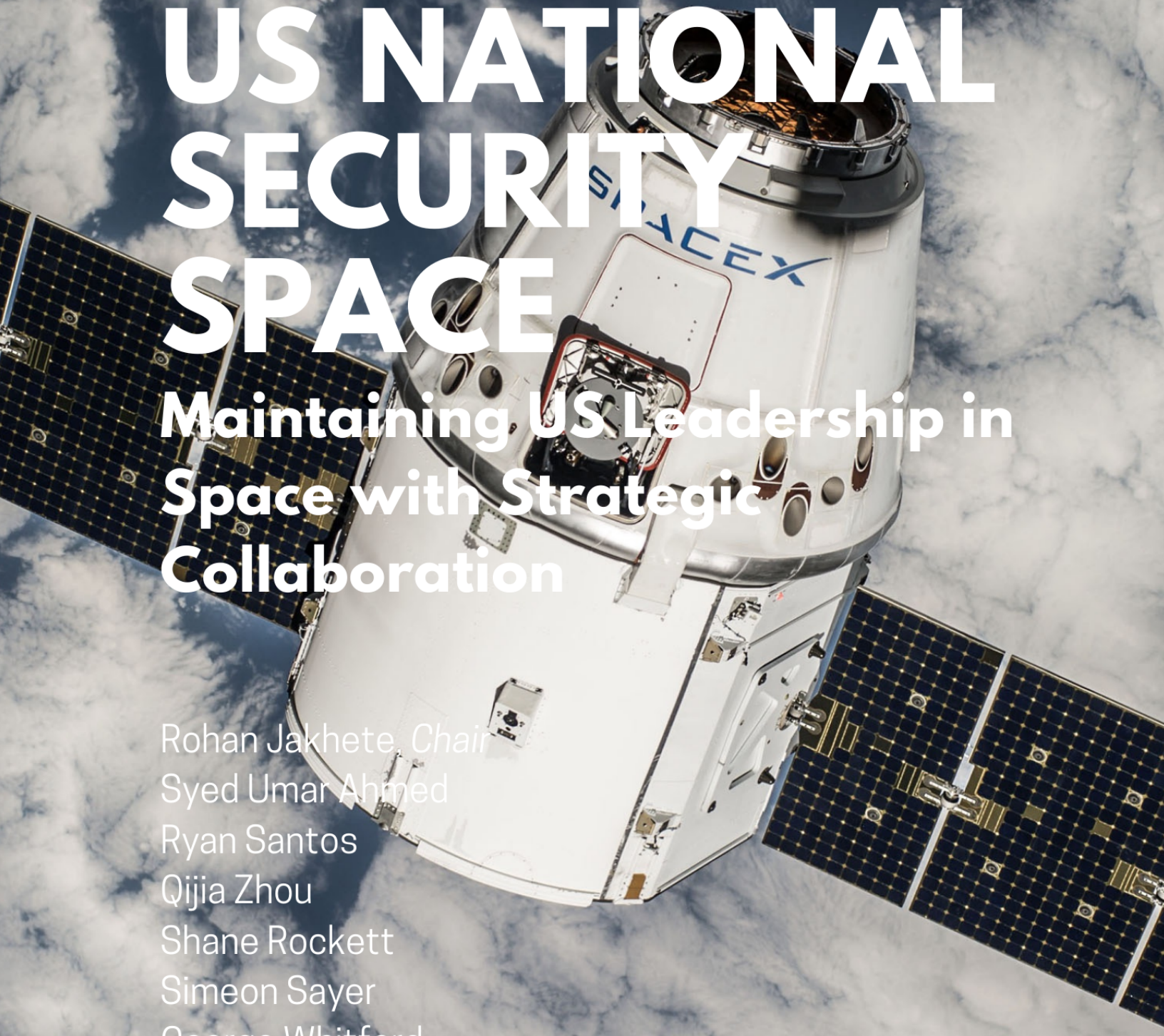
The Harvard Undergraduate Foreign Policy Initiative

# US NATIONAL SECURITY SPACE

## Maintaining US Leadership in Space with Strategic Collaboration

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**Harvard Undergraduate Foreign Policy Initiative (HUFPI)**

# US National Security Space:

## Maintaining US Leadership in Space with Strategic Collaboration

Strategies and Implications

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Achieving US leadership in space requires strategic collaboration both with the private sector and public sector. Maintaining US leadership in space is essential to setting the norms in a new domain, encouraging collaboration and further scientific advancements, and preventing the breakout of any conflict. With states such as China and Russia expanding their influence in space with potential for collaboration, it is necessary for the US to create strategic partnerships with entities that do not pose a risk to US national security. With this goal, in this paper, we propose a series of recommendations for strategic collaboration with the private sector in the US and foreign countries that do not jeopardize US national security interests. We close each section with a case study looking at SpaceX, India, and Japan.

**Ultimately, we realize for the US to lead in space, it must expand its reach within its private sector and strategically work with other countries.**

# Introduction

### 1) US Space Program

#### a) Private

The biggest players in private space travel are SpaceX, Blue Origin, and Virgin Galactic. Each of these companies have different goals and value propositions but compete in a very similar market space. This competition and products of these space companies are necessary in understanding how US private space companies play a role in US national security.

