Strategic Enhancement of Taiwan's Space-Based Capabilities

A Case for A Reimagined Foreign Military Sales Framework

MDAA
Missile Defense Advocacy Alliance

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Executive Summary

The 1979 Taiwan Relations Act solidifies the U.S. commitment to Taiwan's self-defense, albeit with strategic ambiguity to avoid antagonizing China. Recent geopolitical shifts, such as Russia's invasion of Ukraine, highlight the importance of reassessing defense strategies. The study employed extensive literature review, intelligence assessments, and planned interviews to understand Taiwan's space capabilities, assess regional partner capabilities, and explore potential defense cooperation frameworks. The National Defense Strategy emphasizes integrated deterrence and the importance of alliances and partnerships in countering near-peer threats. Security cooperation mechanisms like Foreign Military Sales (FMS), Direct Commercial Sales (DCS), and Building Partner Capacity (BPC) offer avenues for strengthening Taiwan's defense capabilities. Leveraging insights from commercial space capabilities, such as Starlink, Taiwan could enhance its defense through Military Commercially Derivative Spacecraft (MCDS). A proliferated Low Earth Orbit (pLEO) architecture offers advantages like reduced latency and enhanced coverage critical for timely decision-making. Various international relations theories inform approaches to managing China's response, balancing regional stability with defense preparedness, building international support, and easing tensions diplomatically. Given Taiwan's diplomatic challenges, external assistance is crucial to its security. Military SATCOM and ISR coalition payloads, supported by a FMS/FMF space coalition involving the U.S. and regional partners, could significantly enhance Taiwan's defense capabilities. Further research is necessary to evaluate legal, economic, regional, and international implications thoroughly.

Introduction

The 1979 Taiwan Relations Act established the legal foundation for the unofficial relationship between the United States and Taiwan, affirming the U.S. commitment to assisting Taiwan in maintaining its self-defense capabilities. Over the course of more than four decades, U.S. officials have adhered to the "One China" policy, acknowledging Beijing as the legitimate government of China while maintaining an unofficial connection with Taiwan. This situation has been characterized by strategic ambiguity, with the U.S. supplying Taiwan with defensive weaponry such as surface-to-air missiles, tanks, transport aircraft, and fighter aircraft, all while trying to avoid antagonizing China.

> *"A fully realized Chinese order might eventually involve the withdrawal of U.S. forces from Japan and Korea, the end of American regional alliances, the effective removal of the U.S. Navy from the Western Pacific, deference from China's regional neighbors, unification with Taiwan, and the resolution of territorial disputes in the East and South China Seas."*
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> - *Rush Doshi,* The Long Game (2021, p. 4)

The equipment sold to Taiwan, such as the Harpoon Coastal Defense System (HCDS) and High Mobility Artillery Rocket System (HIMARS), reflects American reliance on long-range communications and precisely geolocated Intelligence, Surveillance, and Reconnaissance (ISR) capabilities provided by space assets. However, space-based capabilities to successfully deter or defend against an attack from mainland China are typically not part of the Security Cooperation (SC) program packages sold to Taiwan or other regional allies and partners. Often, classification or throughput barriers prevent the sale of sensitive Department of Defense (DOD) communications satellites (SATCOM) or National Technical Means (NTM) ISR capabilities developed and operated by the Intelligence Community (IC) and the data derived therefrom. However, the U.S. response to Russia's invasion of Ukraine provides insight into the Biden administration's flexibility to both support democracies facing existential crisis and counter threats to U.S.-led international order.

As demonstrated in Ukraine, significant advances in commercial SATCOM and ISR capabilities have enabled the use of commercial systems for military purposes. These new systems provided good enough, and in many cases, as good as the military-spec systems. These systems would be more than sufficient for many of our partner nation's needs. While these countries can go directly to commercial vendors, many companies could be hesitant to sell, given the potential liability for military use. However, if the sale is under Foreign Military Sales or similar USG-sponsored and sanctioned programs, the liability would be transferred to the USG. Additionally, in the Taiwan scenario, time is limited to meet a potential conflict in the 2027-2030 timeframe; the only option for the U.S. to support would be purchasing commercial baseline systems under FMS/FMF.

Our ability to provide FMS/FMF of commercial systems is the first step toward international partnership. Regional military alliances and partnerships in the INDOPACOM area of responsibility bolster deterrence and provide response options to an increasingly aggressive China via traditional land, sea, and air methods. Options for space-based support through international partnering, however, narrow the field of candidates that can bring to bear organic capabilities. Regional actors Australia, Japan, India, and South Korea each have the established space expertise and industrial base to support coalition efforts to counter Chinese aggressions toward Taiwan. Federated space system development and access to U.S. commercial SATCOM and ISR providers via streamlined SC processes will provide critical avenues for successful space support to traditional methods of warfare.

