strategy*, cit.
59 Dobriansky, John and O'Farrell Patrick, "Other Transaction Authority: Acquisition Innovation for Mission-Critical Force Readiness", in *Contract Management*, Vol. 59, No. 7 (July 2018), p. 50-53, https://acquisitioninnovation.darpa.mil/docs/Articles/Contract%20Management%20Dobriansky%20OTA.pdf.
60 NASA website: *Colleges and Universities*, https://www.nasa.gov/?p=122792.
61 NASA website: *National Space Grant College and Fellowship Project*, https://www.nasa.gov/?p=125001.
62 US Department of War Office of the Under Secretary of War, Research and Engineering website: *Federally Funded Research and Development Centers (FFRDC) and University Affiliated Research Centers (UARC)*, https://rt.cto.mil/ddre-rt/rtl-labs/ffrdc-uarc.
63 Utah State University, "Space Dynamics Lab Receives New Department of Defense Sponsorship," in *Utah State Today*, 12 August 2025, https://www.usu.edu/today/story/space-dynamics-lab-receives-new-department-of-defense-sponsorship.
64 Utah State University Space Dynamics Laboratory website: https://www.sdl.usu.edu.
65 US Department of State website: *Artemis Accords*, https://www.state.gov/bureau-of-oceans-and-international-environmental-and-scientific-affairs/artemis-accords.
66 US Department of State, *The United States and the Kingdom of Saudi Arabia Sign Framework Agreement for Space Cooperation*, 16 July 2024, https://2021-2025.state.gov/the-united-states-and-the-kingdom-of-saudi-arabia-sign-framework-agreement-for-space-cooperation.
67 Wilson, Sean, "Next Steps in Advancing U.S. International Partnerships in Space", in *CSIS Commentaries*, 31 October

International Lunar Research Station (2021)[68] have bifurcated international lunar cooperation[69] along technological and geopolitical lines, positioning space exploration as a key domain of contemporary space diplomacy. Politically, the Accords act as a rule-setting mechanism that promotes shared norms for lunar exploration without creating a binding legal regime. In terms of space diplomacy, they embed transparency and deconfliction into cooperative frameworks, while technologically and industrially, they advance interoperability and common standards for mission architectures.

In addition, the US Department of State established the Office of Space Affairs, which conducts diplomatic and public diplomacy efforts to reinforce American leadership in space exploration, applications and commercialisation.[70] Conversely, on the national security side, international cooperation has only begun to develop over the past fifteen years.[71] The culmination of this process is the 2025 USSF International Partnership Strategy,[72] which aims to operationalise the "Strength Through Partnerships" model, creating the conditions for Allies and partners to be integrated into USSF Force Design and Force Development activities, and to participate in Force Employment, pulling in and fully integrating all allies' military capabilities.

The US's key international space partners, therefore, include both long-standing space-fearing allies and emerging nations, which NASA[73] considers essential to advance its science and exploration goals.[74] Europe remains a pillar of US space cooperation, anchored in strong partnerships with France, Germany, Italy and the United Kingdom. These collaborations extend across NASA's exploration and science missions as well as emerging space security dialogues. In the military sector, bilateral ties with European allies are reinforced through formats like the Combined Space Operations (CSpO) initiative[75] and the space Multinational Force Operation Olympic Defender (MNF OOD).[76] The first is a ten-nation multilateral framework, which primarily functions as a politico-military governance and coordination mechanism aiming at enhancing interoperability, space situational awareness (SSA) and the resilience of allied space systems.[77] The second is a multinational military operation led by the US Space Command and designed to integrate allied space capabilities, coordinating tactics, procedures and operational information to strengthen deterrence and mission assurance.[78]

2024, https://www.csis.org/node/113039.

68 ILRS is a China- and Russia-led multilateral initiative aimed at establishing a long-term robotic and, eventually, crewed scientific research infrastructure on the Moon, open to international participation through bilateral and multilateral cooperation agreements.

69 Although no formal prohibition exists against participation in both initiatives, in practice international lunar cooperation has coalesced into two largely distinct blocs; to date, only Thailand and Senegal have formally engaged with both the Artemis framework and the ILRS initiative.

70 US Department of State website: *Office of Space Affairs*, https://www.state.gov/?p=31612.

71 Interview, 31 October 2025.

72 US Space Force, *U.S. Space Force International Partnership Strategy*, June 2025, https://www.spaceforce.mil/Portals/2/Documents/SAF_2025/USSF%20International%20Partnership%20Strategy.pdf.

73 Available at the following link are NASA's 644 agreements, reflecting the scope of US global partnerships and cooperative initiatives in space activities: NASA, *Active International Agreements by Signature Date (as of June 30, 2025)*, https://www.nasa.gov/wp-content/uploads/2025/07/house-appropriations-international-6-30-2025.pdf.

74 NASA, *"International Partnerships" in 2024 Moon to Mars Architecture White Papers*, 2024, https://www.nasa.gov/wp-content/uploads/2024/12/acr24-international-partnerships.pdf.

75 The Combined Space Operations Center (CSpOC) is a US-led multinational command and control centre that coordinates and integrates allied space operations to ensure the safety, security and effectiveness of activities in orbit. Based at Vandenberg Space Force Base, California, it operates under US Space Command and supports missions such as space domain awareness, collision avoidance, and satellite tracking. As the operational hub of the Combined Space Operations (CSpO) initiative – which brings together the United States, United Kingdom, Canada, Australia, New Zealand, France, Germany, Italy, Japan and Norway – the CSpOC strengthens interoperability, resilience, and collective defense across the allied space community.

76 MNF-OOD is a multinational initiative led by the US Space Command, created to integrate military space power on a global scale and enable combined space operations among allied states (Australia, Canada, the United Kingdom, France, Germany and New Zealand). See: US Space Command website: *Multinational Force Operation Olympic Defender*, https://www.spacecom.mil/About/Multinational-Force-Operation-Olympic-Defender; Wilson, Sean, "Next Steps in Advancing U.S. International Partnerships in Space", cit.

77 Italian Air Force, *Il consesso Combined Space Operations Initiative riunito in Italia per promuovere la sicurezza nello spazio*, 6 December 2024, https://www.aeronautica.difesa.it/en/?p=180898.

78 US Space Command website: *Multinational Force Operation Olympic Defender*, cit.

The US-Italy space partnership embodies a dual strategic focus: advancing joint scientific and exploration efforts – through NASA's Artemis programme and Italy's Multi-Purpose Habitation (MPH) module – while strengthening national security coordination, also by supporting UN Resolution 77/41 on banning destructive ASAT tests.[79] On the commercial side, both nations aim to strengthen industrial integration through a Technology Safeguards Agreement enabling US launches from Italy and joint investments in EO and space safety.[80]

In the Indo-Pacific, the US has strengthened space partnerships with Australia, India, Japan, Korea and New Zealand.[81] US-Japan space cooperation has deepened following the 2023 bilateral space agreement,[82] embracing full integration within NASA's Artemis programme and the Gateway lunar station, with Japan investing heavily in lunar surface infrastructure and providing the first non-US astronaut to walk on the Moon.[83] The two nations are also advancing industrial cooperation on missile detection and tracking constellations through the US-Japan Comprehensive Dialogue on Space[84] coordination framework. The Republic of Korea has also emerged as a growing partner in military and security contexts, as Washington seeks to further include Seoul in coalitions such as the CSpO and in trilateral coordination with Japan.[85] Both partners are strengthening space cooperation through joint Artemis initiatives, EO projects and regulatory alignment, while advancing collaboration on space weather and the Korean Positioning System – reflecting their alliance's role as a "linchpin" of Indo-Pacific security.[86]

The US and India have expanded cooperation through joint use of commercial capabilities on the ISS, the NISAR EO mission and plans to send the first Indian astronaut to the Station.[87] Space has become a core pillar of their strategic partnership,[88] encompassing defence innovation under INDUS-X,[89] and deepening research ties between the US National Science Foundation and India's Anusandhan National Research Foundation on critical technologies.

79 USA and Italy, *Joint Statement from the Inaugural U.S.-Italy Space Dialogue*, 15 October 2024, https://it.usembassy.gov/joint-statement-from-the-inaugural-u-s-italy-space-dialogue.

80 Ibid.

81 Australia and New Zealand have signed Technology Safeguards Agreements and space framework accords to enable new commercial launch operations.