| | |
|---|---|
| SpaceX | • Founded in 2002, SpaceX was the first company to dock a spacecraft at the ISS. It developed rocket-landing technology which allows for controlled landings upon re-entry and decreases cost of travel thanks to reusable rockets.<br>• One of its goals is an uncrewed mission to Mars by 2024. They are currently beta testing Starlink, which is intended to deliver high speed internet to remote locations using a satellite constellation |
| Blue Origin | • Founded in 2000 by Jeff Bezos, Blue Origin differs from SpaceX in its focus on commercially viable space tourism. |

| | |
|---|---|
| | • Blue Origin's New Shepard rocket can be landed, and they intend to begin human flights soon<br>• Blue Origin received funding from NASA's Flight Opportunities Program for moon gravity simulation by turning its New Shepard rocket into a centrifuge |
| Virgin Galactic | • Focused primarily on space tourism. Launches their vehicle not from the ground as Blue Origin and SpaceX do, but from a jet airplane<br>  ○ Delayed Spaceship 2 flights, pushing their goal of tourist flights to 2022. |

Figure 1. Review of US Private Space Companies

**b) Public**

The US public space program has an intuitive relationship with national security. As space has become more geopolitically important, the US has started to move away from its previously open space practices. For context, even during the Cold-War, the US would cooperate with the Soviet Union on space projects. Following the space race, the 1975 Apollo–Soyuz mission marked the beginning of a period in which the US and the Soviet Union normalized cooperation in space.

Today, the US has decided that this type of cooperation with our rivals is not in the US's interest. Following multiple instances of Chinese espionage in civilian space work, the US blocked all bilateral cooperation with China without explicit approval from Congress. It should be noted that multilateral cooperation is not banned, just bilateral cooperation. The intent is to prevent the transfer of dual-use technology that China can use militarily in space.

With that, the biggest security threat that comes from the US public space program is the unintentional transfers of sensitive technology. Even after the passage of the Wolf Amendment, Chinese nationals have repeatedly been caught trying to take sensitive US technology. Beyond China, this highlights a significant national security threat from within the public space program. So much technology that is used for civilian space exploration can also be used to improve military rocket technology (especially Anti-Satellite Weapons).

The problem is, while the US doesn't cooperate much with China, it does cooperate with many other countries. For example, the US and Russia are very active partners, with both countries being mainly responsible for the development of the International Space Station (granted, the relationship seems to be deteriorating).

## 2) Foreign Space Programs

### a) China

China's space program is directed by the China National Space Administration (CNSA). China, since the inception of its space program, has resorted to copying the designs of other nations in order to reach their space objectives. In 1958, China reverse-engineered the Soviet R-2 short-range ballistic missile which led to their own development of ballistic missiles. China was then able to achieve nuclear capabilities in 1964.[1] Since Mao, China has pursued a military first approach to space, mainly to compete with Russia at first and later the US.[2] In May 1999, a report from the Select Committee on US National Security regarding China alleged that technical information provided to China for their commercial satellites resulted in improved Chinese intercontinental ballistic missiles.[3] China also became the third country to launch a human into space in 2003, and in 2011, the US Congress banned NASA from bilateral cooperation with China (a move that does not address multi-lateral cooperation).[4] Done to prevent the Chinese governments from stealing intellectual property from US based companies, this action has done little to curb China's space program.

China will continue is its trajectory of space development. We have seen mounting success from China in its development of new satellites, rockets and plans for a new space station and moon base. With the increase of spy satellite launches and cooperation with Russia, China has strategically implemented space technologies to surveil terrestrial behavior and assert its place in space.[5] Since China has already started a search for water on the moon, they could potentially locate a water source by the time their collaboration with Russia yields a lunar base. Although collaboration is being framed as a purely scientific endeavor, there are underlying motivations for the push toward lunar occupancy. One main reason is to spread their influence in the

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[1] "China." *Nuclear Threat Initiative*, Apr. 2015 www.nti.org/learn/countries/china/nuclear

[2] "Decryption-Project 640: China's Super Anti-Missile Artillery Project Picture." *Decryption-Project 640*, History of the Second Research Institute of the Ministry of Aerospace Industry web.archive.org/web/20080510190021/ido.3mt.com.cn/Article/200609/show474021c30p1.html

[3] H.R. Con. Res. 463, 1998. https://archive.is/Zja5K

[4] H.R. Con. Res. 1473, 112th Cong. Rec. 112-10 (2011) (enacted) https://www.congress.gov/112/plaws/publ10/PLAW-112publ10.htm

[5] Howell, Elizabeth. "China Has 3 New Spy Satellites in Orbit after Long March 4C Launch." *Space.com*, Space, 19 Mar. 2021, www.space.com/china-yaogan-31-military-satellite-launch-march-2021.

international community, as they can be the first to access lunar resources. Although the US has done well in the space race, China is catching up with these implementations and their success in deploying the Tianwen-1 in Mars orbit.[6] As China's space program continues to develop, the US must be vigilant in China's pursuit of expanding its influence in the international community and improving nuclear capabilities with the use of new rockets. Due to the level of secrecy in which China operates, it is difficult to ascertain their level of progress and the US would do well to enter a limited collaborative effort with China.

### b) Russia

Since the collapse of the USSR in 1991 the Russian Space Program has become a diminutive relic of its Soviet predecessor. Russia's capabilities in space, however, still present substantiated challenges to US national security interests. Russia's current military doctrine outlines the "intention to place weapons in outer space" and perceives space as a critical warfighting domain in future conflicts.[7]

The potential use of space as theater for Russian military operations is based on preventing its adversaries from using their space-related infrastructure, primarily through jamming and radio interference as well as offensive capabilities against ground-based space infrastructures.[8] This is driven by Russia's ability to strike targets at virtually any orbit with a variety of launchers and launch facilities.[9] Russia's historical use of electronic warfare directed energy weapons, and rendezvous and proximity operations (RPO) also present highly effective counter space options. The wide range of Russia's abilities in space can be dangerously effective against US military systems which are dependent on space-based infrastructure for intelligence gathering, communications, navigation and early-warning missile detection systems.[10] The US's development of military space hardware has also exacerbated the Russian notion that strategic parity with the US is under threat and highlights the need to compete in the arena of space.

