**Statement before the House Energy and Commerce Subcommittee on Communications and Technology**

# *"Launching Into the State of the Satellite Marketplace"*

A Testimony by:

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Chairwoman McMorris Rodgers, Ranking Member Pallone, Subcommittee Chairman Latta, Ranking Member Matsui, and distinguished Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss space technology trends, the state of foreign competition in space and its security implications, and ideas for maintaining U.S. leadership in space. The Center for Strategic and International Studies (CSIS) does not take policy positions, so the views represented in this testimony are my own and not those of my employer.

I have the privilege of leading the Aerospace Security Project at the Center for Strategic and International Studies, where I examine these issues largely through a national security lens, drawing from my experiences working at a U.S. space technology startup, serving in the Department of Defense (DoD) guiding defense intelligence and security activities, and supporting the House Armed Services Committee.

Whether we realize it or not, space underpins many important technologies and services that we as Americans use in our daily lives and on which our safety and national security depend: from navigation applications in smartphones and financial transactions that rely on Global Positioning System (GPS) and communications satellites, to understanding changes in the environment such as weather forecasting and monitoring soil conditions for crop management.

The United States has long benefited—technologically, economically, societally, militarily, and diplomatically—from its dominance in space. But that advantage is eroding. The United States must take steps now—with urgency and purpose—to maintain that leadership before we are outmatched in space. We have a flourishing commercial space sector brimming with new technologies, innovative solutions, and talented entrepreneurs. The government's actions in domestic and export regulatory reforms, its strong investment in and use of commercial space capabilities, and its leadership role in international fora, are all necessary to ensure this sector remains an American source of strength and a competitive advantage.

## Commercial Space Technology, Economic Trends

It is an exciting time to be in the space community, especially with the confluence of technological advancements, commercial activity, and private investment. Space has become increasingly accessible to more government and commercial actors, with space-based capabilities and services being leveraged by a broader range of commercial, civil, and national security users and applications. According to the Space Foundation, the value of the global space economy was $469 billion in 2021, with other analyses projecting it will increase to over $1.25 trillion in annual revenue by 2030.[1] Over 90 percent of today's spacecraft are commercial.

[1] Space Foundation Editorial Team, "The Space Report," Space Foundation, July 27, 2022, https://www.spacefoundation.org/2022/07/27/the-space-report-2022-q2/; "NSR's Global Space Economy Report Projects $1.25 Trillion in Revenue by 2030," Northern Sky Research, January 27, 2022, https://www.nsr.com/nsrs-global-space-economy-report-projects-1-25-trillion-in-revenue-by-2030/.

I would offer five noteworthy trends:

- ***Diffusion.*** The diffusion of space technology—seen most prominently in the proliferation of small satellites that were once the size of buses and are now the size of microwaves and loaves of bread—is lowering the barrier to entry. This has been enabled by higher processing power on-orbit, lower cost of materials, and decreasing launch costs. These small satellites, which carry a variety of different payloads, can be developed and launched for a few million dollars, making space accessible to more nations, private entities, and universities.

- ***Commercialization.*** The commercialization of space capabilities that were once reserved for nation-states is enabling a wider range of uses and greater transparency. For example, unclassified, shareable data from commercial imagery satellites and radiofrequency signals collection satellites are contributing to maritime security through the detection of illegal fishing; environmental stewardship through understanding the impacts in the Arctic of ice cap melt; and business efficiencies through monitoring gas pipelines and oil storage inventories. Furthermore, it was this commercial data that allowed the United States to build allyship and implement the strongest sanctions in modern history against Russia over its invasion of Ukraine. Commercial companies are pursuing the next space age of technologies through on-orbit servicing, on-orbit manufacturing, and orbital-debris removal concepts – building satellites that function as "tow trucks" and "maintenance shops" that can maneuver towards and grasp other objects in space.

- ***Convergence of technologies.*** The convergence of space sensor data, automation and artificial intelligence (AI), and global distribution networks allows space data to be used faster, more effectively, and with less manual effort. However, this revolution is largely happening outside of government. Commercial companies do not operate within the same bureaucratic military service and agency stovepipes as the government. They can move with greater agility across functional lines, drawing from myriad sources of information at a massive scale (e.g., commercial satellite images, social media posts, and unencrypted radio messages), to deliver timely, fused information products and analytical insights that, with cloud and global communications networks, can be delivered anywhere on the globe.

