SHIELD
by SOURCEREE

National Security Newsletter

July 2021

What's Inside

SOURCEREE

In our July 2021 SHIELD Newsletter, we dive deeper into an industry which is growing at astronomical rates – space. In the first article, we present how the concept of "space power" needs a shared definition to enable us to centralize the way we secure this new frontier and protect vulnerabilities across the growing space infrastructure. The Federal Aviation Administration's Aerospace Forecast highlights the real figures that place a spotlight on these growing vulnerabilities, specifically the increase in space launches as well as the increase in the need for public-private partnerships to foster a robust and valuable space program. Many private companies are joining what has historically been a solely government endeavor, taking advantage of the rapidly developing technology surrounding space flight. These developments translate into new markets for commercial space transportation and logistics, including manned flights, and opportunities to assist government agencies with their new and expanded mission sets. Key points from Morgan Stanley's Space Research Team on the 'New Space Economy' are that space security may be a truly non-partisan issue and there is a large market for emerging business in public-private partnerships – something we have seen in the last few months with the debut of high profile space-based special purpose acquisition companies (SPACs). We end with an analysis of China's tech-forward efforts in their Belt and Road Initiative (BRI) – in the form of the Digital Silk Road and Space Information Corridor. These extra-terrestrial efforts tie together China's global economic corridors and advance the potential to weaponize China's economic strategy by blurring the lines between military and civilian infrastructure.

-- Adam Murphy, Sourceree President

Could Redefining U.S. Space Power Mitigate the Risk of Space Logistics Degradation by the Threat of Space Weaponization?

Space Education and Strategic Applications Journal
Author: Ivan Gulmesoff
Spring/Summer 2021

This article outlines the necessity of an accurate framework for US space operations, starting with the 2001 Rumsfeld Commission's initial recommendations, including establishing a military space department. The US Space Force was established as an independent command in 2019, but we have yet to centralize our space infrastructure across private and public sectors. In this article, Gulmesoff lays out how our definition of space power influences our security and infrastructure for space-based logistical measures. As part of building a space industry, defining the way risk is evaluated will ultimately help to mitigate it. One example of the challenges to maintaining our security as we build out our space program is the interconnected civilian-military satellite communication infrastructure and the benefits and vulnerabilities it creates.

Select excerpts from the piece:

Unlike terrestrial logistics, space operations and the space environment's intricacies make logistics much more complex and demanding on supply chain management. In 2011 alone, 25 tons of supplies and equipment were transported to the ISS consisting of propellant, oxygen, water, food, spare parts, and medical equipment (Johnson 2011). By understanding this logistical complexity, vulnerabilities could be more easily evaluated to mitigate future space weapon attacks' damage. Johnson explains space logistics as (1, 2011) "the theory and practice of driving space system design for operability, and of managing the flow of material, services, and information needed throughout a space life cycle." Within this concept are multiple factors that could lead space logistics to become vulnerable to adversaries and hinder space logistics' effectiveness. For example, the logistics involved with the Shuttle and ISS have demonstrated multiple areas that could improve current space logistics' efficiency.

The lack of security measures increases vulnerability. Security measures could be introduced in many forms. The Rumsfeld Commission was assigned in 2001 to review all U.S. space activities as they related to national security. After a thorough review, what they determined was two significant recommendations were required for all U.S. space activities:

1. A centralized management of space programs and overall acquisition of space platforms for national security
2. Creation of a military space department when conditions allow

Due to the heavy reliance on space-based platforms for civil and military use, the U.S. must continually improve cyber-capabilities as the cyber realm is the most accessible way to effectively target space infrastructure.

While there is no universally accepted theory of Space Power, many concepts attempt to define and address space power. Below are a few key concepts of space power from various known authors on the topic to provide a better understanding. Each author varies in experience and

profession. Some are from military occupations (USAF), others are experts in the field, or scholars. The differences, similarities, and perspectives could shed light on familiar themes and gaps in the theory itself.