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[6] Jones, Andrew. "China's Tianwen-1 Lowers Its Orbit around Mars to Prepare for Rover Landing." *Space.com*, Space, 25 Feb. 2021, www.space.com/china-mars-tianwen-1-spacecraft-lowers-orbit-for-landing

[7] "THE MILITARY DOCTRINE OF THE RUSSIAN FEDERATION." *The Embassy of the Russian Federation to the United Kingdom of Great Britain and Northern Ireland*, The Ministry of Foreign Affairs Russia, 25 Dec. 2014, rusemb.org.uk/press/2029.

[8] Florian Vidal, "Russia's Space Policy: The Path of Decline?", *Études de l'Ifri*, Ifri, January 2021, https://www.ifri.org/sites/default/files/atoms/files/vidal_russia_space_policy_2021_.pdf.

[9] "Russia and Military Uses of Space." *Russian and Chinese Responses to U.S. Military Plans in Space*, by Pavel Podvig and Hui Zhang, American Acadmeny of Arts and Sciences, 2008.

[10] McClintock, Bruce. "Russia's National Security Space Strategy: How to Avoid Repeating History." *ISPI (Italian Institute for International Political Studies)*, ISPI (Italian Institute for International Political Studies), 11 Dec. 2020, www.ispionline.it/en/pubblicazione/russias-national-security-space-strategy-how-avoid-repeating-history-28335.

Rising competition from the US private sectors and China is slated to significantly curtail Russia's long held monopoly in the commercial launch market and alter Russia's agendas in space. Following the conclusion of NASA's Space Shuttle Program in 2011, Russia's Soyuz spacecraft had been the only available means of travel to the International Space Station. More economical options, however, from companies such as SpaceX will certainly end reliance on Russia's space infrastructure. While this has sparked renewed technological competition in the form of Avangard hypersonic missiles and the rapid development of the Sputnik V Covid-19 Vaccine - a tribute to Soviet space exploits - Russia has also pivoted to space as a platform to strengthen its influence as a geopolitical power.[11]

In particular, Russia has become more disinclined to collaborate with the US in space, recently rejecting a bid to join the American-led Artemis Accords. Conversely, Russia has agreed to establish a joint lunar research station and deep space data center with China. The agreed upon cooperation with China signifies Russia's ambition to oppose an American-led space order and provides an alternative system to which traditional US allies such as Turkey and Saudi Arabia, who have fledging space interests, may be tempted to join.[12] China and Russia are also engaged in a strategic partnership which allowed both nations to share military space technology and has most notably helped China build an early-warning missile detection system.[13] While Russia has long been a traditional adversary in space, its joint efforts with China - the foremost threat to greater US interests - could severely imperil US national security objectives.

### c) India

Beginning in the 1960s, NASA and the Indian Space Research Organization (ISRO) have had a strong collaborative relationship. In the 1970s, NASA and ISRO jointly designed the Satellite Instructional Television Experiment (SITE) to bring educational television shows to India's rural population. The project allowed for satellite technology and knowledge transfer from NASA to India, ultimately building the foundation for India's National Satellite System.[14]

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[11] Saragerova, Boryana. "Russia: Space Expansionism Anew?" *Global Risk Insights*, Global Risk Insights, 20 Oct. 2020, globalriskinsights.com/2020/10/russia-space-expansionism-anew/.
[12] Goswami, Namrata. "The Strategic Implications of the China-Russia Lunar Base Cooperation Agreement." *The Diplomat*, Diplomat Media Inc., 19 Mar. 2021, thediplomat.com/2021/03/the-strategic-implications-of-the-china-russia-lunar-base-cooperation-agreement/.
[13] Florian Vidal, "Russia's Space Policy: The Path of Decline?", *Études de l'Ifri*, Ifri, January 2021, https://www.ifri.org/sites/default/files/atoms/files/vidal_russia_space_policy_2021_.pdf.
[14] "'Bringing U.S.-India Space Cooperation to the Edge of the Universe' Special Address by U.S. Ambassador to India Richard Verma at the ORF Kalpana Chawl." *U.S. Embassy & Consulates in India*, 25 Feb. 2016, https://in.usembassy.gov/bringing-u-s-india-space-cooperation-to-the-edge-of-the-universe-special-address-by-u-s-ambassador-to-india-richard-verma-at-the-orf-kalpana-chawl/.

Since then, India has made great strides in space exploration and research. The ISRO successfully sent its first mission to the Moon in 2008[15] and to Mars in 2013.[16] India has led the way in developing cost-effective spacecraft and launch systems, such as the Polar Satellite Launch Vehicle (PSLV). The PSLV is extremely popular for launching foreign payloads, including many US commercial satellites.[17] Further collaboration with India on developing safe and economical space technology can make space more accessible to US commercial interests and research.

Although most of India's space projects have focused on space science and economic development, aggression from China has turned India's attention to space defense. China's 2007 ASAT test spurred India to develop its own ASAT technology, resulting in a successful test in early 2019. While India's ASAT test produced space debris magnitudes below the debris created by the Chinese test, it may exacerbate a worrying trend: ASAT testing is increasingly used as a deterrent for foreign ASAT attacks.[18]

In late 2019, the ISRO launched the Project NETRA (Network for Space Object Tracking and Analysis), India's first independent space situational awareness (SSA) system.[19] Project NETRA tracks space debris and potential space threats using terrestrial telescopes and radar, similar to the US Strategic Command's Space Surveillance Network.[20]

### d) Japan

For decades, Japan's space program had been predominantly focused on the development of civilian technologies. Japan's lengthy list of accolades in space has made the country one of the US's most advanced allies in the domain.

Notable achievements include:

- The Mitsubishi H-IIA rocket - a reliable launch vehicle.