- ***Private capital.*** The private capital being invested in the commercial space sector to fund research and development (R&D), launch, and operations. According to Bryce Tech, a space market analysis firm, 2021 was a record setting year for the number of start-up space deals (up 48 percent from 2020), with start-ups attracting over $15 billion in total financing.[2] This presents an opportunity for government users—who typically rely on taxpayer funded satellite programs—to leverage the space services developed with private capital to help meet their mission needs.

- ***Speed.*** The speed at which the commercial space sector is moving. I spent my career in national security space and was conditioned to expect satellite development and fielding to take 10 years and cost hundreds of millions to billions of dollars. Commercial space companies

[2] "Start-Up Space; Update on Investment in Commercial Space Ventures 2022," BryceTech, accessed January 30, 2023, 2, https://brycetech.com/reports.

are producing small satellites in months and even days. This has been key to proliferated LEO constellations, especially communications satellites. For example, SpaceX is estimated to produce six to seven Starlink satellites per day off its production line (to meet its objective of 12,000 satellites by 2024). This speed has the additional benefit of offering more on-ramps for new technologies and giving young STEM talent numerous opportunities to build new systems, rather than spend a decade on one system. This can also translate to agility once deployed, enabling commercial companies to rapidly iterate and quickly overcome obstacles.

I would emphasize that all these trends, while benefiting U.S. space companies, are also characteristic of the foreign space landscape. The United States cannot maintain a dominant position in each sector of the global commercial space marketplace without active steps to maintain U.S. leadership in space.

## Foreign Competition, Threats

Other countries recognize the national security, economic, and scientific benefits, as well as national prestige, that accompany being a space power. It is therefore not surprising that more than 85 nations are operating in space—from long standing space powers like Russia and France, to newer space players like the United Arab Emirates and Nigeria.[3] However, as the U.S. Department of Defense has articulated in its defense strategy, China is our "pacing challenge" and "most consequential strategic competitor."[4]

### *Competition from China*

China is currently pursuing the most expansive space program, and growth across its space and counterspace programs, that threatens to challenge us diplomatically, economically, and militarily. Chinese President Xi Jinping has articulated a "space dream" to make China the foremost space power by 2045, and lead by 2049. Aerospace was designated as one of 10 top priorities in Beijing's "Made in China 2025" strategic initiative aimed at achieving technological breakthroughs and boosting its innovation base.[5]

The advantages in space technology and dominant market share that the United States has long enjoyed is eroding as China's space capabilities rapidly grow in quantity and quality, accelerated by clear political will, government prioritization, and large state and private investments. According to an unclassified U.S. Defense Intelligence Agency (DIA) report, China doubled the number of satellites it has in orbit from 250 to 499 between 2019 and 2021. It has surpassed all but the United States in the number of space startups receiving funding, drawing 16 percent of

[3] "2020 Annual Report," Space Foundation, 2020, https://www.spacefoundation.org/wp-content/uploads/2021/07/SpaceFoundation_2020-Annual-Report_Final-Web.pdf.

[4] "2022 National Defense Strategy of the United States of America," (Washington, D.C.: U.S. Department of Defense, October 27, 2022) 4, https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF. .

[5] Karen M. Sutter, "'Made in China 2025' Industrial Policies: Issues for Congress," Congressional Research Service, December 22, 2022, 1, https://crsreports.congress.gov/product/pdf/IF/IF10964/9.

total global investment in these ventures.[6] In 2021, the U.S. National Geospatial-Intelligence Agency (NGA) assessed that China was the global leader in three of nine categories of commercial space-based imagery capabilities (best electro-optical (EO) persistence, best video, and best hyperspectral imaging across 20 or more bands). U.S. commercial providers maintained the lead in only three of the categories (best panchromatic resolution, best shortwave infrared, and best synthetic aperture radar (SAR) resolution).[7]