Methodology

The methodology employed in this study includes an extensive literature review of open-source documents and intelligence describing the current state of Taiwan's space capabilities and current assessments of regional partner space capabilities. Additionally, a review of the importance of SATCOM and space-based ISR to the U.S. version of modern warfare will establish the focal point for this study and the scope of the proposed framework. Further, a critical look at U.S. FMS/FMF policy and the modifications and applicability of the regional security cooperation framework for space will occur to better identify recommended changes. Finally, interviews are planned with the Taiwan Space Agency,

Space Systems Command (SSC) Commercial Integration Office, SAF/IA, and Department of State (DOS) to gain first-hand perspectives and insight into how best to reframe FMS activities in a Great Power Competition (GPC) setting.

Defense Security Cooperation Approaches

The most recent National Defense Strategy (NDS) was published in 2022 and is used to provide a strategic framework for the U.S. military to safeguard national interests, deter adversaries, and maintain a stable global order. The 2022 NDS identifies four overarching priorities to strengthen deterrence in an increasingly hostile and competitive environment: "1. Defending the homeland, paced to the growing multi-domain threat posed by the PRC; 2. Deterring strategic attacks against the United States, Allies, and partners; 3. Deterring aggression, while being prepared to prevail in conflict when necessary prioritizing the PRC challenge in the Indo-Pacific region, then the Russia challenge in Europe; and, 4. Building a resilient Joint Force and defense ecosystem" (United States Department of Defense, 2022, p. 7). The NDS recognizes that only through integrated deterrence, campaigning, and building enduring advantages will the Department of Defense (DOD) be able to methodically advance the priorities to counter threats posed by near-peer strategic and persistent threats. Throughout the NDS, the DOD makes it clear that successful implementation of these three tenets rely not only on the inherent capabilities of the U.S., but also the collective strength forged through enduring alliances and partnerships with friendly governments and their militaries. The NDS states that "[m]utually-beneficial Alliances and partnerships are our greatest global strategic advantage – and they are a center of gravity for this strategy" (United States Department of Defense, 2022, p. 2).

The Arms Export Control Act (AECA) of 1976 provides the legal authority for the export of arms to foreign entities. Specifically, the AECA states,

> The Congress recognizes, however, that the United States and other free and independent countries continue to have valid requirements for effective and mutually beneficial defense relationships in order to maintain and foster the environment of international peace and security essential to social, economic, and political progress. Because of the growing cost and complexity of defense equipment, it is increasingly difficult and uneconomic for any country, particularly a developing country, to fill all of its legitimate defense requirements from its own design and production base. The need for international defense cooperation among the United States and those friendly countries to which it is allied by mutual defense treaties is especially important, since the effectiveness of their armed forces to act in concert to deter or defeat aggression is directly related to the operational compatibility of their defense equipment. Accordingly, it remains the policy of the United States to 9acilityate the common defense by entering into international arrangements with friendly countries which further the objective of applying agreed resources of each country to programs and projects of cooperative exchange of data, research, development, production, procurement, and logistics support to achieve specific national defense requirements and objectives of mutual concern. To this end, this chapter authorizes sales by the United States Government to friendly countries having sufficient wealth to maintain and equip their own military forces at adequate strength, or to assume progressively larger shares of the costs thereof, without undue burden to their economies, in accordance with the restraints and control measures specified herein and in furtherance of the security objectives of the United States and of the purposes and principles of the United Nations Charter. (22 U.S.C. § 2751, para. 2-3)

The broad term for how the DOD interacts with militaries of foreign governments is Security Cooperation (SC). Security cooperation efforts are used by the DOD to meet the charge in the NDS to advance the four priorities in an integrated fashion with allied and partner nations. Managed by the Department of State and executed by the DOD, SC maintains specific purpose-driven programs designed "to build security relationships that promote specific U.S. security interests, develop allied and partner nation military and security capabilities for self-defense and multinational operations, and provide U.S. forces with peacetime and contingency access to allied and partner nations" (Congressional Research Service, 2023, p. 1). The Defense Security Cooperation Agency (DSCA) is the lead DOD agency in charge of the SC mission. The DSCA stated mission is "to advance U.S. defense and foreign policy interests by building the capacity of foreign partners in order to encourage and enable allies and partners to respond to shared challenges" (Defense Security Cooperation Agency, 2021, p. 3). While there are many programs funded through the NDAA and executed under the umbrella of SC, the most applicable to the transfer of space systems to allied and partner nations in support of the defense of Taiwain include: Foreign Military Sales (FMS), Direct Commercial Sales (DCS), Foreign Military Funding (FMF), and Building Partner Capacity (BPC) (formerly known as Section 333). The FY2023 DOD budget included

$62.25B in FMS, $3.97B in FMF, $157.5B in D.C.S., and $12.23B in total BPC-related costs (United States Department of State Bureau of Political-Military Affairs, 2024; Office of the Under Secretary of Defense (Comptroller)/Chief Financial Officer, 2022).