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[15] Dooling, Dave. "Chandrayaan | Missions, Discoveries, & Facts." Encyclopedia Britannica, http://www.britannica.com/technology/Chandrayaan. Accessed 24 Apr. 2021.
[16] Dooling, Dave. "Mars Orbiter Mission | Indian Space Mission." Encyclopedia Britannica, http://www.britannica.com/topic/Mars-Orbiter-Mission. Accessed 24 Apr. 2021.
[17] Chandra, Prakash. "India-US Space Cooperation Set to Reach New Heights." *Hindustan Times*, 31 Aug. 2015, https://www.hindustantimes.com/analysis/india-us-space-cooperation-set-to-reach-new-heights/story-M3Aym5IbhRsQJYowCs6hSP.html.
[18] Tellis, Ashley J. "India's ASAT Test: An Incomplete Success." Carnegie Endowment for International Peace, https://carnegieendowment.org/2019/04/15/india-s-asat-test-incomplete-success-pub-78884. Accessed 24 Apr. 2021.
[19] Gill, Prabhjote. "India's New Space Warning System Will Also Keep an Eye out for Hostile Missiles." Business Insider, https://www.businessinsider.in/isro-project-netra-will-track-space-debris-and-hostile-missiles/articleshow/71286808.cms. Accessed 24 Apr. 2021.
[20] Rajagopalan, Rajeswari Pillai. *India and the US Are Expanding Their Space Cooperation*. https://thediplomat.com/2020/10/india-and-the-us-are-expanding-their-space-cooperation/. Accessed 24 Apr. 2021.

- HALCA - the first space-based mission in which multiple telescopes are used to study astronomical objects simultaneously.
- Hayabusa - the first asteroid sample return mission.
- Lunar probes SELENE and IKAROS - the first successful demonstrations of solar sail technology in space.

Japan has also been a valuable partner in US-driven space initiatives such as the International Space Station and more recently the Artemis Program, which aims to land the first woman and the next man on the Moon.[21] The 1978 Fundamental Policy of Space Activities outlines that Japan can only make peaceful use of space for non-offensive purposes. However, rising threats from China and North Korea have underscored the reliance of Japan's national security on space-based technologies. Since 2003, Japan has been developing a constellation of information-gathering satellites (IGS) that have been used by Japan's Self Defense Forces as well as other government entities.[22] Space capabilities such as these have allowed Japan to collaborate with the US on Space Situational Awareness (SSA), where both countries have worked together to locate space debris and protect against anti-satellite weapons that could threaten assets in spaces.[23] This is in line with the traditionally strong network of information sharing between the nations.

In 2020, Japan established a new space operations squadron and outlined ambitions in its Basic Plan to increase cooperation with international partners while increasing its strategic autonomy to achieve superiority in space.[24] Albeit Japan has yet to join the US, China, or Russia in their ambition to potentially weaponize space, Japan has increased the use of space as a domain of national security. Many of Japan's civilian and commercial capabilities can be utilized for military purposes. For example, the Hayabusa-2 space probe fired a 'bullet' into an asteroid, creating a crater and collecting subsurface samples while many of Japan's advanced capabilities in dealing with space debris could be utilized in counter-space operations against adversaries.[25] A staunch ally since the end of World War Two, Japan will continue to be a valuable partner of the US in space and will need to effectively leverage space in order to remain a leader in the world.

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[21] Japan is one of eight countries to join the program. One of the prerequisites of the program was the signing of the Artemis Accords - an international agreement that outlines the peaceful principles for cooperation in the civil exploration of celestial bodies. The accords are based on the 1967 Outer Space Treaty and have been criticized by Russia.
[22] Fatton, Lionel, "Japan's Space Program: Shifting away from "Non-Offensive" Purpose?", *Asia Visions*, No. 115, Ifri July 2020.
[23] Onoda, Masami, and Kimitake Nakamura. "The U.S.-Japan Space Partnership: A Shared, Evolving Mission." Sasakawa USA, Sasakawa USA, 10 Dec. 2020, spfusa.org/event/the-u-s-japan-space-partnership-a-shared-evolving-mission/.
[24] Fatton, Lionel, "Japan's Space Program: Shifting away from "Non-Offensive" Purpose?", *Asia Visions*, No. 115, Ifri July 2020.
[25] Pekkanen, Saadia M. "Japan's Space Defence Policy Charts Its Own Course." *East Asia Forum*, East Asia Forum, 18 Jan. 2021, www.eastasiaforum.org/2021/01/18/japans-space-defence-policy-charts-its-own-course/.

# US x Private Sector

The privatization of Space is two-fold. The militarization of space has introduced the private contractor culture to the industry that is so ingrained into the US defense system.[26] Additionally, the newfound development and accessibility of private orbit capable rocket-based technology has stimulated a market for space related parts and technologies for private objectives.[27]. As each new player enters space, it becomes easier and cheaper for the next to do so.[28] There is now a steady demand for private space companies and their services, and they will continue to supply.

Perfecting the harmony of the US and these emerging sectors is critical for national security. Unlike nuclear technologies, it is not possible for the US to keep space technology a state secret. The free market has its eyes set on space, and it will get there with or without support from the US. In order to maintain an advantage over China and Russia, the US needs to embrace and lead the privatization of space, with policy and programs to support space capable businesses. In being first, the US is in the best position to push for international policy agreement for private interaction in space that favors national security interests. This section will explore how the US can best position itself to explore these future private space capabilities, as well as exploring present opportunities offered by technologies like Starlink.