82 USA and Japan, *Japan (23-619) – Framework Agreement for Cooperation in the Peaceful Uses of Outer Space*, Washington, 13 January 2023, https://www.state.gov/japan-23-619.

83 Wilson, Sean, "Next Steps in Advancing U.S. International Partnerships in Space", cit.

84 Ibid.

85 Ibid.

86 USA and South Korea, *Joint Statement from the Governments of the United States of America and the Republic of Korea at the United States-Republic of Korea Civil Space Dialogue*, 14 April 2025, https://www.state.gov/joint-statement-from-the-governments-of-the-united-states-of-america-and-the-republic-of-korea-at-the-united-states-republic-of-korea-civil-space-dialogue.

87 USA and India, *United States-India Joint Leaders' Statement*, 13 February 2025, https://www.whitehouse.gov/briefings-statements/2025/02/united-states-india-joint-leaders-statement.

88 White House, *Joint Fact Sheet: The United States and India Continue to Expand Comprehensive and Global Strategic Partnership*, 21 September 2024, https://bidenwhitehouse.archives.gov/briefing-room/statements-releases/2024/09/21/joint-fact-sheet-the-united-states-and-india-continue-to-expand-comprehensive-and-global-strategic-partnership.

89 INDUS-X (India-United States Defense Acceleration Ecosystem) is a bilateral initiative launched on 21 June 2023 by the US Department of Defence and India's Ministry of Defence, aimed at creating a bridge for defense innovation between the United States and India. See: US Department of War, *Fact Sheet: India-U.S. Defense Acceleration Ecosystem (INDUS-X)*, 21 February 2024, https://www.war.gov/News/Releases/Release/Article/3682879.

4. India and the civil-military interconnection

by ***Dimitrios Stroikos***[1]

4.1 Introduction: Space for development and India's distinct civil-military evolution

Civil-military interconnection has been a defining feature of most national space programmes since the dawn of the space age. India's trajectory, however, stands out from that of other major space powers. From its inception, the Indian space programme was oriented toward socioeconomic development rather than military applications. Its origins date to the early 1960s, when Vikram Sarabhai and a small group of scientists established the Indian National Committee for Space Research (INCOSPAR) under the Department of Atomic Energy. Sarabhai viewed space technology as a tool for national development that would allow India, as a developing country, to leapfrog stages of modernisation, and therefore considered it a necessity for post-independent India.[2] This conviction, shared by leaders such as Jawaharlal Nehru, linked techno-scientific advancement to the broader postcolonial project of self-reliance and modernity.[3]

Since no overarching policy framework had been formally articulated by the Indian government during this period, Sarabhai's vision can be seen as the closest approximation to an early space policy.[4] In practice, this translated into space-based applications directed toward socioeconomic development and the creation of indigenous capabilities, even as international cooperation remained essential in the programme's early phases.[5]

As a result, at its core, India's space programme developed around three main pillars: communications and remote sensing satellites, practical applications aimed at meeting developmental needs, and the establishment of indigenous launch vehicle capabilities.[6]

Equally important, the institutional architecture that took shape in the 1960s and 1970s placed India's space programme under clear civilian authority. The creation of the Indian Space Research Organisation (ISRO) in 1969 and, a few years later, the Space Commission and the Department of Space (DoS) in 1972, brought the programme under the Prime Minister's Office, where it continues to reside today.

Significantly, unlike other major powers, India's space programme did not grow out of missile development; rather, it was the missile programme that benefited from the technologies and expertise developed in the civilian space sector. A.P.J. Abdul Kalam, who led ISRO's Satellite Launch Vehicle (SLV-3) programme in the 1970s, was transferred to the Defence Research and Development Organisation (DRDO) in 1982 to head the Integrated Guided Missile Development Program (IGMDP), where ISRO-derived technology and expertise were applied to the Agni series.[7]

Despite instances of military spin-offs, it is important to note that India's space and missile programmes have evolved along distinct institutional and technical trajectories, with little

1 Dimitrios Stroikos is a Marie Skłodowska-Curie Actions (MSCA) Postdoctoral Fellow at the University of Bologna. He is Head of the LSE IDEAS Space Policy project and Editor-in-Chief of *Space Policy: An International Journal*.

2 Sarabhai, Vikram, "Speech Given at the dedication of the Equatorial Rocket Launching Station, Thumba, India, 2 February 1968", in P.V. Manoranjan Rao and Paramaswaran Radhakrishnan (eds), *A Brief History of Rocketry in ISRO*, Hyderabad, Universities Press, 2012, p. 36-41; Shah, Amrita, *Vikram Sarabhai: A Life*, New Delhi, Penguin, 2007.

3 Siddiqi, Asif, "Making Space for the Nation: Satellite Television, Indian Scientific Elites, and the Cold War", in *Comparative Studies of South Asia, Africa and the Middle East*, Vol. 35, No. 1 (2015), p. 35-49, DOI 10.1215/1089201X-2876080.

4 Sachdeva, Gulshan S., "Space Policy and Strategy of India", in Eligar Sadeh (ed.), *Space Strategy in the 21st Century*, London/New York, Routledge, 2013, p. 303-321.

5 Sankar, Uday, *The Economics of India's Space Programme. An Explanatory Analysis*, New Delhi, Oxford University Press, 2007; Reddy, S. Vijayasekhara, "India's Forays into Space: Evolution of its Space Programme", in *International Studies*, Vol. 45, No. 3 (September 2008), p. 215-245, DOI 10.1177/002088170904500303; Guruprasad, B.R., "Understanding India's International Space Cooperation Endeavour: Evolution, Challenges and Accomplishments", in *India Quarterly*, Vol. 74, No. 4 (December 2018), p. 455-481, DOI 10.1177/0974928418802077.

6 Lele, Ajey, *ISRO: Institutions that Shaped Modern India*, New Delhi, Rupa Publications India, 2021, p. 7.

7 Mistry, Dinshaw, "The Geostrategic Implications of India's Space Program", in *Asian Survey*, Vol. 41, No. 6 (November/December 2001), p. 1023-1043, DOI 10.1525/as.2001.41.6.1023, https://library.fes.de/libalt/journals/swetsfulltext/14218819.PDF.

interoperability between them.[8] Besides, it is worth recalling that this collaboration between ISRO and DRDO drew international sanctions under the Missile Technology Control Regime (MTCR), constraining ISRO's access to advanced technologies and underlining the costs of association with military activities. In response, the government and ISRO sought deliberately to disentangle the civilian programme from military-related activities, a move aimed at ensuring continued international cooperation in civilian space initiatives.[9]

4.2 Techno-nationalism and self-reliance

More broadly, developmental and military objectives are mutually reinforcing elements within a comprehensive and long-term approach to India's space security.[10] In this respect, it is useful to understand India's approach to the civil-military interconnection through the lens of *techno-nationalism*, a framework that continues to inform the expansion and diversification of India's space programme. Briefly stated, a key aspect of techno-nationalism is the "struggle for independence and autonomy through the indigenization of technology".[11] In the context of armaments production, techno-nationalism concerns not only the pursuit of technological self-sufficiency but also the attainment of geopolitical and strategic autonomy. As such, techno-nationalism extends beyond mere military considerations, as it "serves broad, bold national strategic ambitions, particularly the emergence of a country as a modern, independent, even powerful nation-state".[12]

Although most commonly associated with Japan and China, the concept also helps to capture the centrality of science and technology in postcolonial India, rooted in the emergence of techno-scientific advancement as a "standard of civilisation" in the nineteenth century and in the enduring view of visible technological achievements as markers of modernity, statehood and great-power aspiration. For India, therefore, techno-nationalism has never been solely about technology as a means of economic development or military capability, but also about great-power status and recognition in international society.[13]

What merits emphasis here is that, from a techno-nationalist perspective, external collaboration is seen as a means of acquiring and assimilating advanced technologies that can, over time, strengthen domestic capabilities and reinforce national self-reliance.[14]

4.3 India's evolving space ecosystem and the civil-military interconnection

New Delhi continues to emphasise the use of space for socioeconomic development. However, over the last two decades or so, India's space programme has entered a new phase characterised by a shift towards prestige and security.[15] The growing role of prestige considerations, which is in line with India's quest for great power status, has been manifested in the pursuit of space exploration missions, such as the Mars Orbiter Mission (*Mangalyaan*), which entered Mars orbit in 2014 and, more recently, *Chandrayaan-3*, which achieved a historic soft landing on the Moon in August 2023. Further reflecting this shift, India is working on its human spaceflight programme, *Gaganyaan*, which aims to demonstrate the country's ability to conduct independent crewed missions, along with plans to develop its own space station, signalling its ambitions to establish itself as a great power in space.[16]

8 Sheehan, Michael, *The International Politics of Space*, London/New York, Routledge, 2007, p.142-143.

9 O'Donnell, Frank and Harsh V. Pant, "Evolution of India's Agni-V missile: Bureaucratic Politics and Nuclear Ambiguity", in *Asian Survey*, Vol. 54, No. 3 (June 2014), p. 584-610, DOI 10.1525/as.2014.54.3.584.