Additionally, captured as a subset of the Defense budget BPC, the Pacific Deterrence Initiative (PDI) is a strategic effort to enhance DOD readiness and responsiveness. PDI offers another avenue for building regional ally and partner defense capabilities to bolster the collective regional deterrence against China. The FY2023 PDI subset totaled $6.1B with $453.1M of that going to specific efforts to build the defense and security capabilities, capacity, and cooperation of allies and partners (Office of the Under Secretary of Defense (Comptroller), 2022).

Foreign Military Sales and Direct Commercial Sales

Foreign Military Sales is a form of security assistance authorized under the AECA and allows for the U.S. sale of defense articles and services to foreign countries funded either by the foreign country or the U.S. Government through assistance programs. This program offers a legal pathway for allies and partners to utilize the DOD's acquisition system to procure defense articles on their behalf. Countries designated by the President as eligible can participate in FMS, and the specific transactions require DOS approval. Countries benefit from standardized procedures and access to U.S. defense technology but experience diminished flexibility in selecting and directly negotiating contract cost and payment terms on specific products, services, and technologies offered through DCS. In contrast, DCS provides a means for U.S. companies to obtain commercial export licenses from the Department of State that allow direct negotiations and sales directly to partner nations (Defense Security Cooperation Agency, 2021).

Section 36 of the AECA relegates that the President provide mandatory congressional notifications on FMS and DCS cases based on the requesting country as summarized in Table 1.

These limitations impose necessary checks and balances to ensure transparency and accountability while allowing for the necessary time for congressional oversight reviews.

	Major Defense Equipment (M.D.E.)	Defense Articles or Services	Design and Construction Services	Statutory Notification Period
NATO Member Countries	$25M+	$100M+	$300M+	15 Days
South Korea	$25M+	$100M+	$300M+	15 Days
Australia	$25M+	$100M+	$300M+	15 Days
Japan	$25M+	$100M+	$300M+	15 Days
Israel	$25M+	$100M+	$300M+	15 Days
New Zealand	$25M+	$100M+	$300M+	15 Days
All Other Countries	$14M+	$50M+	$200M+	30 Days

Table 1. FMS and DCS Congressional Notification Criteria
(22 U.S.C. Chapter 39, Section 2776, b 1986)

Foreign Military Financing

Authorized under the AECA, FMF allows the President to finance foreign procurement of defense articles and services through the aforementioned FMS or DCS programs. FMF provides grants and loans to help countries purchase U.S. weapons and defense equipment or defense services and military training (Defense Security Cooperation Agency, 2024). The Secretary of State determines a country's eligibility based on the alignment of strategic interests, ongoing and planned security cooperation efforts, and foreign policy goals. The money in FMF

cases is U.S. funds utilized for defense articles that will be provided to another country that otherwise could not afford to procure the items. In the cases of Australia, India, Japan, South Korea, and Taiwan, FMF-type funding would likely be in the realm of repayable loans versus grants.

Building Partner Capacity

Encompassing both SC and security assistance activities, BPC cases are administered within the FMS framework to provide defense articles and services aimed at increasing the military capacity of allies and partners in defense and deterrence. Initiatives under the BPC umbrella include training and equipping projects, joint military exercise inclusion, and training for peacekeeping operations. The BPC programs are tailored to meet specific needs and challenges faced by partner nations that also meet U.S. national security objectives.

The Precedence for FMS

Ensuring space systems are available in advance of an anticipated 2026 attack on Taiwan requires rapid capability development, flexible contractual mechanisms, and responsive funding procedures. FMS offers a means for governments to procure major systems as a complete package that includes training, spare parts, and sustainment support throughout the system's first few years of operation (Defense Security Cooperation Agency, 2021).

Taiwan's current space capabilities are lacking in the event of a conflict with China. Taiwan does not have a military branch focused on space support. Instead, Taiwan's Space Agency (TASA) develops space capabilities focused on economic development and disaster response, not for military use. This absence of space capability will significantly hinder Taiwan's early warning, SATCOM, and ISR capabilities in a conflict with China. Unfortunately, the capability shortfall is not from a lack of interest. Taiwan is eager to invest in new space

technology and dual-use systems but is hampered by international support in developing and launching dedicated military systems.