Table 1. Concepts of Space Power by Various Authors

Author	Definition of Space Power
Oberg, Jim	(9, 2010) "Space power is the combination of technology, demographics, economic, industrial, military, national will, and other factors to contribute to the coercive and persuasive ability of a country to politically influence the actions of other states and other kinds of players, or to otherwise achieve national goals through space activity."
Varni, Jamie et al.	(73, 1996) "Global space power involves the application of the full spectrum of force, physical and virtual, from space on demand to an adversary's means of pursuing the conflict."
Smith, M. V	(49, 2002) "Space power is not composed alone of the war-making component of space. It is the total space activity; civil, commercial, defense, and intelligence, potential as well as existing.
October 1999 USAF Doctrine Center Publication	(7, 2002) "Space power, like airpower, can place an adversary at a disadvantage. Space Power is a subset of aerospace power."
Lupton, D	(141, 2013) "space power is the ability of a nation to exploit the space environment in pursuit of national goals and purposes and includes the entire astronautical capabilities of the nation."
Swilley, S	(146, 2013) "space exploration, commercial space endeavors, and space enablers serve as the core space activities associated with space power. These three core space power activities serve three distinct national processes: innovation, prosperity, and security"

The U.S. Space Command (USSPACECOM) seems to have accepted Lupton's understanding of space power by prioritizing certain aspects of its vision for 2020. As Steele explains, four central tenants of USSPACECOM's vision: the control of space, global engagement, full force integration, and global partnerships (Steele 2001). The aspect that pertains most to Lupton's doctrine is the first aspect of USSPACECOM's vision. USSPACE1COM's control aspects include surveil1lance as well as protection that are both vital elements of space power.
The security of space logistics is dependent on the vigor and efficiency of the supply chain. The key to this dependency is the satellite command and control architecture (C2). The C2 is the primary control to uplink communication and downlink data to ground stations through antennas, transmitters, and receivers (DIA 2019). In addition to the C2, there are many variables associated with the supply chain and the space environment that can transport logistics very difficult,

leading to costly mistakes. As Andy et al. explain (35, 2006), "we have also come to learn that the path to optimizing operability and sustain1ability is by consideration of the entire supply chain." The strength of the supply chain directly relates to the success of space logistics and space operations in general.

According to the U.S. Space Policy, the space infrastructure is considered a vital national interest and must be protected (Weston 2009). The U.S. national interest in space has grown with the reliance and dependence on technological capabilities regarding communications, remote sensing, global positioning/navigation, broadband, and entertainment. As Georgescu et al. state, 90% of military communications are transmitted and routed through civilian satellite systems (Georgescu et al., 2019). This reliance by the U.S. military on civilian communication satellites and the U.S. infrastructure consisting of more satellites than any other state inevitably increases vulnerability. In 2009, the U.S.-owned 400 satellites worth over $123 billion out of the 900 active satellites in orbit (Weston 2009). However, an adversary could expose those vulnerabilities and render U.S. satellites or their associated space logistics useless or incapacitated by other means.

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FAA Aerospace Forecast Fiscal Years 2021-2041

Federal Aviation Administration
July 2021

The FAA is ultimately responsible for the safe operation of aircraft and spacecraft. In this article, we see that the number of tracked flights to space is increasing dramatically, despite the losses that the air industry faced during 2019-2020. There is a substantial increase to the number of launches to space, but more importantly, there is an increase to the number of businesses able to launch. This is in large part due to the accessibility of new technologies and lower costs associated with a space launch, but it also brings significant risks that haven't been fully evaluated yet as we continue to intertwine public and private investment in space logistics, technology, and spaceports.