10 Sheehan, Michael, *The International Politics of Space*, cit., p. 143.

11 Samuels, Richard J., *Rich Nation, Strong Army. National Security and the Technological Transformation of Japan*, Ithaca/London, Cornell University Press, 1996, p. ix.

12 Bitzinger, Richard, *Arming Asia. Technonationalism and its Impact on Local Defense Industries*, London/New York, Routledge, 2017, p. 7.

13 Stroikos, Dimitrios, "China, India, and the Social Construction of Technology in International Society: The English School Meets Science and Technology Studies", in *Review of International Studies*, Vol. 46, No. 5 (December 2020), p. 713-731, DOI 10.1017/S0260210520000273.

14 Bitzinger, Richard, *Arming Asia*, cit., p.19.

15 Rajagopalan, Rajeswari Pillai and Dimitrios Stroikos, "The Transformation of India's Space Policy: From Space for Development to the Pursuit of Security and Prestige", in *Space Policy*, Vol. 69 (August 2024), Article 101633, https://doi.org/10.1016/j.spacepol.2024.101633.

16 Pillai, Soumya, "'India Working on Its Own Space

Crucially, however, this diversification of India's space activities has been characterised by a gradual but notable shift toward the military use of space. From the 2000s onwards, ISRO developed a range of Earth observation and imaging satellites, such as the Cartosat and Risat series, that have clear dual-use applications and are now routinely used by the armed forces. Building on these capabilities, India started launching dedicated military satellites for communications, navigation and intelligence.[17] In addition, the Indian Regional Navigation Satellite System, operated by ISRO and known as NavIC, provides regional positioning and timing services, including an encrypted signal reserved for military users. ISRO has also begun developing its own space situational awareness project, known as Project NETRA (Network for Space Objects, Tracking and Analysis). The initiative aims to build an indigenous capacity to monitor satellites and orbital debris in order to enhance space situational awareness (SSA), marking an important step toward protecting national assets in space.[18]

More tellingly, perhaps, there has been a growing interest in the development of counterspace capabilities. In this respect, a defining moment came in March 2019 with Mission Shakti, the country's first successful anti-satellite (ASAT) test. DRDO used a modified ballistic interceptor to destroy the Microsat-R satellite that ISRO had launched earlier that year. The ASAT test also served as a catalyst for institutional change. In its aftermath, the government moved to formalise the military dimension of India's space activities. The Defence Space Agency (DSA) was created under the Integrated Defence Staff (IDS) of the defence ministry to coordinate operations across the three services, while the Defence Space Research Organisation (DSRO) was established as a technical body to support research on counterspace and related technologies.[19]

The growing importance of space for military uses is also evident in the 2017 Joint Doctrine of the Indian Armed Forces, which foresees space as a potential arena of future conflict and stresses its value as a force multiplier.[20] More recently, this process has culminated in the release of a Joint Military Space Doctrine in September 2025, although the document has not yet been made publicly available.[21] What should be added, however, is that India has not introduced a comprehensive space policy or a formal national defence strategy, and there is very limited authoritative public information available on the internal functioning of DSA and DSRO. This is consistent with the overall broader opacity that characterises India's defence institutions.

If the militarisation of India's space programme represents one turning point, the move toward commercialisation and privatisation constitutes another. In 2020, as a result of the decision to open India's space sector to private participation, the government announced the setting up of the Indian National Space Promotion and Authorisation Centre (IN-SPACe) under the DoS as the main institutional gateway for non-governmental actors, giving it a coordinating role and operational autonomy.[22] IN-SPACe provides the main institutional link between ISRO and non-governmental entities (NGEs), supporting wider private participation across different segments of India's space sector. Its mandate includes authorising and overseeing NGEs' space activities, facilitating access to relevant public infrastructure and facilities and supporting the development of

Station, Human Spaceflight Mission' — Modi on 'atmanirbharta' in Space", in *ThePrint*, 15 August 2025, https://theprint.in/?p=2721735.

17 The first was GSAT-7 for the Navy in 2013, followed by GSAT-7A for the Air Force in 2018 and Emisat in 2019 for electronic intelligence.

18 Stroikos, Dimitrios, "Still Lost in Space? Understanding China and India's Anti-Satellite Tests through an Eclectic Approach", in *Astropolitics*, Vol. 21, No. 2-3 (2023), p. 179-205, https://doi.org/10.1080/14777622.2023.2277253.

19 It is also worth noting that several Indian strategic analysts have called for the establishment of a dedicated Space Command or an Indian Space Force, which reflects ongoing debate but not current institutional reality. See for example: Lele, Ajey, "Indian Space Force: A Strategic Inevitability", in *Space Policy*, Vol. 65 (August 2023), Article 101526, DOI 10.1016/j.spacepol.2022.101526; Stroikos, Dimitrios, "Still Lost in Space?", cit.

20 India Ministry of Defence, *Joint Doctrine Indian Armed Forces* (JP-01/2017), April 2017, https://cms.spacesecurityportal.org/uploads/1718bbb2_cb9c_4ef5_9843_cb670e58afb7_324809bdc3.pdf.

21 "Top Commanders Release Jt Military Space Doctrine", in *The Times of India*, 18 September 2025, https://timesofindia.indiatimes.com/articleshow/123960677.cms.

22 IN-SPACe is composed of three directorates: the Promotion Directorate, the Technical Directorate and the Program Management and Authorization Directorate (PMAD). See IN-SPACe website: *About Us*, https://www.inspace.gov.in/inspace?id=inspace_about_inspace_v3.

additional capacity where needed.[23]

The Indian Space Policy 2023 has codified this shift by establishing a clear regulatory architecture through IN-SPACe and NewSpace India Limited (NSIL). The policy also directs ISRO to collaborate with research institutions and share technologies with NGEs.[24] These reforms aim to relieve ISRO of routine operational tasks, foster innovation through start-ups, attract foreign investment and promote a more dynamic space ecosystem overall. Notably, the policy also links space activities to national security, indicating that commercialisation is expected to create new synergies between the civilian and military domains. As of FY 2025-26, India's civilian space budget under the Department of Space is estimated at 134,16 million Indian rupee (approximately 1.31 billion euros[25]).[26] For comparison, the Department of Space budget in 2015-16 was 69,59 million Indian rupee, indicating a steady increase over the past decade.[27] However, expenditures related to military space activities are not publicly disclosed.

4.4 India's international partnerships

Internationally, India has diversified its partnerships, moving beyond its traditional cooperation with Russia – which has gradually declined in scope – to pursue deeper engagement with the United States, exemplified by the NASA-ISRO Synthetic Aperture Radar (NISAR) mission and growing defence-oriented collaboration under the US-India Initiative on Critical and Emerging Technology (iCET) and its upgraded successor framework, Transforming the Relationship Utilizing Strategic Technology (TRUST) initiative.[28] Other key partners include France and Japan, while cooperation within the Quad framework has advanced in recent years.[29]

More specifically, France remains one of India's oldest and closest partners in space, as evident in past joint missions such as Megha-Tropiques and SARAL-AltiKa and in ongoing cooperation on the upcoming TRISHNA Earth-observation mission.[30] More recently, both sides reaffirmed their intention to deepen collaboration in defence, security and space during high-level consultations in June 2025.[31] Japan has also become a key space partner for India, reflected in regular high-level consultations such as the Japan-India Space Dialogue, where both sides exchange views on space policy and advance cooperation between JAXA and ISRO across areas including space security, SSA, satellite navigation and space-industry collaboration.[32] Cooperation within the Quad has broadened through the Indo-Pacific Partnership for Maritime Domain Awareness (IPMDA), which provides space-based radio-frequency data as well as associated analytical training and capacity-building.[33] At the same time, New Delhi has come to recognise the importance of space as a tool of foreign policy, exemplified by the 2017 launch of the South Asia Satellite, which was offered to its smaller neighbours, Afghanistan, Bangladesh, Bhutan, Nepal, the Maldives and Sri Lanka, to promote regional cooperation and showcase India's leadership role in South Asia.[34]

23 Ibid.; ISRO website: *Indian National Space Promotion and Authorization Center (IN-SPACe)*, https://www.isro.gov.in/IN-SPACe.html.