China's global space objectives have been incorporated into its Digital Silk Road (DSR) initiative, which involves a strategy of exporting terrestrial infrastructure, information and communications technology, and other high technology areas.[8] However, this expanding space network and dependency on Beijing comes at a price as Beijing seeks to translate its economic influence into coercive leverage and to acquire advanced technology for its own military advantage through licit and illicit means.[9] China's military-civilian fusion (MCF) policy blurs the distinction between civil/commercial sectors and military/defense industrial sectors. It facilitates the transfer of space-related technology and investments from the commercial sector to the military. Its national intelligence law, passed in 2017, requires that "all organizations and citizens shall support, cooperate with, and collaborate in national intelligence work… and shall protect national work secrets they are aware of."[10] For the U.S. aerospace sector, Beijing's "economic and industrial espionage against the United States continues to represent a significant threat to America's prosperity, security, and competitive advantage."[11,12]

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[6] Enabled by a 2019 National Development and Reform Commission (NDRC) policy directive that opened China's nascent space economy to private investors; "Challenges to Security in Space," (Washington, D.C.: U.S. Defense Intelligence Agency, 2022) 3, https://www.dia.mil/Portals/110/Documents/News/Military_Power_Publications/Challenges_Security_Space_2022.pdf.

[7] Theresa Hitchens, "After Satellite 'Olympics,' IC Retinks Wary Stance on Foreign Commercial Data," Breaking Defense, October 8, 2021, https://breakingdefense.com/2021/10/after-satellite-olympics-ic-rethinks-wary-stance-on-foreign-commercial-data/

[8] Makena Young and Akhil Thadani, "Low Orbit, High Stakes: All in on the LEO Broadband Competition," Center for Strategic and International Studies, December 14, 2022, https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/221214_Young_LowOrbit_HighStakes.pdf?VersionId=vH1lp3dD7VcHGRcvuF9OdzV2WJc_KG42; Peter Wood, Alex Stone, and Taylor A. Lee, China's Ground Segment: Building the Pillars of a Great Space Power (Montgomery, AL: China Aerospace Studies Institute, 2021), 62, https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/Space/2021-03-01%20Chinas%20Ground%20Segment.pdf; and "Full Text of White Paper on China's Space Activities in 2016," The State Council of the People's Republic of China.

[9] "Annual Threat Assessment of the US Intelligence Community," (Washington, D.C.: U.S. Office of the Director of National Intelligence, 2021), https://www.dni.gov/files/ODNI/documents/assessments/ATA-2021-Unclassified-Report.pdf; "Foreign Economic Espionage in Cyberspace," National Counterintelligence and Security Center, July 24, 2018, https://www.dni.gov/files/NCSC/documents/news/20180724-economic-espionage-pub.pdf

[10] William Evanina, Director of the National Counterintelligence and Security Center, Office of the Director of National Intelligence, "Keynote Remarks as Prepared for Delivery, International Legal Technology Association (ILTA), LegalSEC Summit," June 4, 2019, 2, https://www.dni.gov/files/NCSC/documents/news/20190606-NCSC-Remarks-ILTA-Summit_2019.pdf

[11] "Foreign Economic Espionage in Cyberspace," (Washington D.C.: U.S. National Counterintelligence and Security Center, 2018) 1, https://www.dni.gov/files/NCSC/documents/news/20180724-economic-espionage-pub.pdf

[12] A notable example is the 2021 conviction of a Chinese intelligence officer for economic espionage and theft of trade secrets from the U.S. aviation sector, who was part of a Chinese Ministry of State Security network that was

***Space threats***

Our adversaries know how vital space capabilities are to our military operations, our ability to project power, employ precision weapons, gather intelligence, and securely communicate. They seek these same benefits while also seeking to deny our use of space. CSIS captures these key trends in foreign threats to U.S. space capabilities in an annual Space Threat Assessment.[13]

In our 2022 report, we highlighted China's increasingly robust space capabilities, including advanced positioning, navigation, and timing (PNT); satellite communications (SATCOM); intelligence, surveillance, and reconnaissance (ISR) and missile warning; in-space logistics; and space situational awareness.[14] China's proficiency in areas like space-based imagery capabilities, paired with its advances in AI, means that it will be able to detect and locate U.S. forces from space in near-real time. China also has a robust arsenal of counterspace capabilities able to target U.S. space assets, ranging from cyber-attacks, to reversible GPS and SATCOM jammers, to direct ascent anti-satellite (ASAT) missiles and co-orbital satellites that kinetically impact their targets.