Select excerpts from the piece:

Inspections and Enforcement

FAA currently conducts as many as 330 pre-flight / reentry, flight / reentry, and post-flight / reentry safety inspections per year. Inspections often occur simultaneously at any of the 12 licensed U.S. and international commercial space launch sites, as well as at 4 Federal launch ranges and 3 exclusive-use launch sites. The establishment of non-federal launch sites requires additional inspections in areas such as ground safety that have traditionally been overseen by the U.S. Air Force (now the U.S. Space Force) at Federal ranges. At spaceports and launch sites with high launch rates (e.g., Cape Canaveral Space Force Station, Vandenberg Air Force Base, the Mid-Atlantic Regional Spaceport, and Spaceport America), at least 80 percent of inspections are typically conducted by locally-based field inspectors. Additionally, as a result of the COVID-19 pandemic, many inspections in fiscal year (FY) 2020 were handled remotely. FAA will leverage this approach in the upcoming years in order to respond to a dynamic operational tempo, minimize cost, and increase efficiency.

FAA's Launch and Reentry Operations Forecast

There are several factors that magnify the challenges associated with predicting the number of launches and reentries to expect in a given year. They include:

- list of firms intending to launch or actually launch is dynamic
- continued development of new technologies
- launch rates for reusable launch vehicles
- commercial human spaceflight by both government astronauts and private citizens
- dynamic nature of flight test programs
- mishaps

The number of firms actively communicating with [the] FAA increased from 14 in 2014 to 68 in 2020, an increase of more than 380%. There are currently 23 active launch licenses issued by the FAA. Since the beginning of this year, there have been 32 FAA approved launches – 23 of which were SpaceX rockets.

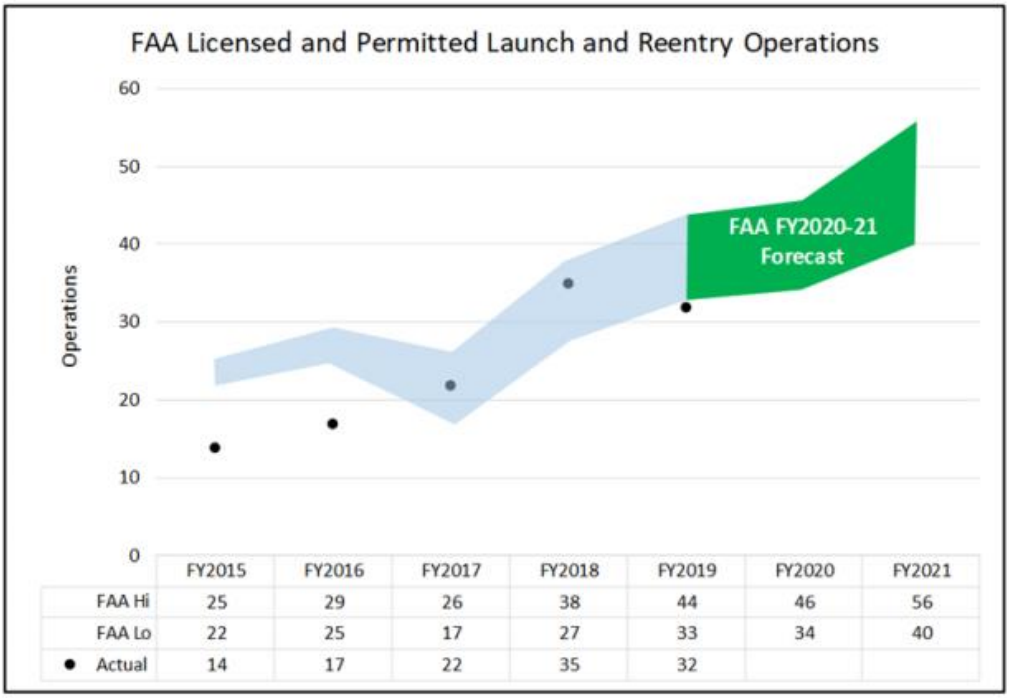
The commercial space transportation industry is exploring a variety of new technologies and new approaches to space launch and reentry. Both Blue Origin and SpaceX have successfully demonstrated the reusability of their vertically launched rockets, and in 2020 Rocket Lab successfully recovered a flown booster and announced their intent to re-fly it in 2021. These approaches allow for lower costs and more sustainable investments for private companies but may lead to mishaps if used before they are truly tested and ready.