24 ISRO, *Indian Space Policy 2023*, https://www.isro.gov.in/IndiaSpacePolicy.html.

25 Converted at the average euro/Indian rupee exchange rate for November 2025.

26 India Ministry of Finance, *Notes on Demands for Grants, 2025-26: Demand No. 95 - Department of Space*, https://www.indiabudget.gov.in/doc/eb/sbe95.pdf.

27 "Budget 2016 Gives Major Boost to Department of Space", in *The Times of India*, 1 March 2016, https://timesofindia.indiatimes.com/articleshow/51209070.cms.

28 Stroikos, Dimitrios, "India's Space Policy: Between Strategic Autonomy and Alignment with the United States", in *CFR Articles*, 5 June 2025, https://www.cfr.org/article/indias-space-policy-between-strategic-autonomy-and-alignment-united-states.

29 Rajagopalan, Rajeswari Pillai and Dimitrios Stroikos, "The Transformation of India's Space Policy", cit.

30 More information on India-France space cooperation can be found on the website of the French Embassy in New Delhi: *France in India*, https://in.diplomatie.gouv.fr/en.

31 Press Trust of India, "India, France Agree to Intensify Defence, Space, N-Cooperation", in *The Indian Express*, 14 June 2025, https://indianexpress.com/?p=10065736.

32 Japan Ministry of Foreign Affairs, *The Third Meeting of the Japan–India Space Dialogue*, 1 April 2025, https://www.mofa.go.jp/fp/msp/pagewe_000001_00177.html.

33 USA, Australia, India and Japan, *2025 Quad Foreign Ministers' Meeting*, 1 July 2025, https://www.state.gov/releases/office-of-the-spokesperson/2025/07/2025-quad-foreign-ministers-meeting.

34 Stroikos, Dimitrios, "Space Diplomacy? India's New Regional Policy under Modi and the 'South Asia Satellite'", in *India Review*, Vol. 23, No. 1 (2024), p. 46-70, https://doi.org/10.1080/14736489.2023.2295715.

4.5 Conclusion

Despite ISRO's civilian mandate, the organisation has increasingly supported national security objectives by launching satellites with dual-use and dedicated military functions for the armed forces, as well as by engaging in projects such as NETRA. That being said, it remains too early to assess the effectiveness of the newly created DSA and DSRO. In many ways, their establishment reflects an effort to streamline military space activities and reduce reliance on the historically underperforming DRDO. ISRO, by contrast, represents one of India's most successful scientific institutions and is likely to remain a central, if ad hoc, partner for defence-related applications alongside the growing private sector. Yet, given ISRO's prestige and entrenched bureaucratic interests, there are strong institutional incentives to preserve its civilian character. In sum, to date, civil–military integration has largely flowed from the civilian to the military domain rather than the reverse. Having said that, whether this trajectory will shift remains to be seen.

5. Japan's national security and civil-commercial space activities: A deepening interconnection

by ***Yasuhito Fukushima***[1]

Japan traditionally placed its primary emphasis on civil space activities. This approach stemmed from the 1969 Diet Resolution, which required that Japan's space development and utilisation be conducted exclusively for "peaceful purposes".[2] The government subsequently interpreted "peaceful purposes" as "non-military use". The same principle was codified in the National Space Development Agency Law enacted later that year, serving as the legal foundation for the establishment of the National Space Development Agency of Japan (NASDA).[3]

However, around the turn of the 21st century, Japan began to emphasise space activities for national security purposes. NASDA and its successor organisation, the Japan Aerospace Exploration Agency (JAXA), became involved in space research and development to support security-related objectives.[4] Furthermore, Japan's defence-related space efforts accelerated significantly with the 2008 enactment of the Basic Space Law and the 2018 National Defense Program Guidelines (NDPG). The Basic Space Law reinterpreted the longstanding "peaceful use" principle from "non-military" to "non-aggressive," paving the way for a new level of cooperation between JAXA and the MoD and Self-Defense Forces (SDF).[5]

The 2022 National Security Strategy (NSS)

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2 The National Diet of Japan consists of the House of Representatives and the House of Councillors, both of which adopted relevant resolutions in 1969.

3 Japan, Law No. 50 of 23 June 1969: *Law Concerning the National Space Development Agency of Japan*, https://www.unoosa.org/oosa/en/ourwork/spacelaw/nationalspacelaw/japan/nasda_1969E.html.

4 In 2003, NASDA, the Institute of Space and Astronautical Science, and the National Aerospace Laboratory were integrated to form JAXA.

5 The MOD and SDF essentially refer to the same organisation. The former denotes its administrative dimension, while the latter refers to its operational dimension as a uniformed organisation capable of conducting armed operations. Japan Ministry of Defence website: *About JMOD*, https://www.mod.go.jp/en/about/index.html.

signalled an expansion in collaboration between the defence and commercial space sectors. The strategy clearly articulates the government's goal of establishing a "virtuous cycle" in the space domain, whereby public support fosters the domestic space industry. This enables the utilisation of private space technologies for national defence, which then stimulates industrial development. Building on this approach, the government introduced policies to promote the indigenous development of space systems with high dual-use potential through the 2023 Space Security Initiative and the 2025 Space Domain Defense Guidelines.

Nevertheless, efforts to implement this cycle in a lasting way remain a challenge. The government needs to continuously provide clear and predictable demand signals in the defence space sector. As Japan's security environment becomes increasingly volatile, the domestic space industry is expected to demonstrate its capacity to deliver technologies and services that enhance defence superiority within a relatively short timeframe.

5.1 A longstanding track record in civil space activities

Japan has long maintained credible civil space capabilities. In 1970, Japan successfully launched its first satellite, Ohsumi, from the Kagoshima Space Center using a Lambda L-4S-5 rocket. This milestone made Japan the fourth state, after the Soviet Union, the United States and France, to independently launch a domestically manufactured satellite from its own territory using its own rocket.

Since then, Japan has made substantial advances in civil space activities. Although Japan does not possess its own crewed spacecraft, it is a partner in the International Space Station (ISS) programme and has operated the Kibo experiment module since 2008. Kibo is Japan's first human-rated facility in orbit, supporting a range of microgravity experiments and observations. Japanese astronauts began long-duration stays on the ISS in 2009, and Japan commenced cargo transportation to the station that same year using its indigenously developed H-II Transfer Vehicle.

Japan also participates in the US-led Artemis programme, in which JAXA and Toyota are jointly developing a crewed, pressurised rover. In uncrewed exploration, Japan's Hayabusa probe achieved the world's first sample return from an asteroid in 2010,[6] followed by Hayabusa2's successful return of samples from another asteroid in 2020. These efforts reflect the sustained progression of Japan's civil space programmes.

5.2 A momentum in space for national security and the civil-national security interconnection

At the beginning of the 21st century, Japan significantly intensified its efforts to utilise space for national security, with the government moving to acquire space assets to enhance its security capabilities. The catalyst for this shift was the 1998 "Taepodong Shock," when North Korea launched the Taepodong-1 multi-stage ballistic missile, which flew over Japan before falling into the Pacific Ocean.[7] In response, the Japanese government concluded that it needed its independent capabilities to monitor North Korea's military activities. At a cabinet meeting that year, the government decided to introduce a programme to develop Information Gathering Satellites (IGS), a multipurpose satellite system for security and crisis management, including responding to large-scale disasters.

In 2001, the government established the Cabinet Satellite Intelligence Center (CSICE) within the Cabinet Intelligence and Research Office of the Cabinet Secretariat, which assumed responsibility for the development, operation and imagery analysis of the IGS.

Notably, the development of the IGS and its associated ground facilities was entrusted to NASDA.[8] Although NASDA had traditionally focused on civil space activities, once it began

6 Japan Ministry of Education, Culture, Sports, Science and Technology, *Hayabusa Back to the Earth*, https://www.mext.go.jp/en/policy/science_technology/research_development/title01/detail01/sdetail01/1374004.htm.