Historically, the United States has been a significant supplier of military equipment to Taiwan. Taiwan's security is strategically important to the United States, and providing military support to Taiwan is often viewed as a means of maintaining stability in the region, particularly in light of tensions with China. Between FY2020-2022, Taiwan emerged as the largest U.S. FMS purchaser, with transactions exceeding $8 billion. From FY1950-FY2022, Taiwan ranked as the fourth-largest purchaser of FMS (Defense Security Cooperation Agency, 2022). In FY2023-2024, the United States continued its support for Taiwan's defense capabilities by offering almost $2 billion in arms sales. These sales are often part of a broader strategy to bolster Taiwan's defense capabilities and maintain a balance of power in the region. However, it is important to note that arms sales to Taiwan are often subject to geopolitical considerations and may face opposition or scrutiny from China, which considers Taiwan a part of its territory. As a result, the United States typically and carefully navigates its support for Taiwan to avoid escalating tensions with China while fulfilling its commitments to Taiwan's security.

Many European nations are hesitant to provide arms to Taiwan due to political and economic pressures from China, despite sharing democratic ideals. France, however, stands out as an exception. In the early 1990s, France sold Mirage 2000 fighters to Taiwan, valued at over $6B over objections from China, and has continued to support Taiwan with spare parts and support. In 1998, France sold 6 Lafayette frigates to Taiwan valued at over $3B and continues to provide upgrades and parts, announcing a $79M upgrade as recently as February 2023 (Chuang, 2023). With the new emphasis on GPC focusing on the Pacific and the recent willingness of the

U.S. administration to support Taiwan with military systems (e.g., the 2019 FMS sale of 66x F-16 fighters), FMS and DCS are viable avenues to provide needed space capabilities to Taiwan.

Historically, Space FMS has been limited to ground equipment (i.e., GPS receivers) due to policy limitations. However, in the last four years, Space FMS beyond ground equipment has become a reality with potential pLEO SATCOM in the EUCOM AOR. Relaxing export policy is a potential inroad into building a regional FMS case with regional partners such as Japan, South Korea, and India. Additionally, the FY2023 budget authorized Taiwan to use FMF up to $2B per year over the five-year period. This budgetary allocation is the first time Taiwan has been authorized for U.S. funding normally reserved for nation-states. Notably, the NDAA also authorized offshore procurement for Taiwan FMF, which allows Taiwan to use a portion of its FMF grants to invest in its own defense-industrial base instead of purchasing weapons from U.S. defense contractors, as other recipients are required to do. Only Israel has been given this special privilege.

Commercial Space Technologies

Drawing insights from Russia's invasion of Ukraine, the significant impact of commercial space capabilities like Starlink in enhancing military operations is evident. A similar approach could be considered for Taiwan's defense using Military Commercially Derivative Spacecraft (MCDS) within a framework resembling FMS or FMF. To proceed, there is a need for additional research to outline Taiwan's Concept of Operations, resource allocation, training, and allied support and assess the potential effectiveness of this strategy.

Based on SATCOM mission requirements for Taiwan, a proliferated Low Earth Orbit (pLEO) architecture offers significant advantages over a Geosynchronous Orbit (GEO). A pLEO system provides superior capabilities such as reduced latency and attenuation, enabling near real-time communication critical for timely decision-making. Additionally, pLEO architectures offer improved coverage in anti-

access/area denial environments, ensuring reliable communication even in challenging operational scenarios. Next, pLEO systems also offer benefits in terms of reduced launch and maintenance costs due to smaller satellites and more frequent launch opportunities. The inherent resilience and scalability of pLEO constellations further enhance their attractiveness, allowing for continued operation even in the event of individual satellite failures or attacks. Figure 1 depicts the access over Taiwan at any given time for a large pLEO constellation like Starlink.