The use of such counterspace weapons is not hypothetical. In the war in Ukraine, commercial SATCOM enables Ukrainian forces to communicate while on the move and imagery satellites aid the identification of adversary forces, mapping of humanitarian evacuation corridors, and collection of war crimes evidence. Russia quickly targeted GPS, Starlink and Viasat through jamming and cyberattacks, aiming to shut down access to navigation and communications services.[15] As space capabilities increasingly show their value to national security, especially in areas like imagery and communications, adversaries will seek to deny their use.

China's accelerating space prowess and reach presents both economic and national security challenges. China's expanding space sector creates a competitive alternative in the global marketplace, oftentimes with attractive incentives and financing, that will steadily chip away at the market share enjoyed by U.S. companies. As highlighted in a 2021 European market assessment, "[W]hile the most advanced commercial space companies clearly remain Western companies, China is now leading the world in terms of number of commercial space companies being established."[16] On the national security front, the U.S. military's battlefield advantage has long rested on our superior technology. But that is at risk as Beijing seeks to close the gap in our technology advantage.

**LEO Broadband Competition**

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also targeting Europe's aerospace sector. Source: "Joint address by MI5 and FBI Heads," MI5, https://www.mi5.gov.uk/news/speech-by-mi5-and-fbi.

[13] "Space Threat Assessment," Aerospace Security Project, https://aerospace.csis.org/tag/space-threats/.

[14] Todd Harrison et. al., "Space Threat Assessment 2022," Center for Strategic and International Studies, April 4, 2022, https://aerospace.csis.org/space-threat-assessment-2022/.

[15] Kari A. Bingen et.al., "Russia Threatens to Target Commercial Satellites," Center for Strategic and International Studies, November 10, 2022, https://www.csis.org/analysis/russia-threatens-target-commercial-satellites.

[16] "Chinese Space Sector Continues World-Leading Post-Covid Rebound: Euroconsult Quarterly Report," Euroconsult, May 11, 2021, https://www.euroconsult-ec.com/press-release/chinese-space-sector-continues-world-leading-post-covid-rebound-euroconsult-quarterly-report/.

A particularly acute area of space competition is in commercial SATCOM, which CSIS recently examined in a study on low Earth orbit (LEO) broadband networks. U.S. and foreign companies are investing in large constellations of satellites—each comprising hundreds to thousands of satellites—that orbit the Earth at altitudes lower than 1,000 kilometers. These space-based broadband internet constellations offer a compelling solution for bridging the digital divide, where nearly 40 percent of the world's population remain unconnected.[17] In the United States alone, 28 percent of rural households (roughly 4.8 million Americans) remain unconnected.[18]

***Market opportunity***

The market potential for such connectivity remains high, as more consumers and businesses demand higher bandwidth, speed, and quality. The global SATCOM market is estimated to grow to $40 billion by 2030, largely driven by LEO-based ventures, with global subscribership increasing 11 percent in 2021—up to 3 million people—since the year prior.[19] For households and businesses in remote and hard-to-reach areas, where building dedicated ground infrastructure like cable laying and network tower construction is too expensive or infeasible, LEO systems can provide quality internet coverage. They can also boost the performance and resiliency of communications networks and fill gaps in service, whether due to routine outages, natural disasters, or conflict.

Space is becoming integral to enabling and maintaining terrestrial digital transformation. LEO communications systems will become increasingly integrated into terrestrial networks and will come to play a large role in facilitating internet service delivery, 5th and 6th generation cellular networks, cloud computing networks, and internet of things (IoT) systems. While the initial use-case for LEO SATCOM systems largely rests on broadband delivery, the universe of applications will continue to expand as the technology matures.

***Competition***

While U.S. company SpaceX was first to the large-scale market with its Starlink constellation, others like Amazon, with its Project Kuiper, are entering this burgeoning market. Internationally, extensive state-backed and private resources are being invested to establish LEO satellite constellations, with Canada's Telesat LightSpeed and newly merged OneWeb/Eutelsat as two example competitors. However, outside of western competitors, China's LEO broadband

[17] "Digital around the World," Datarportal, accessed January 31, 2023, https://datareportal.com/global-digital-overview.