**Recommendation: Increase demand for space.**

**Method**

- Diversify space objectives by setting clear goals for the nation and the world in space
- Generate more national incentives and programs for different types of space objectives, i.e. outside of conventional exploration (NASA), allowing companies to fill that gap and innovate around creating solutions
- Allows more space project to be under the umbrella of "US government sponsored projects" rather than full private sector development, which could be useful while the international recognition of fully private entities in space

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[26] Macias, Amanda. "Space Force General Says Success of Private Companies like SpaceX Helps U.S. Secure the Space Domain." CNBC, 3 Feb. 2021, www.cnbc.com/2021/02/03/space-force-general-america-owns-space-with-help-from-elon-musks-spacex.html.

[27] Reportlinker. "The Global Space Propulsion Market Size Is Projected to Grow from USD 6.7 Billion in 2020 to USD 14.2 Billion by 2025, at a CAGR of 16.2% from 2020 to 2025." PR Newswire, 16 Oct. 2020, www.prnewswire.com/news-releases/the-global-space-propulsion-market-size-is-projected-to-grow-from-usd-6-7-billion-in-2020-to-usd-14-2-billion-by-2025--at-a-cagr-of-16-2-from-2020-to-2025--301153871.html.

[28] "Space Launch to Low Earth Orbit: How Much Does It Cost?" Aerospace Security, 2 Sept. 2020, aerospace.csis.org/data/space-launch-to-low-earth-orbit-how-much-does-it-cost.

remains hazy - firmly places them under US protection, and offers incentive for new private entities to be allied to the US
- These objectives could be enabled by non-conventional space players within the US government - i.e. other than the Department of Defense

**Financial Programs**
- Offer incentives for companies to have interest in space and contribute to the development of the private space infrastructure
- Not just rocket companies, but encourage relevant companies to develop a "space activities department"
- This support could come from direct purchase from the US government, grants, tax incentives, use of US space infrastructure

**Reasoning**
- In order to facilitate collaboration between the US and the private sector, the private sector must be stimulated so that there is something to collaborate with
- Having a rich private sector will stimulate education in space related fields, and enable the training of the next generation of space capable engineers and scientists and the necessary pressure for universities to adopt these fields into their curriculum

**Recommendation: Create a general use framework for utilization of the private sector.**

**Method**
- Public works ground projects
    - Space should be treated like any other mode of transport. For cars there are state highways, for boats there are national ports and public use lighthouses etc.
- In similar vein, there should be private accessible space ports – it is not viable for every company to develop its own launch site
    - While there has been some leasing of government sites for the use of private companies (SpaceX's launch complex 39a)[29], these are bespoke arrangements - a more standard model for the creation and access to these facilities would ease development of private space launch capabilities
    - Private works projects

[29] Society, The Planetary. "SpaceX Launch Pad 39A." The Planetary Society, 12 Nov. 2020, www.planetary.org/space-images/spacex-launch-pad-39a.

    - There should be incentives for companies to develop these frameworks as part of their business
    - The US could subsidize the operations of such businesses in return for offering access to their facilities at a reasonable price
    - Such subsidies already exist with payloads (private satellites can receive state funding)[30], but should be expanded to launch capabilities
- Open framework space projects
    - Vessels like the Lunar Gateway[31] should be designed to work with private entities
    - All government space projects should be designed for use beyond the mission to facilitate third party integration or reuse of design for private objectives
    - US should consider designing general purpose space vessels whose sole purpose is to assist the private sector - the "pilot boats" of space operations

**Reasoning**

- While there is a gray area in international policy and recognition of private entities in space, the closer the US can keep the private sector to the existing government framework, the better
    - Provides a blanket protection against inter satellite aggression or foreign interference
- The best way to keep the private sector close is to build useful frameworks for it to use, otherwise it will venture on its own, or with the assistance of other countries
- This may be expensive, but will ensure that the US stays (and attracts others to) the international hub for space activities, and slows private entities being lured by other nation's incentives, as can occur in an open market
    - Maintaining this position stimulates US industry, and reduces the influence of foreign space powers

**Recommendation: Support international private sector stimulation.**

**Method**

- The US could allow for private companies to collaborate on space projects from outside the US

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[30] Sheetz, Michael. "SpaceX's Starlink Wins Nearly $900 Million in FCC Subsidies to Bring Internet to Rural Areas." CNBC, 7 Dec. 2020, www.cnbc.com/2020/12/07/spacex-starlink-wins-nearly-900-million-in-fcc-subsidies-auction.html.
[31] NASA. "Gateway." NASA, www.nasa.gov/gateway. Accessed 21 Mar. 2021.

- The US could allow for the exportation of private space launch technologies (SpaceX etc.) to friendly countries to promote allied space interests
- Could use the "Fighter Jet" model of diplomacy, where certain models are available to be exported to friendly countries

**Reasoning**

- As space technology becomes more and more common, other nations will likely develop their own space industries
- By providing the access via the private sector for other countries to go to space, the US can use it as leverage to push foreign countries to follow space law frameworks that are advantageous to the US and its interests
- Can push for exclusivity, which could be used to combat future Chinese rocket export technology programs

## CASE STUDY: Space X

- Competitors exist, but Starlink is the frontrunner for satellite-based broadband internet by far. By leveraging SpaceX's ability to cheaply launch satellites into orbit, Starlink has already reached operational capacity, but not on a global scale yet.[32]
- From the perspective of internet-controlling regimes**,** Starlink presents a threat to countries which block or monitor their citizens' internet usage because an American company will be capable of selling access to unblocked internet anywhere on earth and thus circumventing internet controls.
- The Great Firewall of China is an example of the internet controls that could be circumvented via Starlink.
    - In the past, Chinese citizens were able to bypass the Great Firewall by using virtual private networks (VPNs) to route their internet traffic through foreign servers. However, President Xi's 2015 crackdown on VPNs has increased the Chinese government's ability to detect and block unauthorized VPN use.
    - Unlike VPN, Starlink does not require the user to go through their domestic internet to connect. Users simply need a small physical terminal, which is much harder for the government to regulate, making Starlink a stealthier, more practical method to access the open internet.[33]

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[32] Weinzierl, M., Lucas, K., & Sarang, M. (2020). SpaceX, Economies of Scale, and a Revolution in Space Access. Harvard Business School, 9-720–027, 1–28. https://www.hbs.edu/faculty/Pages/item.aspx?num=57679

[33] Newman, Neil. "Starlink: a Game-Changer for China's Great Firewall and Hedge Funds." South China Morning Post, 21 June 2020, www.scmp.com/week-asia/opinion/article/3089854/elon-musks-starlink-game-changer-chinas-great-firewall-and-hedge.