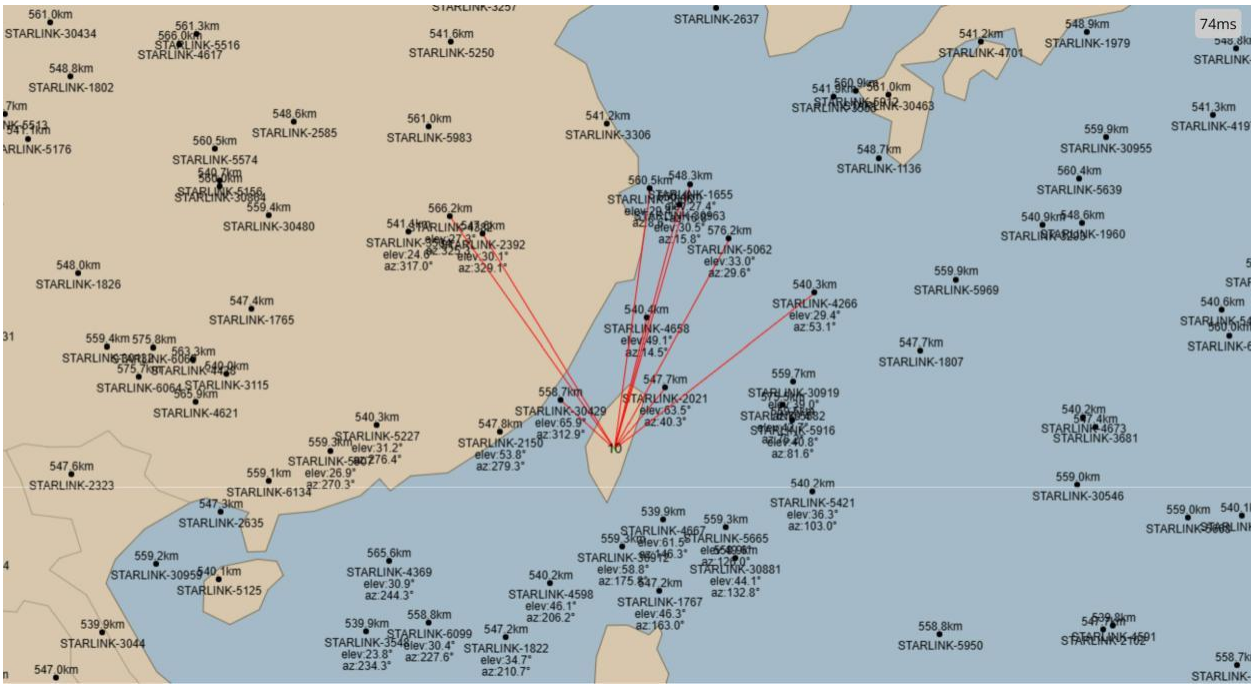

Figure 1. Starlink pLEO Constellation Access to Taiwan (Satellite Map, n.d.)

Furthermore, pLEO architectures enable rapid deployment of new satellite capabilities, facilitating the integration of cutting-edge technologies and mission updates without extensive lead times. This agility is paramount in meeting evolving operational needs and staying ahead of potential adversaries. While GEO constellations may offer a reduced ground component compared to pLEO systems, the utilization of shared Military Commercially Derivative Spacecraft with multiple mission partners in a regional security framework can help mitigate costs. By pooling resources and sharing infrastructure, the overall financial burden of satellite operations can be minimized, allowing for more efficient utilization of resources and greater flexibility in mission planning.

ISR technologies play a crucial role in various industries, including defense, security, and even environmental monitoring. Commercially available ISR technologies have seen significant advancements in recent years, offering high-quality capabilities for various applications. These commercially available ISR systems leverage advanced technologies such as artificial intelligence (AI), machine learning, and big data analytics to provide actionable intelligence for various purposes. The following are a few commercially available ISR technologies and their quality: Unmanned Aerial Vehicles (UAVs) and drones, satellite imaging services, sensor fusion, data analytics and artificial intelligence (AI), cyber intelligence platforms, and underwater surveillance.

UAV and drone technology has progressed rapidly, providing high-resolution imaging, thermal sensors, and even LiDAR capabilities for accurate terrain mapping. The quality of UAV ISR systems allows for precise surveillance, target tracking, and reconnaissance missions in both civilian and military domains. These UAVs are widely used for border patrol, infrastructure inspection, disaster response, and more. Commercial satellite imaging services offer high-resolution imagery with increasing frequency and coverage. The quality of satellite imagery has improved, enabling detailed monitoring of large areas with remarkable clarity. Companies like Maxar, Planet Labs, and DigitalGlobe provide high-resolution satellite imagery for various applications, including agriculture, urban planning, and environmental monitoring. Satellite constellations equipped with advanced sensors provide near-real-time updates, enhancing situational awareness and intelligence gathering capabilities. Sensor fusion technologies improve the quality of intelligence by providing comprehensive data analysis and reducing false alarms. Integrating multiple sensor modalities such as optical, thermal, radar, and signals intelligence (SIGINT) into ISR systems enhances their effectiveness.

Advanced data analytics and AI algorithms play a crucial role in extracting actionable insights from large volumes of ISR data. Machine learning algorithms can detect patterns, anomalies, and trends in surveillance data, enhancing the quality of intelligence analysis and decision-making. Commercial cyber intelligence platforms offer sophisticated capabilities for monitoring, analyzing, and mitigating cyber threats in real-time. These platforms utilize machine learning and behavioral analytics to identify

malicious activities and vulnerabilities, ensuring the quality of cybersecurity defense mechanisms. Companies offer software solutions for monitoring and analyzing digital communication networks to gather intelligence on cyber threats, fraud detection, and information warfare. Advancements in underwater sensor technologies, such as sonar systems and autonomous underwater vehicles (AUVs), have improved underwater surveillance capabilities. High-quality underwater ISR systems enable monitoring of maritime environments, underwater infrastructure, and submarine activities with enhanced accuracy and resolution. Overall, the quality of commercially available ISR technology continues to improve, driven by innovations in sensor technology, data analytics, and AI. These advancements empower organizations and governments to gather timely and accurate intelligence, enhance situational awareness, and make informed decisions in various operational contexts.