[18] Emily A. Vogels, "Some Digital Divides Persist between Rural, Urban and Suburban America," Pew Research Center, October 19, 2021, https://www.pewresearch.org/fact-tank/2021/08/19/some-digital-divides-persist-between-rural-urban-and-suburban-america/; "QuickFacts: United States," U.S. Census Bureau, accessed November 18, 2022, https://www.census.gov/quickfacts/fact/table/US/HSD410220; and Elizabeth A. Dobis et al., Rural America at a Glance: at a Glance 2021 Edition (Washington, DC: U.S. Department of Agriculture, 2021), 10–14, https://www.ers.usda.gov/webdocs/publications/102576/eib-230.pdf.

[19] "State of the Satellite Industry Report," Satellite Industry Association, June 2022, https://sia.org/news-resources/state-of-the-satellite-industry-report/; Thibault Werlé et al., "LEO Satellites: A Technology to Revolutionize Global Connectivity?" Boston Consulting Group, June 1, 2021, https://www.bcg.com/publications/2021/leo-satellites-unlock-connectivity-opportunity.

initiatives, including its planned 13,000-satellite StarNet (or, GuoWang) constellation in LEO—part of a "national network"—pose the greatest competitive challenge and security risk to U.S. economic and national security interests.

LEO broadband initiatives receive top-down support from the Chinese Communist Party (CCP), are guided by state-owned enterprises (SOEs), and enjoy large tracts of funding, municipal government support, and regulatory leeway. In 2020, China's National Development and Reform Commission (NDRC) added satellite internet to its list of priority "new infrastructures," signaling increased investment and support for the burgeoning commercial sector. Adopted in 2021, China's fourteenth Five-Year Plan explicitly outlined the goal of establishing "a space infrastructure system for communication, navigation and remote sensing with global coverage and efficient operation."[20] Furthermore, in January 2022, Beijing's Space White Paper, released every five years, announced near-Earth orbit satellite systems as a priority focus.[21]

***What's at stake***

With its heavy economic presence in many Belt and Road Initiative (BRI) countries, China is positioned to negotiate regulatory concessions for its national LEO system while discouraging the adoption of U.S. commercial services. A combination of diplomatic maneuvering, the bundling of hard infrastructure and digital services, and attractive pricing will likely make it difficult for U.S. companies to compete with Chinese companies for market share in BRI countries. Further, the proliferation of Chinese LEO broadband services could boost Beijing's presence in foreign terrestrial networks, providing it with greater control over international data flows, allowing it to spread techno-authoritarian norms and standards, growing its voice in international governance and standards bodies, and granting it extensive intelligence and coercive powers.

Foreign customers of Chinese LEO broadband service should be aware that their data could be sent to Beijing, as was reportedly done to the African Union Headquarters, whose network infrastructure was built and operated by Chinese entities.[22] They should also assume that Beijing could surveil users and block internet access, exacerbating the risk that information is suppressed or censored. These security implications become more acute militarily. The war in Ukraine is showing the benefits of LEO broadband in providing secure communications for government leaders and military forces; transmitting intelligence, command and control, and missile warning data; and enabling civilians to maintain connectivity with the outside world. This underscores the importance of widespread, unrestricted, reliable services which can support citizens and militaries

[20] Xinhua, "中华人民共和国国民经济和社会发展第十四个五年规划和2035年远景目标纲要" [The Fourteenth Five-Year Plan for National Economic and Social Development of the People's Republic of China and Outline of the Vision for 2035], The State Council of the People's Republic of China, March 13, 2021, http://www.gov. cn/xinwen/2021-03/13/.

[21] Young and Thadani, "Low Orbit, High Stakes: All in on the LEO Broadband Competition."

[22] Abdi Latif Dahir, "China 'Gifted' the African Union a Headquarters Building and Then Allegedly Bugged It for State Secrets," Quartz, January 30, 2018, https://qz.com/africa/1192493/china-spied-on-african-unionheadquarters-for-five-years.

alike who need accessible information and communication channels, particularly in times of unrest.