7 For details on the introduction of IGS, refer to: Sunohara, Tsuyoshi, *Tanjō Kokusan Supai Eisei: Dokuji Jōhōmō to Nichi-Bei Dōme* (The birth of Japan's first spy satellite: An independent intelligence network and the Japan-US alliance), Tokyo, Nikkei, 2005.

8 Space Development Committee, *Minutes of the 8th Meeting of the Planning and Evaluation Subcommittee* (in Japanese), 22 August 2001, https://www.mext.go.jp/b_menu/shingi/uchuu/minutes/gijiroku/02/08.htm.

developing the IGS in the late 1990s, it effectively assumed the role of an implementing agency for national-security space research and development.

CSICE began launching IGS in 2003. As of 2025, it operates a total of ten satellites (optical and radar) and one data relay satellite.[9]

In fiscal year 2025, the Cabinet Secretariat's space budget was 94.7 billion yen (approximately 611 million US dollars).[10] In the same year, Japan's overall space budget amounted to 936.5 billion yen (approximately 6.04 billion US dollars). The Cabinet Secretariat ranked fourth in terms of budget size, following the Ministry of Education, Culture, Sports, Science and Technology (382.4 billion yen, approximately 2.47 billion US dollars), the MoD (136.6 billion yen, approximately 881 million US dollars) and the Ministry of Economy, Trade and Industry (136.2 billion yen, approximately 879 million US dollars).[11] Moreover, the Cabinet Secretariat's space budget had remained at around 80 billion yen annually for the past decade. Still, it has increased to over 90 billion yen since fiscal year 2023, indicating a clear upward trend.[12]

Regarding space activities for defence purposes, the MoD and SDF were not permitted to acquire, possess, or operate dedicated space capabilities until the enactment of the Basic Space Law in 2008. Prior to that, as noted, Japan's space development and utilisation were limited to non-military purposes.

Within these constraints, the SDF primarily relied on satellites operated by other ministries and agencies, commercial providers and the US military.[13] This practice was justified under what is known as the generalisation theory. This refers to the government interpretation presented in a 1985 Diet testimony by Koichi Kato, then Director General of the Japan Defense Agency, the predecessor to the MoD, who stated that "satellites whose use has become widespread, as well as satellites possessing functions equivalent to such satellites, may be utilised by the Self-Defense Forces".[14] In this testimony, Kato explained that the US military's FLTSATCOM communications satellites performed relay functions similar to those of INTELSAT and INMARSAT, which had already become widely used. He further clarified the government's view that the use of such satellites by the SDF would not contravene the spirit of the Diet Resolution limiting space activities to peaceful purposes.

The Basic Space Law reinterpreted the longstanding "peaceful use" principle from "non-military" to "non-aggressive," thereby enabling the MoD and SDF to acquire their own space assets. Following this reinterpretation, the MoD began acquiring and fielding X-band defence communications satellites.

In conjunction with the enactment of the Basic Space Law, the JAXA Act was amended in 2012, which allowed cooperation between JAXA and the MoD and SDF in the space sector.[15] Prior to this amendment, under the aforementioned Diet Resolution and the accompanying official government statement, space cooperation between JAXA (and its predecessor organisations) and the MoD and SDF had remained proscribed for decades. Following this change, personnel exchanges between JAXA and the MoD began in fiscal year 2014, and personnel from the Air Self-Defense Force (ASDF) were also seconded to JAXA from fiscal year 2017.[16] In 2016, the government

9 Cabinet Satellite Intelligence Center, *Development and Operation Costs for Intelligence-Gathering Satellites* (in Japanese), 16 September 2025, p. 2, https://www8.cao.go.jp/space/comittee/dai119/siryou1-2.pdf.

10 Japan's fiscal year runs from April to the following March. Yen-to-US dollar conversions in this paper are calculated at an exchange rate of 155 yen per US dollar. Cabinet Office, *Space-related Budget in the Preliminary Budget Request for Fiscal Year 2026* (in Japanese), 16 September 2025, p. 1, https://www8.cao.go.jp/space/comittee/dai119/siryou1-1.pdf.

11 Ibid.

12 Ibid.; Cabinet Satellite Intelligence Center, *Trends in the Budget for Reconnaissance Satellites* (in Japanese), https://www.cas.go.jp/jp/gaiyou/jimu/pdf/r07_suii.pdf.

13 For example, the SDF procured and used user terminals to utilise US military communications and navigation satellites, and accessed early-warning satellite data provided via the US Shared Early Warning system.

14 House of Representatives, *102nd National Diet, House of Representatives, Budget Committee, No. 5, February 6, 1985* (in Japanese), https://kokkai.ndl.go.jp/simple/txt/110205261X00519850206/8.

15 Preceding this, JAXA and the MoD and SDF had already been cooperating in the field of aviation.

16 Japan Ministry of Defence, *Initiatives on Space Development and Utilisation at the Ministry of Defence* (in Japanese), 17 October 2014, p. 4, https://www.mext.go.jp/b_menu/shingi/gijyutu/gijyutu2/071/shiryo/__icsFiles/afieldfile/2014/10/22/1352273_1.pdf; Air Staff Office of Japan Air Self-Defence Force, *Overview of the Japan Air Self-Defence Force 2024 Edition. To the Sky and Beyond* (in Japanese), 2024, p. 81, https://www.mod.go.jp/asdf/special/uploads/docs/

approved the development of a national space situational awareness (SSA) system linking JAXA and MoD assets.[17]

In 2018, the publication of the NDPG marked a new phase in space initiatives undertaken by the MoD and SDF. The NDPG classified space, cyber and the electromagnetic spectrum as new domains, positioning them as equally important to Japan's defence as the traditional domains of land, sea and air. The NDPG also called for the establishment of an ASDF unit dedicated to the space domain, tasked with conducting space surveillance and ensuring superiority in the use of space.

As a result, the ASDF established a lieutenant colonel-led Space Operations Squadron in 2020, followed by the creation of a colonel-led Space Operations Group in 2022, a higher-echelon unit overseeing the squadron. In 2023, the Space Operations Group initiated a space domain awareness (SDA) mission and began sharing relevant data with JAXA and the US Space Command (USSPACECOM).

Building on these developments, the ASDF established the Space Operations Wing, commanded by a major general, in March 2026 and plans to reorganise into the "Air and Space Self-Defense Force" in fiscal year 2026, underscoring the growing relevance of defence space activities. As part of this transition, the space domain-dedicated unit is expected to be elevated to the level of a Space Operations Command in fiscal year 2026, becoming one of the service's major commands.

5.3 Strengthening public-private partnerships in defence space activities

A notable aspect of Japan's recent space policy is its emphasis on fostering stronger public-private partnerships in the defence space sector. The MoD and SDF have long utilised commercial space services for communications and other purposes. As previously mentioned, this largely stems from the need to rely on commercial services, given that the SDF was prohibited from owning satellites. Additionally, the operation of the MoD's X-band defence communications satellites has been outsourced to the private sector through the Private Finance Initiative (PFI).[18]

However, the Japanese government began further promoting public-private partnerships in the defence space domain under the 2022 NSS. The strategy describes this approach as a virtuous cycle in which government support for the domestic space industry enables the use of private space technologies for defence purposes.[19] The document specifically cites the construction of satellite constellations as an illustrative example.[20]

Based on the 2022 NSS, the Space Development Strategy Headquarters, led by the prime minister and comprising all Ministers of State, developed the Space Security Initiative in 2023. This policy sets out the initiatives to be implemented over an approximately ten-year period.[21] In this document, the government has articulated its policy to expand support programmes for startups and other entities in critical security technologies.[22] The initiative specifically aims to increase support for fields with high dual-use potential, citing on-orbit services, small synthetic aperture radar and optical satellites, optical communications satellites and small rockets.[23]

Accordingly, public-private collaboration in the defence space sector is beginning to take shape. In

gaiyou2024_1.pdf.

17 Ministry of Education, Culture, Sports, Science and Technology, *Agreement Regarding the Development of the National SSA System* (in Japanese), 24 March 2016, p. 1, https://www.mext.go.jp/content/20210719-mxt_bunjou-000016923_12.pdf.