There are several companies working on space-based radar technology for various purposes, including Earth observation, weather monitoring, and defense applications. These companies include Capella Space, ICEYE, Umbra Lab, Synspective, Satellogic, BlackSky, Maxar, Planet Labs, Airbus Defence and Space, and DigitalGlobe. Capella Space is based in the United States and provides synthetic-aperture radar (SAR) satellite data and analytics solutions for applications like agriculture, infrastructure monitoring, and defense. Capella Space offers high-resolution SAR imagery with frequent revisit rates. ICEYE is based in Finland and offers SAR satellite data and analytics services for various applications such as maritime surveillance, disaster monitoring, and infrastructure monitoring. ICEYE focuses on providing high-resolution and frequent imagery. Umbra Lab is based in the United States and develops SAR microsatellites for high-resolution Earth observation. Umbra Lab aims to provide persistent monitoring capabilities for defense, intelligence, and commercial customers. Synspective is based in Japan and offers SAR satellite data and analytics services for urban planning, infrastructure monitoring, and disaster response. Synspective focuses on providing frequent and high-resolution SAR imagery to support various applications. Satellogic is based in Argentina and operates a constellation of small satellites equipped with SAR and optical sensors for Earth observation. Satellogic offers a range of data products and analytics services for agriculture, environmental monitoring, and infrastructure

management. BlackSky is based in the United States and offers a combination of SAR and optical satellite imagery for various applications such as intelligence, defense, and commercial purposes. BlackSky provides timely and high-resolution geospatial intelligence solutions. Maxar is based in the United States and provides a range of geospatial intelligence solutions, including satellite imagery, analytics, and data products. Maxar caters to various industries such as defense, intelligence, and commercial sectors. Planet Labs is based in the United States and operates a constellation of small satellites that capture high-resolution optical imagery of Earth. Planet Labs offers geospatial data and analytics services for agriculture, forestry, urban planning, and environmental monitoring. Airbus Defence and Space is based in the Netherlands and offers satellite imagery, analytics, and geospatial intelligence solutions for defense, security, and commercial applications. Airbus Defence and Space provides high-resolution optical and radar imagery from their satellite constellation. DigitalGlobe is a Maxar company known for its high-resolution satellite imagery and geospatial intelligence solutions. DigitalGlobe serves customers in defense, intelligence, energy, and other sectors with a wide range of data products and analytics services.

Geopolitical Challenges and Strategies

Asiatic nations partnering with the United States pose a threat to China's pursuit of regional hegemony and challenge the legitimacy of coerced reunification with Taiwan. Militarily strong allies and partner nations aligned with the U.S. mean that China will increase efforts to counter this arrangement.

Managing China's Response to Increased Defense Collaboration

The U.S. wields every instrument of national power at its disposal throughout the strategic continuum of competition with China. Each instrument of power, diplomatic, informational, military, and economic (DIME), is invoked as the U.S. increases military coalitions to counter China's behaviors. This effort, as extensive as it may be, makes little difference when focusing attention on the space domain.

To counter increased DIME partnerships between the U.S. and Asian countries, China is pursuing ties with North Korea and Russia and conducting localized deterrent strategies (e.g., increased maritime patrols following U.S., Philippine, Australian, and Japanese naval exercises). In the scenario described in this paper of utilizing commercial space systems to augment military capabilities, China is following suit. In 2014, "the Chinese government published Document 60, a document allowing for increased freedom of private investment into technologies such as launch and satellite manufacturing. [Since 2014] more than 100 commercial space companies [were] established in China, with these companies having raised more than $1.4 billion (10 billion yuan) in the process"(Curcio, 2020, para. 2). "[Today], many of them are reaching maturity and are ready for commercial operations" (Curcio, 2020, para. 6).

Understanding adversary capabilities in space is extremely challenging. Dual-use phenomenology means that while the stated purpose of a system may be for peaceful commercial purposes, the opportunity and ability exists to perform nefarious on-orbit actions or provide military-relevant data. Essentially, this has led to blurring commercial, civil, and military space capabilities and applications such that deceive, degrade, deny, disrupt, and/or destroy options are on the table throughout the continuum of competition.

Building International Support

The Quadrilateral Security Dialogue, also known as "The Quad," is a strategic security dialogue among Australia, India, Japan, and the United States to support a free, open, and inclusive Indo-Pacific region. The dialogue reflects a collective effort to counterbalance China's growing influence in the region and to ensure that a rules-based international order, particularly in maritime security, is maintained. While the Quad's discussions and initiatives have primarily been focused on maritime security, cyber security, and economic cooperation, the potential for collaboration in space security is significant.