***Challenges***

U.S. LEO broadband operators face several challenges domestically and in the global marketplace that may hinder their expansion and long-term viability in contrast to foreign competitors.

- ***Capital investment.*** Like Earth-based infrastructure, high capital investments are required to develop, launch, and maintain LEO constellations, as well as to build out the initial infrastructure of satellite manufacturing facilities, ground stations, and procure launch vehicles. McKinsey estimates the cost of deploying an operational LEO satellite constellation runs between $5 and $10 billion, with recurring operating and maintenance costs an estimated $1 to $2 billion per year more.[23]

- ***Regulations and licensing.*** Licensing and regulatory requirements are extensive, oftentimes opaque, and variable across different agencies. In the United States, space operators go to multiple regulatory agencies – the Federal Communications Commission (FCC) for spectrum, Federal Aviation Administration (FAA) for launch, National Oceanic and Atmospheric Administration (NOAA) for commercial remote sensing licenses, and the Departments of State or Commerce for exportability. Each federal agency has different processes, timelines, and positions. As the market analysis firm Quilty Analytics observed, "The most difficult aspect of building a [low Earth orbit] broadband system is acquiring the spectrum, not building and launching satellites… Navigating an onerous regulatory process—while also facing narrow profit margins and unforgiving business models of LEO broadband systems—can make it impossible for all but the largest, most well-resourced companies to obtain licenses."[24]

- ***Capacity and technical proficiency.*** Over the past two years, the FCC has received applications for over 64,000 new satellites (in contrast, only 6,800 functioning satellites are in orbit as of November 2022).[25] Regulatory agencies with jurisdiction over space and space-related activities are struggling to keep pace with this growth. Further, these agencies retain varying levels of proficiency on space-related matters, which has been exacerbated by the pace of technological change. Long regulatory approval timelines risk certain technologies being supplanted by the time approvals are secured.

- ***International structures.*** U.S. companies seeking to expand service to foreign markets face different national regulatory structures, complex requirements, market access restrictions, and

[23] Chris Daehnick et al., "Large LEO Satellite Constellations: Will It Be Different This Time?," McKinsey & Company, May 4, 2022, https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/large-leosatellite-constellations-will-it-be-different-this-time.

[24] Young and Thadani, "Low Orbit, High Stakes: All-in on the LEO Broadband Competition," 17.

[25] Federal Communications Commission, "Chairwoman Rosenworcel Announces Plan to Modernize the FCC by Establishing a Space Bureau and Office of International Affairs," press release, November 3, 2022, https://www.fcc.gov/document/chairwoman-rosenworcel-proposes-space-bureau; and "Space Debris by the Numbers," European Space Agency, updated November 7, 2022, https://www.esa.int/Safety_Security/Space_Debris/Space_debris_by_the_numbers.

high compliance costs, and are often at a disadvantage to national telecommunications companies. There is also a risk that asymmetric requirements between U.S. license holders and foreign-licensed companies with permission to operate in the United States may create an uneven playing field at home. U.S. companies often face protectionist barriers and a complex regulatory landscape when looking to expand into foreign markets.

**Recommendations**

Below are a few recommendations that I believe can help maintain U.S. leadership in space and position U.S. space companies to retain their competitive advantage internationally.

- ***FCC regulatory reform.*** As the FCC continues to play the dominant role in SATCOM regulations, it should take care to strike the appropriate balance between burdensome regulation and market development. This must be a continuous process, with regulations evolving as the market and technology evolves. Simple changes such as providing additional clarity and establishing defined approval timelines, adhering to deadlines on public comment periods, and opening communication channels with commercial companies submitting licensing requests can have an enormous impact as commercial competition and the pace of that competition intensifies.

- ***Export policy reform.*** Technology control policies are a barrier to innovation and hinder space cooperation with allies and partners, which we need to successfully compete against China.[26] International Traffic in Arms Regulations (ITAR) processes are lengthy, opaque, and do not adequately account for the diffusion of space technology and capabilities of foreign competitors. We need to find the right balance between protecting sensitive technology, recognizing Beijing's expansive efforts to acquire U.S. technology, and taking a broader view of our national security interests and the competitive advantage afforded by technology cooperation with allies and partners. Further, it is in the U.S. government's interest to have a vibrant commercial space sector bolstered by diverse revenue sources rather than being wholly reliant on U.S. government contracts.