**What courses of action might Russia and China take?**

- Russia has already denounced Starlink, and the Duma has deliberated whether to fine Starlink users.[34] The Russian space agency, Roscosmos has also unveiled plans to launch a rival broadband-providing constellation, Sfera (Sphere)[35]
- China may use market-controls to pressure SpaceX into denying service completely within their borders or at least applying internet controls to service for Starlink users in China.
    - For example, China may punish Tesla by restricting sales should SpaceX refuse to comply.
    - Both Russia and China could ban the purchase or use of Starlink terminals, which would prevent users from legally accessing the satellite signal.
    - China will also be developing a national telecommunications constellation, "StarNet", as part of their 5-year plan. Taking a page from their Huawei playbook, this project may attempt to undercut global competitors by using state financing.[36]

**Recommendation: Subsidize the development of untraceable terminals.**

- Users illegally connected to Starlink within repressive regimes would be putting themselves at risk of signal tracing. If there exists a method to develop terminals whose signal would be hidden from authorities, SpaceX will not develop it on their own. Simply put, it wouldn't be worth it for them to research and develop undetectability in terms of ROI.
- The US should consider the geopolitical benefits of unblocked internet access to citizens within Russia and China. Accounting for this political externality, **the US should subsidize research into an untraceable terminal,[37] which citizens could use within their borders at little risk of being caught by authorities.** [38]
    - This assumes that Starlink will withstand the pressure and agree not to disable internet usage within these countries' borders. In order to ensure Starlink compliance, the US could offer the subsidy on the condition that Starlink agrees to provide internet over Russia and China.

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[34] Berger, E. (2021, January 12). Russia may fine citizens who use SpaceX's Starlink Internet service. Ars Technica. https://arstechnica.com/science/2021/01/russia-may-fine-citizens-who-use-spacexs-starlink-internet-service/
[35] TASS. (2020, October 28). Russia to start deploying new cluster of Sfera next-generation satellites from 2021. https://tass.com/science/1217351
[36] McGill, M. H. (2021, March 16). China's on a mission to dominate space internet. Axios. https://www.axios.com/china-spacex-satellite-broadband-starlink-7ed34084-c8a6-4a46-894e-c33dbdec2bd7.html
[37] May need to consider possible regulations from the FCC with this.
[38] This idea was presented to the analysts by Dr. Herb Lin, senior research scholar for cyber policy and security at the Center for International Security and Cooperation and Hank J. Holland Fellow in Cyber Policy and Security at the Hoover Institution. He has expressed willingness to speak further upon request.

- Additionally, **the US should purchase a certain amount of bandwidth from Starlink and provide it to potential allies at little or no cost while subsidizing or gifting terminals.**[39] As an example, the US will be able to provide African nations at risk of falling into China's sphere of influence with free internet provided by Starlink and paid for by the U.S. Government.
    - The ability to provide internet globally represents an opportunity to deliver foreign aid directly to those in need, rather than the middleman of a potentially inefficient third party. Providing unblocked internet will work towards winning hearts and minds for the US cause.
    - Additionally, the free flow of information and ability to organize via unblocked internet will support democratic development and inclusive institutions.

# US x Foreign Governments

We assess that strategic collaboration with the international community will result in US dominance in space. The US will need to work with other nations to combat the rise in Chinese and Russian collaboration. Cooperation with other nations enables the US to control the transfer of technologies, tackle the issue of space debris, and deescalate potential space conflicts, inadvertently or not. We assess that strategic partnerships with certain nations will lead to favorable terms for the US, including an increase in situational space awareness which benefits the international community as well. As the US looks to assert its dominance in space, we recommend implementing the following strategies:

In order to secure US interests, we must analyze what our allies and competitors are currently working on and devise strategies that build favorable partnerships and secure our military and civilian operations in space.

**Recommendation: Implement a proactive approach for other nations to join the Artemis Accords.**

- There are currently only eight countries in the Artemis Accords including the US. The other countries include Australia, Canada, Italy, Japan, Luxembourg, UAE and

[39] The analysts were presented this idea by Jason Blackstone of Yarbrough Blackstone PLLC. He has also expressed his willingness to discuss further.

the UK. It is vital that the US pursues other nations to ensure that space is governed by democratic principles.[40]

    - **India:** The Indian Space Research Organization (ISRO) has entered a partnership with NASA to explore Mars further, which opens the door for further discussions and negotiations. India shares US democratic principles and has had successful space missions.
    - **South Korea:** The Korea Aerospace Research Institute (KARI) partnered with NASA in 2016 and created a lunar exploration program. They will be using SpaceX's Falcon 9 to carry the mission forward which presents an opportunity for the US to approach the South Korean government.
- If countries are not willing to join the Artemis Accords, the US must display its implied incentives to existing Artemis members to attract other nations. We must create an expansive bloc that curbs any progress that a collaboration between China and Russia space programs will make.
    - By displaying the benefits other nations are receiving through the leadership of the US, we can create an attractive program for other nations to join.
    - Potential benefits include rockets and satellites as well as collaboration on scientific research that can assist with their space program.
- The Wolf Amendment gives China the opportunity to challenge the US's leadership in space exploration and governance. By prohibiting direct cooperation with China, the US engages with the international community with a glaring blind spot.