Diplomatic Roles in Easing Tensions

Keeping open lines of communication and leveraging multilateral diplomacy are key in easing overall tensions in the region. Leveraging multilateral forums and international organizations to address

concerns within the United Nations, ASEAN, “The Quad,” or other regional and global bodies, diplomats can seek broader consensus and support for peace and stability. “Unless China, Russia, and America’s other space competitors throw in their towels, short-circuiting military competitions in space via diplomacy will be challenging, at best. Trust is low and likely to dip even further. Rules of the road and redlines for space behavior will be useful, but unless they are self-executing, such agreements will lack proper enforcement and could actually make matters worse” (Sokolski, 2022, para. 5).

Proposed Collaboration Framework

Space FMS is still in its infancy as national policies have not been clearly defined. Traditional terrestrial, air, and maritime policies may not be sufficient for the space domain. Until recently, Space FMS has been restricted to the sales of ground equipment, and in the rare case of Wideband Global Satellite Communcitions (WGS), the purchase of an entire satellite by a partner nation as their monetary contribution to the WGS program. In Ukraine, we saw the success of the data as a service model (Starlink), where a partner nation buys the needed data and associated ground user terminals without the cost of satellite development, manufacturing, or operations. While this model is sufficient in Ukraine, the ‘data as a service’ model does not meet Taiwan’s unique requirement. Taiwan desires to have its own satellite systems and ideally would pursue development programs that benefit the Taiwanese space industry. As a result, Taiwan is unlikely to pursue the ‘data as a service’ construct. However, Taiwan recognizes that the requirement for training and logistical support for an indigenous operations capability may not meet the needs of the near-term objective of having an operational system in orbit in the mid-2026 timeframe. As a result, a co-production and government-owned and contractor-operated system would satisfy both Taiwan’s need for control and meet the required timelines.

Additionally, streamlining AECA congressional notifications and financial limitations for commercial space systems under FMS would aid in shortening timelines and increasing accessibility for key strategic partners. For example, Starlink satellites are estimated at a per unit cost of $250K with an internal launch cost of roughly $30M for SpaceX (Wang, 2019). If the

AECA was amended to allow Australia, India, Japan, South Korea, and Taiwan certain SATCOM and ISR commercial space system limits that avoid congressional notification or funding caps, the process of developing and delivering capability beneficial to coalition military needs and integrated into the U.S. space architecture can occur on a reduced timeline. Table 2 offers a potential option for including commercial space systems and allies with increased financial limitations and congressional notifications building from Table 1. The values indicated account for the full FMS benefit: system development, transition, training, and sustainment. The value also expresses rough estimates based on SpaceX mass production (low-end valuations) and more bespoke commercial ISR capabilities like Capella Space (higher-end valuation).

	Major Defense Equipment (MDE)	Defense Articles or Services	Design and Construction Services	Commercial Space Systems	Statutory Notification Period
NATO Member Countries	$25M+	$100M+	$300M+	$200M+	10 Days
South Korea	$25M+	$100M+	$300M+	$200M+	10 Days
Australia	$25M+	$100M+	$300M+	$200M+	10 Days
Japan	$25M+	$100M+	$300M+	$200M+	10 Days
Israel	$25M+	$100M+	$300M+	$25M+	15 Days
India	$25M+	$100M+	$300M+	$200M+	10 Days
New Zealand	$25M+	$100M+	$300M+	$200M+	10 Days

Taiwan	$25M+	$100M+	$300M+	$200M+	10 Days
All Other Countries	$14M+	$50M+	$200M+	$25M+	30 Days

Table 2. AECA Limitations Re-imagined for Commercial Space Systems and Inclusion of Asia Regional Partners

Co-Production

Taiwan historically has had a limited space sector capability despite being an economic powerhouse that developed several world-leading, high-tech industries. In particular, Taiwan leads semiconductor manufacturing, accounting for over 50% of the world's total foundry revenue, producing 90% of the chips for some of the biggest U.S. tech firms, including Apple, Amazon, Google, Nvidia, and Qualcomm (Arcuri, 2022). Given Taiwan's high-tech manufacturing prowess and desire to build an indigenous space capability, the opportunity exists for a co-production FMS construct not seen before in Space FMS.

Over the past 30 years, Taiwan has made significant strides in its satellite manufacturing capabilities, particularly with the successes of the FORMOSAT series and collaboration with the U.S. and NOAA. Since 1994, Taiwan has slowly increased its capability to manufacture satellite components, culminating in the first indigenous design and manufacturing of FORMOSAT-5 Earth observation satellites in 2017 (Lee, 2013). The success of FORMOSAT-5 and subsequent FORMOSAT-7/COSMIC-2 missions in collaboration with the National Oceanic and Atmospheric Administration (NOAA) further advanced Taiwan's satellite manufacturing capabilities (NOAA, 2024).