- ***International coordination bodies.*** Working in key international coordinating bodies, like the International Telecommunication Union (ITU) (part of the United Nations), the government can support U.S. companies in the deconfliction of finite spectrum resources, and take a leadership role in setting emerging standards, norms, and best practices for operations in the space domain. The ITU could be a key partner for the United States and FCC in promoting common international norms and standards regarding shared spectrum. Notably, in 2022, a U.S. representative was elected Secretary-General of the ITU; previously the position had been held by China.

- ***Acquisition.*** The government should seek greater adoption of commercial space capabilities and services to support its mission needs, taking advantage of the speed, agility, and private

[26] William C. Greenwalt, "Twelve Problems Negatively Impacting Defense Innovation," American Enterprise Institute, January 26, 2023, https://www.aei.org/foreign-and-defense-policy/twelve-problems-negatively-impacting-defense-innovation/

capital being invested in them. It must figure out how to buy services from commercial space companies—e.g., LEO broadband services, remote sensing data, and space situational awareness data—instead of its traditional model of buying satellites that it owns and operates. It must do so on timelines relevant to the speed at which these companies can move rather than through sequential, multi-year requirements and acquisition processes (e.g., 12-18 months to set requirements, 18-24 months for proposal solicitations and reviews, and 6 months to bring the awardee on contract).

- ***Space Situational Awareness (SSA) / Space Traffic Management (STM) implementation.*** Encourage the Department of Commerce to be forward-leaning in its execution and resourcing of plans to provide a space safety service to commercial space operators, as required by a 2018 space policy directive. The U.S. government, international space actors, and commercial space operators will be increasingly reliant on SSA information to maintain awareness of the space environment: track space debris, identify threats and anomalous behaviors from noncooperative space operators (e.g., China and Russia), and avoid collisions. The scale and complexity are substantial: together, proposed LEO broadband constellations could add over 90,000 satellites into Earth orbit, well above the estimated 9,610 satellites that are in space today, of which 6,800 are still functioning. Additionally, roughly 29,000 pieces of debris are in orbit the size of a softball (or larger than 10 cm) and 670,000 objects the size of a pea (or larger than 1 cm), all of which can damage satellites traveling at 17,000 miles per hour.[27]

Finally, commercial space offers incredible soft power for the United States. It supports our Nation's policy objectives, helps allies and partners who need such capabilities, and it strengthens our innovation base. U.S. leaders should aim to increase soft power across the globe by working with U.S. companies that can provide commercial space capabilities and services, including satellite broadband internet, to address the security challenges of our allies and partners. The unclassified nature of commercial space capabilities and services make them well-suited to supporting a range of applications such as maritime and border security, humanitarian and disaster relief operations, environmental monitoring, and sanctions enforcement. The U.S. government should also incorporate commercial space into its security cooperation objectives. Our alliances and partnerships are a distinct competitive advantage that China does not have.

**Summary**

Our space capabilities are a source of military and economic strength, international prestige, technological innovation, and inspiration, drawing next-generation talent to fields in science and engineering. While the United States leads in space today, and American commercial space companies retain a dominant position in the global space economy, that position is not assured. Beijing is rapidly expanding its government and commercial space sectors, accelerated by political direction from President Xi himself, government-wide prioritization, large state and private investments, technology theft, and ready international markets primed through the BRI.
We must take urgent and purposeful steps to maintain our space advantage. Domestic policies and export regulations that help grow, strengthen, and maintain a diverse ecosystem of U.S. space

[27] "Distribution of debris," European Space Agency, April 16, 2023, https://www.esa.int/ESA_Multimedia/Images/2013/04/Distribution_of_debris.

companies are one critical element. Another element is the government's strong investment in and use of commercial space capabilities—across both civil and national security space—to augment and add resiliency to critical national security space systems. A final element should include the U.S. government continuing to lead in international fora, shaping the norms and standards that preserve the use of space for peaceful purposes.

Thank you again for your time today and I look forward to your questions.