**Recommendation: Open a limited but sustained channel of communication with China's space program.**

- Although our main competition is with China and Russia, there should be a level of cooperation that is limited in its exchange of ideas and information.
- The US must understand that China will continue to move ahead in its operations regardless of collaboration. Isolating ourselves from China puts us in a precarious situation because we will not have any insight into the Chinese space program.
    - There should be minor collaboration between NASA and CNSA that limits the amount of information that the US offers to China but allows them to invite us to their table when discussing matters of space with the international community.
    - Engaging with China in a limited capacity enables further collaboration with other nations. Our current approach has secluded US officials when

[40] 13, Jeff Foust — October, and Jeff Foust. "Eight Countries Sign Artemis Accords." *SpaceNews*, 13 Oct. 2020, spacenews.com/eight-countries-sign-artemis-accords/

the international community is invited to China, creating a distance between the US and other nations.

- The US must clarify its intent and pursue more limited cooperation to prevent unnecessary escalation.
    - As China continues to pursue ASAT development and the US loses touch with China's civilian space program, the odds of a space conflict arising by accident (due to debris destroying sensitive satellites) increase significantly.[41]
    - It is in the interest of national security to ensure that the US and China are transparent with one another about space situational awareness.

**Recommendation: Increase collaboration on satellite management and space debris.**

- Space has become an increasingly vulnerable domain for escalation, running a serious risk for unnecessary escalation if communication does not exist.
- As satellite space lowers and the amount of debris increases (whether it be from ASAT tests or defunct satellites), collisions become much more likely. This poses a serious national security risk to the US for two reasons:
    - **Debris accidents could be devastating to US capabilities.** Satellites that are used for civilian, military and intelligence matters are vulnerable to catastrophic damage. If one is destroyed, that raises the risk more satellites will be hit, making the situation in orbit more perilous. [42]
    - **It raises the risk of a conflict because of miscalculation.** Due to the fragility and importance of assets in orbit, countries, including the US, have an incentive to use space weapons immediately if they suspect that they are being attacked.

**Recommendation: The US must clarify its intent with both China and the international community – ideally through limited civilian cooperation.**

- In the long term, the US needs to make a choice regarding its overarching strategy in space. If cooperating with China is so much of a threat that they cannot be cooperated with at any level, then the US needs to think about seriously limiting cooperation with its allies.

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[41] Weeden, Brian. "Current and Future Trends In Chinese Space and Counterspace Capabilities." *Étude De L'Ifri Proliferation Papers*, vol. 62, Nov. 2020.
[42] "The Current State of Space Debris." *The European Space Agency*, 10 Dec. 2020, www.esa.int/Safety_Security/Space_Debris/The_current_state_of_space_debris

    - The Wolf Amendment has only served to decrease the US's control of technology transfers to China and has made it harder to understand the role and intent of China's civilian space sector. [43]
    - Mutual cooperation allows us to see how China is using certain technologies and lets them see the same for us. That minimizes the confusion about the potential for dual use in certain space technologies.
    - China regularly cooperates with our allies, who have access to our technology. At best that means the message the US is sending has no weight to it, as China can still access important space technologies. Thus, the US must rethink its most basic assumptions about the role of space cooperation as a diplomatic tool.
- Ambiguity in space benefits no one. Dominance, in the traditional sense, is not possible in orbit. Giving the impression that the US is universally trying to deny access to space increases the likelihood of an unwinnable conflict in space that spills down.[44]
    - Access is too important for our allies and enemies alike, and accidentally sending the signal we are trying to crowd them out only incentives other countries, like China, to invest in more developing ASATS.
    - The first strike instability of space means that, in order to ensure dominance in space, the US should minimize any incentives to develop ASATs and other space military technologies. Clarifying intent will allow the US to exert more effective leverage against those testing, increasing the odds that the US maintains its edge and more debris is not created.
- If space cooperation is too big of a risk, the US needs to limit transfers to its closest allies, who will not stop cooperating with China unless the US exerts serious pressure. This requires changing the very nature of international space cooperation and is not very realistic.

[43] Makena Young, "Bad Idea: The Wolf Amendment (Limiting Collaboration with China in Space)," Center for Strategic and International Studies, December 4, 2019, last modified December 4, 2019, https://defense360.csis.org/bad-idea-the-wolf-amendment-limiting-collaboration-with-china-in-space/

[44] Weeden, Brian, and Victoria Samson. "India's ASAT Test Is Wake-up Call for Norms of Behavior in Space." *SpaceNews*, 8 Apr. 2019, spacenews.com/op-ed-indias-asat-test-is wake-up-call-for-norms-of-behavior-in-space

## CASE STUDY: India

**Recommendation: Establish formal Space Situational Awareness (SSA) data-sharing agreement with India.**

- In the US, US Strategic Command (USSTRATCOM) keeps a global space surveillance network, which maintains a catalog of positional data for satellites in orbit.[45]
- USSTRATCOM has an SSA data sharing program. Currently, 20 nations are formally sharing data, as well as two intergovernmental organizations and 78 commercial satellite owners/operators/launchers.[46]
- India's Project NETRA is intended to strengthen their SSA system in the coming years.[47] Including India's SSA data can make our system more comprehensive.
- **For SSA, the more data collected, the better the accuracy.**
- Enhancing the SSA system through data partnership can:
    - Better track Chinese and Russian satellites and predict ASAT attacks from adversaries. An enhanced SSA system could also act as a deterrent for potential ASAT attacks.
    - Decrease the chance that an accidental collision would be interpreted as an ASAT attack. This would serve US interests to protect our assets in space, as well as prevent unnecessary and costly conflicts in space.
    - Prevent the creation of space debris.
    - Keep space safe for military, commercial, and scientific interests.