By partnering with the United States through a Co-Production FMS construct, Taiwan can tap into the advanced commercial space technology available in the U.S. market. This collaboration would enable Taiwan to enhance its satellite manufacturing processes, access

cutting-edge components and subsystems, and leverage the expertise of U.S. companies in space technology development.

Furthermore, the Co-Production FMS model, with standard Intellectual Property (IP) protection standards akin to commercial products like Ring cameras and Apple iPhones, ensures that both Taiwan and the U.S. can safeguard their respective technological advancements and interests. This approach facilitates collaboration while mitigating concerns about IP rights and technology transfer.

Additionally, the authorization provided by the 2023 NDAA Foreign Military Financing with offshore procurement further supports the feasibility and viability of this Co-Production FMS construct. For the commercial vendor, this offshore production model has the potential benefit of increasing production if needed, and as other partner countries sign on to purchase their systems, an already established production line would provide for increased capacity without impacting U.S.-based production.

Operational Construct

Traditional weapon systems have been predominantly government-owned and government-operated (GOGO) due to various factors, including the need for strict control over the use of kinetic weapons, liability concerns, and the significant investment required in infrastructure, logistics, training, and personnel. The decision to engage or release kinetic weapons is a critical one with profound legal, ethical, and strategic implications. Having government operators responsible for making such decisions ensures accountability and adherence to established rules of engagement and international laws of armed conflict. Additionally, it allows for direct command and control over military assets, ensuring that they are used effectively and in accordance with national security objectives.

Moreover, the operation of traditional weapon systems entails complex logistics, maintenance, and support requirements. This practice includes maintaining weapons platforms, munitions, supply chains, and personnel training programs. These investments are necessary to ensure the readiness and effectiveness of military forces in combat scenarios.

However, as technology evolves and mission requirements change, there has been a growing trend toward exploring alternative models such as government-owned contractor-operated (GOCO) for certain non-kinetic missions like intelligence, surveillance, and reconnaissance (ISR). These models offer advantages in terms of flexibility, cost-effectiveness, and access to specialized expertise from the private sector.

For ISR missions, using contractor-operated platforms like the MQ-9 Reaper allows the military to leverage specialized skills and expertise from the private sector while maintaining oversight and control over operations. This structure can be particularly beneficial in situations where there is a shortage of uniformed personnel or where the specialized nature of the task requires expertise that may not be readily available within the military ranks.

Similarly, in the realm of space systems, where technology is rapidly evolving and the demand for capabilities like satellite communication, navigation, and reconnaissance is increasing, the GOCO model allows the military to tap into the expertise of private contractors to operate these systems efficiently without the burden of extensive infrastructure, logistics, and personnel investment.

The GOCO model could be particularly advantageous for Taiwan given the urgent need to rapidly enhance national security and defense capabilities, and the potential limitations in Taiwan's personnel, training resources and infrastructure, leveraging private contractors through a GOCO model could all offer a viable solution.

By partnering with private contractors (e.g., SpaceX, Kuiper, and other suppliers), Taiwan could expedite the deployment and operation of SATCOM and ISR assets. These contractors bring not only technical expertise but also existing infrastructure, equipment, and personnel that can be quickly mobilized to meet Taiwan's requirements.

Moreover, the GOCO model reduces the burden on Taiwan's government to invest heavily in developing and maintaining its own space infrastructure and operational capabilities from scratch. This strategy is particularly beneficial when time is of the essence and there is a need to rapidly enhance national security and defense capabilities.

Overall, embracing the GOCO model for space systems could enable Taiwan to quickly bridge its capability gaps and strengthen its defense posture in the face of evolving security challenges.

Risk to Commercial Vendors

China's geopolitical and economic tensions present significant risks for any global vendor who directly or indirectly supports Taiwan. These risks include cyber-attacks, potential loss of intellectual property, supply chain disruptions, and economic sanctions. Mitigating these risks requires a balanced and nuanced approach. Not only that, "Taiwan is the world's 16th largest trading economy, having imported and exported $922 billion in goods and services in 2021. Almost all of this trade would be severely disrupted in the event of a blockade" (Vest et al., 2022, para. 7). Risk mitigation strategies include maintaining a low profile, diversifying markets and supply chain and beefing up cyber security protocols.

Conclusion

Given Taiwan's diplomatic challenges with China, it relies on external assistance for security. Historically, the U.S. has supported Taiwan through the 1979 Taiwan Relations Act. Regarding space needs, Taiwan could use commercial space assets but would benefit more from

military SATCOM and ISR coalition payloads on satellites like Starshield. A FMS space coalition involving the U.S., Australia, Korea, and Japan could enhance Taiwan's defense though space capabilities. Further research is needed to assess legal, economic, regional, and international implications.

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