18 PFI is a method for constructing, maintaining, and operating public facilities through the use of private financing, management, and technical skills. Cabinet Office, *What is PPP/PFI?* (in Japanese), https://www8.cao.go.jp/pfi/pfi_jouhou/aboutpfi/aboutpfi_index.html.

19 National Security Council, *National Security Strategy of Japan*, December 2022, https://www.mofa.go.jp/fp/nsp/page1we_000081.html.

20 Ibid.

21 The Space Development Strategy Headquarters was established within the Cabinet pursuant to the Basic Space Law. The Headquarters has formulated the Basic Plan on Space Policy five times to date. It also meets two to three times annually to revise the implementation plan of the Basic Plan on Space Policy. Cabinet Office, *About the Space Development Strategy Headquarters* (in Japanese), https://www8.cao.go.jp/space/hq/about.html.

22 Japan Government, *Space Security Initiative*, June 2023, p. 13, https://www8.cao.go.jp/space/english/anpo/kaitei_fy05/enganpo_fy05.pdf.

23 Ibid.

2023, the Air Staff Office of the ASDF established the Space Collaboration and Innovation Office at the Cambridge Innovation Center Tokyo, a co-working space for startups located outside MoD and SDF facilities, to promote collaboration with the private sector.[24] In April 2025, the MoD launched a programme to construct a satellite constellation for target detection and tracking utilising PFI. This constellation is intended to acquire the targeting data necessary for operating standoff defence capabilities, including long-range cruise missiles. Unlike the X-band defence communications satellites acquired under the PFI framework, which are government-owned, this constellation is designed to be owned and operated by private-sector entities under a different PFI arrangement.

Furthermore, in July 2025, the MoD published its first Space Domain Defense Guidelines, signalling its commitment to actively promoting the adoption of advanced technologies and services from domestic and international providers.[25] The guidelines outline measures to promote technological development and investment, including dual-use technologies, and to foster and strengthen the national industrial base. To this end, the ministry will intensify communication with private companies and research institutions and enhance information dissemination and the articulation of its requirements, thereby improving the predictability of its initiatives.[26] The document identifies several commercial services and technologies that will be leveraged under this policy, including optical communications, EHF (millimetre wave), infrared sensors and in-orbit propellant replenishment and repair.[27] It further states that the ministry will enhance coordination with research and development support schemes administered by other ministries and agencies, including the Space Strategy Fund.[28]

While public-private collaboration in the space sector has deepened, there remains a post-World War II legacy of constraints on academic institutions' involvement in defence-related research, and the space domain is not exempt from these limitations. Although some universities have come to receive basic research funding from the Ministry's Acquisition, Technology and Logistics Agency, the scale of such funding remains modest and is restricted to fundamental research. Consequently, space cooperation between the ministry and academia remains narrowly circumscribed, with minimal indication of significant expansion in the near term.[29]

5.4 International cooperation and key space partners

The MoD and SDF, in strengthening their capabilities in the space domain, have prioritised cooperation not only with JAXA and domestic commercial space actors but also with allied and like-minded states. The US remains Japan's sole ally under the Japan-US Security Treaty, and Japan has deepened defence cooperation with the US in the space domain accordingly. The ASDF, as previously noted, shares SDA data with USSPACECOM. Japan is also exploring collaboration with US industry on satellite constellations to detect and track hypersonic glide vehicles, as Japan's domestic industry does not

24 Japan Air Self-Defence Force, *Opening of the Space Collaboration & Innovation Office*, 28 September 2023, https://www.mod.go.jp/asdf/news/uploads/docs/20230928_1en.pdf.

25 Japan Ministry of Defense, *Guidelines for the Defense of the Cosmic Realm* (in Japanese), July 2025, p. 11, https://www.mod.go.jp/j/press/news/2025/07/28a_02.pdf.

26 Ibid.

27 Ibid.

28 Ibid. The Space Strategy Fund was established within JAXA in 2024 by the Ministry of Economy, Trade and Industry, the Cabinet Office, the Ministry of Internal Affairs and Communications and the Ministry of Education, Culture, Sports, Science and Technology. It is a ten-year fund with a total budget of 1 trillion yen, intended to support technology development by private companies, universities and other entities. One of the primary objectives of the fund is to double the domestic space market to 8 trillion yen by the early 2030s. See Japan Aerospace Exploration Agency and Space Strategy Fund Department, *Overview of the Space Strategy Fund (SSF)*, April 2026, https://fund.jaxa.jp/content/uploads/Overview_of_The_SpaceStrategy_Fund.pdf.

29 The Innovative Science and Technology Initiative for Security, launched by the agency in fiscal year 2015, has a total annual budget of approximately 10 billion yen, with a maximum of 2 billion yen in funding allocated per project over a five-year period. Of the 22 research topics announced in the fiscal year 2025 call for proposals, only one concerned the space domain, focusing on basic research into propulsion and motion control technologies for spacecraft and related systems. See Acquisition, Technology and Logistics Agency, *Overview of the Security Technology Research Promotion Program* (in Japanese), 2025, p. 1, 3-4, https://www.mod.go.jp/atla/funding/gaiyo/seidogaiyo_20250318.pdf.

yet possess comparable expertise.[30]

In addition, Japan participates in US military-led space cooperation frameworks. Japan began taking part in the Global Sentinel SSA tabletop exercise in 2016, followed by the Schriever Wargame in 2018, and in 2023, it also joined the Combined Space Operations Initiative. In 2025, Japan launched a Quasi-Zenith Satellite (QZS) equipped with a US SDA sensor into geostationary orbit, and another QZS carrying a US SDA sensor is scheduled for launch.

Cooperation with other like-minded partners continues to expand. For example, Japan has participated in the AsterX exercises hosted by the French Armed Forces, as well as Germany's SSA training course. The US-led cooperation frameworks referenced above also provide venues for engagement with these partners.

Furthermore, space security cooperation between Japan and the North Atlantic Treaty Organization (NATO) and the European Union (EU) has begun to emerge. In 2023, Japan and NATO agreed on the Individually Tailored Partnership Programme, which explicitly identifies promoting space security cooperation as a priority area.[31] In 2024, Japan and the EU announced the European Union-Japan Security and Defence Partnership, which states that both sides will expand the existing Japan-EU Space Policy Dialogue and explore the possibility of including space security-related issues within its scope.[32] As Japan, NATO and the EU each accelerate their respective space security efforts, such cooperation is expected to deepen and become more substantive.

5.5 Future outlook

As discussed, Japan began to accelerate its space activities for national security purposes around the turn of the 21st century. In this process, JAXA and its predecessor organisation, NASDA, came to assume responsibilities for security-related research and development, and cooperation between JAXA and the MoD and SDF commenced following the amendment of the JAXA Act.

More recently, collaborations between the MoD and private space companies have intensified. However, the government's effort to establish the aforementioned defence-industry cycle remains in its early stages. It is essential for the government to clearly and consistently signal to the private sector the existence of defence requirements and provide whole-of-government support for the development of dual-use space technologies. At the same time, given the increasingly volatile security environment, the domestic space industry will need to deliver defence-relevant technologies and services within a relatively short timeframe. Lastly, while continuing to support the development of the domestic space industry, the MoD and SDF will, in practice, have to leverage commercial space technologies and services from the US and Europe and promote international collaborations among private actors to meet defence needs.

30 USA and Japan, *United States-Japan Joint Leaders' Statement. Global Partners for the Future*, 10 April 2024, https://www.mofa.go.jp/files/100652114.pdf.

31 NATO, *Individually Tailored Partnership Programme between NATO and Japan for 2023-2026*, 12 July 2023, https://www.nato.int/en/about-us/official-texts-and-resources/official-texts/2023/07/12/individually-tailored-partnership-programme-between-nato-and-japan-for-2023-2026.

32 EU and Japan, *The European Union-Japan Security and Defence Partnership*, 1 November 2024, https://www.mofa.go.jp/mofaj/files/100747825.pdf.

6. Conclusions

by ***Karolina Muti***

The analysis of civil-military interconnections in space across China, Russia, the United States, India and Japan reveals diverse governance models, budget allocations and strategic priorities that offer valuable insights for Europe and Italy. Each space power has developed distinct approaches to integrating civilian and military space activities, shaped by their political systems, security environments and industrial ecosystems. Drawing conclusions from these models can inform European and Italian space policy development, particularly as the continent seeks to strengthen its strategic autonomy and competitiveness in an increasingly contested space domain.