New Commercial Launch Technologies and Operations are Emerging on an Accelerated Basis

Other U.S. commercial entities are also pursuing the development of reusable launch vehicles (RLVs). At the same time, state and local governments are joining with commercial firms to promote additional launch and reentry sites, and some firms are seeking to establish launch sites for their exclusive use. This added launch capacity sets the stage for simultaneous operations and an increase in the number operations per year.

New Markets for Commercial Space Transportation are Emerging

The continuing development of commercial space transportation technology has spurred new markets for commercial space transportation services. As private industry continues to develop and test new vehicles capable of space flight participants on suborbital and orbital flights, companies and organizations are proposing to offer human space flight training and several organizations have already begun to provide this service.



	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021
FAA Hi	25	29	26	38	44	46	56
FAA Lo	22	25	17	27	33	34	40
● Actual	14	17	22	35	32		

Note: FAA FY2020-21 Forecast Range finalized the second quarter of FY2020.

Since 2008, NASA has managed the Commercial Resupply Services (CRS) program, which acquires transportation services from commercial providers to deliver cargo to and from the International Space Station (ISS). In 2020, SpaceX successfully transported NASA astronauts to the ISS under the auspices of a Commercial Crew Transportation Capability contract – the first time humans have traveled to orbit under an FAA-license. Boeing is expected to do the same in 2021.

Looking further afield, there are several companies in the regulatory pipeline seeking authority to land commercial vehicles on the Moon, establish private-sector space stations, service satellites on-orbit, and establish launch sites using non-traditional technologies like railguns and tube launchers.

2021: A New Space Economy

Morgan Stanley Research
4 February 2021

As space becomes more accessible through lower costs, cloud based computing, and new manufacturing techniques, more and more companies are debuting in a sector that was previously only attainable for government organizations. Increasingly, private business has taken to the stars, offering new possibilities, and alleviating some of the workload from traditional government space agencies like NASA. Overall, space is more and more a business venture – from tracking orbital debris to providing broadband internet globally, the public sector is seeing the value provided by private business. In addition, Special Purpose Acquisition Companies (SPACs) will likely become more common as they are a particularly well-suited business model in space.

Select excerpts from the piece:

The rush to explore the expanding frontiers of the space economy is accelerating, with sustainability- and government-related applications driving critical growth and private investment.

"If I had to pick just three words to capture my conversations in this arena, it would be 'space is existential,' from the future of the planet to the future of commerce," says Adam Jonas, Head of the Morgan Stanley Research Space Team.

1. A growing relationship between space and climate change
Space and sustainability have aligned. With more investors focused on environment, social and governance (ESG) factors, satellite imagery may provide them with key data on the environmental impact of company activities. Satellite applications include monitoring greenhouse-gas emissions from companies and regions, helping utilities optimize renewable energy infrastructure and mining data to project how climate change could affect particular industries.

2. Increased capital formation
First, investors are rethinking "old" vs. "new" space. It's now less about the disruption and replacement of traditional players, and more about how the capabilities of new entrants complement them. "There's enough room for the exquisite legacy capabilities of aerospace outfits and the more affordable new commercial players," says Jonas.

Second, SPACs—special purpose acquisition companies—may be a potentially well-suited mechanism to attract capital for long-horizon business models in space.

Finally, the space industry now regards private corporate involvement in the sector more positively. As government entities like NASA set their sights on ambitious missions, such as Mars exploration, private companies are focusing on low-Earth-orbit transportation, satellite launches and commercial human spaceflight. Government agencies are also welcoming greater

involvement from the investment community to develop the commercial potential of space and space-related markets.