**Recommendation: Discourage future ASAT or space weapon tests in India (and other allied countries).**

- India-China tensions, both terrestrial and in space, pressure India to assert their strength in response to Chinese aggression.[48]
- However, continued escalation of ASAT testing could:
    - Increase space debris.
    - Encourage other countries that are not yet a space power to develop and demonstrate ASAT capabilities.
    - Escalate tensions between India and China. **While it would be in US interests to prove dominance over China, this feedback loop of**

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[45] "Space Situational Awareness." Space Foundation, https://www.spacefoundation.org/space_brief/space-situational-awareness/. Accessed 24 Apr. 2021.
[46] "USSTRATCOM, Polish Space Agency Sign Agreement to Share Space Services, Data." U.S. Strategic Command, https://www.stratcom.mil/Media/News/News-Article-View/Article/1811729/usstratcom-polish-space-agency-sign-agreement-to-share-space-services-data/. Accessed 24 Apr. 2021.
[47] Gill, Prabhjote. "India's New Space Warning System Will Also Keep an Eye out for Hostile Missiles." Business Insider, https://www.businessinsider.in/isro-project-netra-will-track-space-debris-and-hostile-missiles/articleshow/71286808.cms. Accessed 24 Apr. 2021.
[48] Tellis, Ashley J. "India's ASAT Test: An Incomplete Success." Carnegie Endowment for International Peace, https://carnegieendowment.org/2019/04/15/india-s-asat-test-incomplete-success-pub-78884. Accessed 24 Apr. 2021.

**testing and asserting strength is unlikely to result in effective deterrence.**

- Multilateral cooperation with India and other allies to decrease or ban ASAT testing can apply international pressure and reputation costs on China and Russia if they decide to continue testing. In general, the international community is supportive of peaceful use of space, so advocating for that ideal will increase international support for the US in the space arena.
- Formal data-sharing with India can increase the efficacy of the USSTRATCOM surveillance network, as well as increase India's confidence in its ability to defend itself from Chinese threats. Thus, there are less incentives to use ASAT testing as a deterrence method.

## CASE STUDY: Japan

**Recommendation: Support Japan's efforts at developing a more active defense and deterrence posture in space to ensure regional security.**

- Domestic legal, political, and budget constraints in Japan currently limit its activity in space to non-offensive purposes. Enhanced cooperation with the US is, therefore, critical to ensuring Japan's national security through space technologies.
- The development of Japan's strike capabilities using space technologies would be integral in defending against threats posed by China and North Korea, which could be accomplished without violating Japan's pacifist constitution.
- Likewise, space-based technology would play a vastly important role in any potential regional conflict and would help monitor regional flashpoints along the Korean Peninsula, South China Sea, and Taiwan Strait.
    - For example, Japan's Ballistic Missile Defense (BMD) system is dependent on space-based technologies as are positioning devices needed to locate adversarial and friendly forces.
    - Another example is Japan's Quasi-Zenith Satellite Systems (QZSS), which has been proven to be more precise than the US's Global Position System (GPS). Japan's Space Situational Awareness (SSA) capabilities have already allowed the US to cover blind spots over China and North Korea, and continued development in Japan's constellation of radar and optical information gathering satellites could increase security in the region.
- Developing Japan's abilities to defend itself via space would benefit the US's current strike capabilities in Japan under the Fifth Air Force and Seventh Fleet, as well as help monitor and protect US interests in Asia-Pacific.

**Recommendation: Establish greater collaboration on cost-sharing for capital-intensive projects and research and development of space-based assets.**

- Arguably the largest inhibitor to greater investment in space technologies are exorbitant financial costs, particularly for Japan which spends less than a percent of GDP on defense.
- The US should enter similar agreements with Japan as it has with the International Space Station and Ballistic Missile Defense (BMD) system. This cost-sharing agreement would lead to increased returns on investment and would be interpreted as more politically sound. Likewise, collaboration on cost-sharing initiatives could potentially galvanize Japan's growing private space sector and challenge China's emerging space ventures.
- Japan's strong automotive industry is emblematic of Japan's industrial might and expertise in developing cutting-edge technologies. Another avenue of cost-sharing collaboration could be in Japan's scientific and space exploration program with its research agendas.
    - The Japan Aerospace Exploration Agency (JAXA) is currently working on several projects that could be of benefit to US national security interests including the Super-low Altitude Test Satellite (SLATS), which is capable of tracking hypersonic glide missiles launched by China, as well as the orbital debris removal program, and space-based dual-band infrared sensors with early warning functions.

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# Appendix I

| | |
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| **On SpaceX and Starlink** | 1. Starlink aims to provide "high-speed, low-latency broadband internet" across the world through the deployment of many low-orbiting satellites. These efforts are especially aimed at rural and remote communities, where it is very difficult to access traditional internet services (Starlink).<br>**2.** By mid-2027, SpaceX plans to have up to 42,000 satellites in orbit. |
| **Space-Based Weapons** | Anti-satellite weapons (ASATs) and anti-ballistic missiles can be used to destroy satellites in orbit. While anti-ballistic missiles are typically launched from the ground to respond to an incoming missile, anti-satellite weapons can be released into orbit and then move itself into the orbit of another satellite, eventually either exploding near its target satellite or directly colliding with it. |
| **Maximizing US Leadership** | While the US has one of the most developed space programs and networks, it also means that it has more to lose during conflict or bargaining with other countries. In other words, reliance and investment into space technologies can simultaneously give us a strategic advantage in space as well as a disadvantage when evaluating our costs in conflict with another country. |

**Figure 1: Space-Based Technology**

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