The European space sector can appear less competitive in comparison with other space powers' systems, especially when looking at the cumbersome, fragmented governance and decision-making structure, or at the capability gaps in sectors such as access to space, space communication, AI software technologies, or at the lack of scale stemming from the fragmentation of procurement. Similarly, blurred lines between civil and military applications in space technologies and the related institutional and industrial governance are less of a problem for illiberal regimes such as China or Russia, whose lack of transparency and accountability towards the public opinion, and a strongly hierarchical relationship between institutions and industry, make it easier to manage. For liberal democracies, especially in countries like Japan or Italy, the distinction between civil and military involves two separate processes, with a scrutiny of the public opinion with regards to the defence component.

In the context of what can be defined as "space power", a tentative comparison between states is possible in terms of space capabilities, doctrine, governance and public-private partnerships models. Nevertheless, such exercise seems counterproductive when applied to the European space architecture in its composite, multinational and multifaceted dimensions, comprising both the EU, ESA and their respective member states. Such difficulty is even more evident when it comes to addressing the moving target of civil-military interconnection in space.

In the last few years, Europe has proven to be increasingly but not fully aware of the relevance of the civil-military interconnection in space. On one hand, a number of EU and ESA documents demonstrate rising awareness concerning this aspect. On the other, compartmentalisation and silos persist in complex international organisations when addressing military and civilian aspects of space.

The EU Space Strategy for Security and Defence (EUSSSD), published in March 2023, overtly recognised that a "systematic cross-fertilisation between EU space, defence and security initiatives would facilitate the development of dual-use EU space components taking into account defence and security needs under an overarching capability-driven approach".[1] The Strategy announced an opening of the EU space programme to specific security-sensitive applications, services and data. In the White Paper for European Defence Readiness 2030, space is mentioned in a cross-cutting manner, with respect to the defence focus.[2] The document recognises that the European space programme is a critical asset and, more recently, a tool of EU foreign policy.

The Atlantic Alliance is stepping up ambition on leveraging civil and military applications of space services too. The NATO Space Commercial Strategy published in 2025 aims at strengthening cooperation with commercial space partners in order to facilitate the use of their services for allied operational and defence planning requirements.[3] The Strategy sees this goal as essential to "unlock the full potential of space technologies for defence and security".

Against this backdrop, rather than comparing the complex institutional and multinational space

1 European Commission, *European Union Space Strategy for Security and Defence* (JOIN/2023/9), 10 March 2023, p. 10, https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex:52023JC0009.

2 European Commission, *Joint White Paper for European Defence Readiness 2030* (JOIN/2025/120), 19 March 2025, https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex:52025JC0120.

3 NATO, *NATO Commercial Space Strategy*, 13 February 2025, https://www.nato.int/en/about-us/official-texts-and-resources/official-texts/2025/02/13/nato-commercial-space-strategy.

governance in Europe with that of individual, nation-state space powers, this conclusions will identify four elements drawn from the analysis of those powers that are particularly relevant to the specific features of the European space architecture and Italy's approach to space.

6.1 Strategic and institutional coherence in civil and military space policies and programmes

European space governance, particularly in the context of the civil-military interconnection, operates through a complex multi-level institutional architecture, involving a number of EU and non-EU organs and agencies: the EU Commission, the European Union Agency for the Space Programme (EUSPA), the European Defence Agency (EDA), the European External Action Service (EEAS), but also ESA and member states with their MoDs and space agencies. Such fragmentation and compartmentalisation risks jeopardising rapid decision-making and effective coordination, and is one of the key factors that makes Europe lagging behind with respect to other space powers.

Compared with nation-states, it takes also more effort to ensure that civil space projects and the emerging EU portfolio of programmes with security and defence applications, such as the future IRIS2 or the European Resilience from Space (ERS) programmes, or the European Defence Fund (EDF) space-related projects, are strategically aligned and reflect a coherent vision with a clear operational direction.

As of today, the expectation contained in the EU Space Strategy for Security and Defence for the EU to be able to protect its space assets, and to respond to space threats, remains on paper, since the envisaged governance, involving the High Representative and EEAS, EUSPA, and the EU Space Information Sharing and Analysis Centre (ISAC) is not apt for timely decision-making and for the establishment of sufficient deterrence mechanisms, despite the consolidation of space intelligence within the EEAS.

With regards to decision-making, other space powers have, or have recently launched, Space Commands and Space Forces fully integrated in their Defence apparatuses. It is the case for all countries under analysis in the previous chapters. Whereas several major European countries have introduced their own Space Commands, the lack of a European Chief of Defence Staff and of a European Space Command limits the ability to prioritise vision and direction over the single space programmes, and to coordinate military and civil applications of European space assets.

EU Satellite Centre (SatCen) is currently the EU agency with the most consolidated, three decades long expertise in space for defence, geospatial intelligence and training. The Centre provides defence-relevant space data on force deployment, military infrastructure monitoring and battle damage assessment. Based on these tasks, EU SatCen has been a precious tool for EU Common Security and Defence Policy, differently from other agencies and EU institutions that are just recently developing competences in the military sector. A more streamlined involvement of EU SatCen would represent a step towards a more effective operational dimension of the EUSSSD and its objectives.

When it comes to the EDF space-related initiatives, after five years since its launch and a patchwork of different projects, assessing their impact should support a process of prioritisation and more stringent selection of initiatives in the EDF Working Programmes, to concentrate the limited funding on the most urgent military space priorities and reducing the "time to market" of the solutions to be developed.

The introduction of new legislation such as the EU Space Act should first and foremost ensure that the European space ecosystem can stay competitive, accelerate technology innovation and space capability development processes, and is not slowed down with respect to non-EU space players, in a context where Europe is already lagging behind and the bureaucratic burden on companies is already high.

6.2 Sustained and predictable investments for fewer priority projects

The European space budget has augmented substantially in the last years, and it is going to increase further. The EU announced a budget of 131 billion euros for defence and space in the framework of the next Multiannual Financial

Framework (MFF) 2028-2034. Such sum is five times higher with respect to the previous MFF according to the Commission. In parallel, at ESA Ministerial Meeting in Bremen in November 2025, the budget agreed for 2026-2028 amounted to 22.3 billion euros, with an increase of 31 per cent if compared to the previous one.[4]

The EU announced that the next MFF will be more flexible in order to ensure a better ability to act and react faster to changing priorities and circumstances, and that the financial programmes of the Union will be simpler and harmonised, with an eye to competitiveness in terms of supply chains and innovation.[5] Despite such a massive increase in budget, the European space funding risks to remain too fragmented if it is not streamlined and concentrated on few selected priorities. Balancing ESA contributions, EU and national programmes creates planning challenges for industry and complicates bidding mechanisms. In a coherent vision, the same spending priorities should be applied cross-institutionally throughout ESA and the EU mechanisms, ensuring that the two organisations develop programmes in maximum synchronisation and cooperation, co-funding priority projects and avoiding duplication. Within the EU, focussing on fewer but more strategic programmes and on their acceleration, rather than applying a distribution of funds logic to projects with at times dubious results would help ensuring the scale and coordination to compete globally. This would also guarantee to work faster and more effectively towards higher levels of strategic autonomy in the areas where it is more needed.

Moreover, in Europe, including Italy, the funding of space projects is still coming disproportionally from the public sector. Attracting more private investment, for instance through private funds and venture capital, is a declared objective of the EU Commissioner for Defence and Space. It is a delicate balancing act between ensuring that space sector in Europe has the necessary resources to grow, and escaping the harmful systemic dependencies of space industry from public support. In the case of Italy, after several years of substantial public funding dedicated to space mainly through the NextGenerationEU and contributions to ESA, the economic sustainability after 2026 for flagship programmes such as the IRIDE constellation, risks to be a challenge.

Uncertainty regarding long-term Italian funding commitments should be addressed by a multiannual space investment plan that clearly signals priorities across science, commercial space applications and defence capabilities, taking into account European and transatlantic initiatives. This would send clearer demand signals for Italian industries. The Italian space law adopted in June 2025 establishes a new National Plan for Space Economy and a related Space Economy Fund.[6] Such measures positively imply that the government conducts a strategic planning identifying resources and priorities. However, for the first year, the fund accounts for a modest sum of 35 million euros, and it remains to be seen if it will increase in the next years.