3. Mitigating orbital debris
According to the U.S. National Oceanic and Atmospheric Administration, the number of active satellites in orbit could increase by 50% or more in 2021. As space becomes more congested, the threat of "space junk"—orbital debris from old spacecraft and satellites—to new satellites and rocket launches has grown. Some government agencies now struggle to track this orbital debris, creating potential demand for private companies to monitor and manage this potentially catastrophic space waste.

4. Space and security
Space has become an increasingly contested domain among countries, underscoring the need for "space domain awareness" by private and governmental players. That means identifying, characterizing and understanding objects in orbit.

In the U.S., space could therefore become less of a partisan issue. Satellite providers, for example, see their services cutting across political lines to address issues important to everyone, including national security and bridging the digital divide.

5. Telecoms a near-term focus
Satellite operators see value across all three orbital altitudes—GEO, MEO and LEO (Geostationary Equatorial Orbit, Medium Earth Orbit and Low Earth Orbit, respectively)—with companies taking different approaches to blending them.

GEO still underpins the industry, but telecoms also want to provide differentiated broadband services with integrated, seamless offerings for consumer, business and government customers.

Telecoms will also need to work with regulators at the U.S. Federal Communications Commission and the UN's International Telecommunication Union to treat space as a shared global resource, with spectrum rights and orbital debris being two key issues.

Weaponizing the Belt and Road Initiative

Asia Society Policy Institute
September 2020

The strategy for the Chinese economic flagship, the Belt and Road Initiative (BRI), takes into account that simply recreating the historic Silk Road in our current climate of 5G and private space travel is not a suitable strategy to solidify the People's Republic as an economic powerhouse. Today, the global economy stretches beyond the terrestrial, into both space and cyberspace – both of which are being pursued by Chinese state-owned entities. One of the dramatic results of Chinese investment in the BRI is an increase in defense spending – particularly funding for the People's Liberation Army – Navy (PLAN). This coupled with port acquisition and development in strategic defense locations means that Chinese space and cyber efforts like the BeiDou satellite system – the "digital glue" for the BRI's global economic infrastructure – are the central and final pieces of the BRI puzzle.

Select excerpts from the piece:

The Belt and Road initiative (BRI), announced by China's President Xi Jinping in 2013, is a massive international infrastructure program involving nearly 140 countries and 30 international organizations. Xi's ambitious vision is to construct a network of infrastructure across the world that will facilitate trade, investment, and connectivity with China. The initiative is a loose portfolio of disparate projects, many of which predate the "Belt and Road" brand. The BRI is composed of the land-based "Silk Road Economic Belt" and the sea-based "21st Century Maritime Silk Road." It encompasses an estimated $1 trillion in infrastructure projects spanning energy, transport, mining, information technology (IT), "smart cities," and special economic zones (SEZs). Supplementing the original "One Belt, One Road" are now the "Digital Silk Road," the "Belt and Road Space Information Corridor," the "Health Silk Road," and the "Green Belt and Road." This proliferation of BRI corridors and roads has provided Beijing with an all-purpose vehicle to support its foreign and economic policies and a brand that links the differing streams together under one rubric

Although the importance of physical infrastructure cannot be overstated, the BRI is much more than a portfolio of terrestrial assets. The initiative's expansion into the digital and space arenas underscores its all-encompassing nature. In launching the Digital Silk Road and the BRI Space Information Corridor, the provision of Chinese technology and access to Chinese networks provides Beijing the opportunity to enhance digital connectivity in partner states and regions, advance Chinese technological standards, and support China's rise as a technological power.

Similar concerns have been raised over the BRI's technology-focused corridors. Certainly, developing economies would benefit from next-generation Chinese technology and systems that help accelerate their integration into the global digital economy. However, what does Beijing gain by providing these technological assets to BRI states? What kind of military and strategic advantages could China amass through the establishment of the Digital Silk Road and BRI Space Information Corridor? Is the BRI a vehicle for creating an expanded Chinese-dominated regional

ecosystem that disadvantages the United States and likeminded states militarily as well as commercially? This report undertakes to examine these questions.