6.3 Academic and research institutions are a strategic asset, between open research, innovation and security

The Chinese example demonstrates how scientific innovation and national security planning are interconnected in a single, comprehensive vision that has favoured Beijing's innovation quality leap in the last decades. In Europe, the link between research institutions, technology sovereignty and the security and defence of the Old Continent is not self-evident, as it brings together a number of variegated actors with different interests and priorities, operating in a liberal democratic system whose principles and rules do not correspond to a top-down, centralised and controlled system. Open European societies are based on academic freedom, open science and research as guiding principles that regulate the functioning of academic and research institutions and foster international cooperation, attracting students, researchers and workers from all

4 ESA, *ESA Member States Commit to Largest Contributions at Ministerial*, updated on 2 December 2025, https://www.esa.int/About_Us/Corporate_news/ESA_Member_States_commit_to_largest_contributions_at_Ministerial.

5 European Commission website: *The 2028-2034 EU Budget for a Stronger Europe*, https://commission.europa.eu/strategy-and-policy/eu-budget/long-term-eu-budget/eu-budget-2028-2034_en#protecting-europe.

6 Law No. 89 of 13 June 2025: *Disposizioni in materia di economia dello spazio*, Articles 22-23, https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:2025;89.

over the world. Yet in specific sectors, including science and technology, such openness can result in vulnerabilities related to scientific espionage, unwanted transfer of information and/or technology, ultimately in loosing technological edge to the benefit of autocratic competitors exploiting the democratic openness within research and science institutions.

Critical areas related for example to Science, Technology, Engineering and Mathematics (STEM), should be considered as a strategic asset for a continent where European leading space-fearing nations, such as Italy, struggle to graduate a sufficient amount of skilled professionals needed to boost the growth of its aerospace and defence sectors. Open research remains a strategic asset and must be more systematically integrated into the overall space technology value chains, in a synergic way. A rising awareness in the EU on this topic is demonstrated by the fact that Horizon Europe, EU's flagship funding programme for research and innovation, when addressing the Open science concept states that knowledge, tools and results sharing must be "as open as possible, but as closed as necessary".[7] Despite these first steps, still much needs to be done to bring a mindset's change in Europe in order to protect more effectively research and technology innovation and excellences across the continent, notably when competing in a technology race with global powers that do not reciprocate even slightly such level of openness.

6.4 Balancing the quest for autonomy with international partnerships

The European and Italian space sectors face a critical challenge: balancing the pursuit of strategic autonomy with the benefits of global partnerships. While strategic autonomy is essential for safeguarding security, sovereignty and access to critical space infrastructure, pursuing complete independence is neither economically viable nor strategically desirable in an increasingly interconnected space environment. The reality is that no single European country, including major space powers like France, Germany and Italy, possesses the full spectrum of capabilities, technologies and financial resources to operate entirely independently. Rome, with its strong industrial base and expertise in launchers, satellite manufacturing, sensors and Earth observation, plays a key role in this balance, contributing to both European autonomy and international cooperation. The most sustainable way ahead involves developing autonomous capabilities in critical domains such as secure communications, navigation, space situational awareness and defence applications, while maintaining strategic partnerships with reliable allies for commercial activities, scientific research and access to emerging markets. This dual approach requires careful differentiation between areas where Europe must maintain full control (particularly defence and security-related applications) and areas where collaboration offers mutual benefits, such as climate monitoring, deep-space exploration and commercial satellite services. The challenge lies in ensuring that partnerships do not create dependency while simultaneously leveraging global cooperation to enhance Europe's competitiveness and technological leadership in the global space economy.

7 European Research Executive Agency website: *Open Science*, https://rea.ec.europa.eu/open-science_en.

Acronyms

AI	Artificial intelligence
AIT	Assembly, Integration and Test
APSCO	Asia-Pacific Space Cooperation Organization
ASAT	Anti-Satellite
ASF	Aerospace Force
C2	Command and Control
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance
CALT	China Academy of Launch Vehicle Technology
CAS	Chinese Academy of Science
CASC	China Aerospace Science and Technology Corporation
CASIC	China Aerospace Science and Industry Corporation
CASR	Commercial Augmentation Space Reserve
CAST	China Academy of Space Technology
CBERS	China-Brazil Earth Resources Satellite
CIC	Cambridge Innovation Center
CLEP	Chinese Lunar Exploration Programme
CNSA	China National Space Administration
COPUOS	Committee on the Peaceful Uses of Outer Space
COTS	Commercial Orbital Transportation Services
CPC	Communist Party of China
CRS	Commercial Resupply Services
CSICE	Cabinet Satellite Intelligence Center
CSpO	Combined Space Operations
DA-ASAT	Direct-Ascent Anti-Satellite
DARPA	Defense Advanced Research Projects Agency
DIUx	Defense Innovation Unit
DoD	Department of Defence
DoS	Department of Space
DRDO	Defence Research and Development Organisation
DSA	Defence Space Agency
DSRO	Defence Space Research Organisation
EDA	European Defence Agency
EDF	European Defence Fund
EEAS	European External Action Service
EO	Earth Observation
EOP	Executive Office of the President
ERS	European Resilience from Space
ESA	European Space Agency
EU	European Union
EUSPA	European Union Agency for the Space Programme
EW	Electronic Warfare
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FY	Fiscal Year
GEO	Geostationary Earth Orbit
GPS	Global Positioning System
iCET	Initiative on Critical and Emerging Technology
IDS	Integrated Defence Staff
IGMDP	Integrated Guided Missile Development Program
IGS	Information Gathering Satellites
ILRS	International Lunar Research Station
IN-SPACe	Indian National Space Promotion and Authorisation Centre
INCOSPAR	Indian National Committee for Space Research
IPMDA	Indo-Pacific Partnership for Maritime Domain Awareness
ISAC	EU Space Information Sharing and Analysis Centre
ISF	Information Support Force
ISR	Intelligence, Surveillance and Reconnaissance
ISRO	Indian Space Research Organisation
ISS	International Space Station
ITU	International Telecommunication Union
JAXA	Japan Aerospace Exploration Agency
LEO	Low Earth Orbit
LNG	Liquefied natural gas
MCF	Military-civil fusion
MEXT	Ministry of Education, Culture, Sports, Science and Technology
MFF	Multiannual Financial Framework
MIIT	Ministry of Industry and Information Technology
MNF OOD	Multinational Force Operation Olympic Defender

MoD	Ministry of Defence
MoU	Memorandum of Understanding
MPH	Multi-Purpose Habitation
MTCR	Missile Technology Control Regime
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NATO	North Atlantic Treaty Organization
NavIC	Navigation with Indian Constellation
NDPG	National Defense Program Guidelines
NDRC	National Development and Reform Commission
NETRA	Network for Space Objects, Tracking and Analysis
NGEs	Non-governmental Entities
NISAR	NASA–ISRO Synthetic Aperture Radar
NOAA	National Oceanic and Atmospheric Administration
NSC	National Security Council
NSIL	NewSpace India Limited
NSP	National Space Policy
NSS	National Security Strategy
NSTC	National Science and Technology Council
OTAs	Other Transaction Authorities
PFI	Private Finance Initiative
PLA	People's Liberation Army
PLASSF	People's Liberation Army Strategic Support Force
pLEO	Proliferated LEO constellations
PNT	Positioning, Navigation and Timing
QZS	Quasi-Zenith Satellite
RAF	Russian Space Forces
R&D	Research and Development
S&T	Science and technology
SAST	Shanghai Academy of Spaceflight Technology
SatCen	EU Satellite Centre
SATCOM	Satellite Communications
SBIR	Small Business Innovation Research
SDA	Space Development Agency
SDA	Space Domain Awareness
SDF	Self-Defense Forces
SDL	Space Dynamics Laboratory
SLV-3	Satellite Launch Vehicle
SMMS	Small Multi-Mission Satellites
SOEs	State-owned enterprises
SPDs	Space Policy Directives
SSA	Space Situational Awareness
SSF	Strategic Support Force
STEM	Science, Technology, Engineering and Mathematics
STTR	Small Business Technology Transfer
SUPARCO	Space and Upper Atmosphere Research Commission
SVOM	Space Variable Object Monitor
TRUST	Transforming the Relationship Utilizing Strategic Technology
UARCs	University Affiliated Research Centers
USSF	US Space Force

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