China's rapid military modernization program, the increasing ubiquity and assertiveness of its navy and air force, and its apparently insatiable appetite for ports worldwide have heightened the West's concern about the BRI's role in China's security strategy. Moreover, the expansion of the BRI into space through the launch of the Beidou Satellite Network and into the digital realm through the Digital Silk Road raises further questions about how Beijing may use technological features of the BRI to enhance its influence over recipient states and to gain military advantages. Particular suspicion has accrued to seemingly overbuilt but underutilized ports along important Indian Ocean trade routes that appear more suitable as potential naval bases than as commercial operations.

he expansion of the BRI is not only terrestrial. Cyberspace and outer space constitute two other domains connected by the BRI network. Each of these domains has dual civilian and military utility. And as China's 2015 white paper on military strategy points out, both are arenas for international strategic competition where China is determined to secure its national interests. Not only is cyberspace a "new pillar of economic and social development"; it is also a new domain of national security. The white paper argues that China must enhance its cyber capabilities to ensure national and information security, stem crises, and maintain stability. The Digital Silk Road – covering cyberspace – and the Belt and Road Space Information Corridor – covering outer space – provide Beijing with additional channels to strengthen its influence and leverage in project host states. Additionally, these newer components of the BRI promote the incorporation of Chinese technological standards and advance key national strategic and defense aims.

The State Council mandated the Belt and Road Space Information Corridor in 2016 with the goal of using space technology to support the development of the BRI and strengthen participant states' links to China. Central to this corridor is the Beidou satellite system that is meant to serve as the "digital glue for the roads, railways, ports, and industrial parks" being developed under the BRI flag. Components of the corridor are to include navigation, remote sensing, weather, communication, data-relay satellites, and ground stations and data centers. Applications include but are not limited to disaster relief, port operations, transportation, financial services, agriculture, and urban planning. With the recent completion of the 35-satellite Beidou system, China should be in a position to provide this range of services to all countries along the BRI. As the Beidou system becomes fully operational and more widely utilized, China will be able to reduce BRI partner governments' dependence on the U.S.-operated global positioning system (GPS) and bring them further under its technological umbrella.

This growing space and digital component of BRI has a commercial rationale and offers a number of potential benefits to recipient countries. At the same time, both the Digital Silk Road and the Space Information Corridor, which generate immense streams of big data, directly support the next-generation artificial intelligence technologies that China seeks to dominate. Beijing's access to and potential control of vast amounts of information have clear military and intelligence implications. The big data harvest from BRI can bolster the Peoples Liberation Army's (PLA) capabilities in what the military calls C4ISR – Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance. The use of the Beidou Satellite Network removes the PLA's vulnerability under the U.S.-controlled GPS

system. And widespread adoption of Beidou challenges American technological dominance and increases China's leverage over third countries. Beyond the collection of data or any military advantages, the spread of the Digital Silk Road and the Space Information Corridor systems helps promote Chinese influence, commercial interests, and standards.

Beijing's nominally commercial BRI investments, particularly in port infrastructure and digital projects, directly facilitate Chian's transition to a strong maritime power and provide the PLA with strategic assets to support its priorities. Despite its branding as an economic and development initiative, the BRI is in fact the embodiment of a whole-of-government effort to develop the "close coordination between military struggle and political, diplomatic, economic, cultural and legal endeavors" that Xi Jinping has called for to foster a strategic environment conducive to China's rise. Integrating the civilian and military sectors is a pillar of China's defense policy strategic framework. It allows China to obtain benefits from national defense resources in peacetime and from civilian infrastructure projects in the event of conflict. Given that Xi Jinping has championed the "unified military-civil system of strategic capability," it should come as little surprise that major components of BRI infrastructure, including the port-park-city model, the Digital Silk Road, and the BRI Space Information Corridor, are designed with dual-use features that bolster a range of potential military and intelligence capabilities.

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