

Global Space Domain Awareness, "Partnering to Win" with AUKUS

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Abstract

Space domain awareness (SDA) is presently conducted by governments (civil and military), commercial firms, academics, and individuals, with additional bilateral and multilateral SDA sharing agreements, such as consortiums. One goal of SDA is to help operators understand their options when they need to maneuver to execute their missions and to understand options if their Resident Space Objects (RSO) need to give way for debris and other RSOs which do not maneuver.

This paper will describe "Partnering to Win" data-sharing methods with Australia under the AUKUS Pact as a model framework for advancing a "collaborative endeavor" to shape a Global Space Domain Awareness (GSDA) concept. The Australian Defense Space Command has highlighted that SDA is a cornerstone space control program. The AUKUS SDA framework can contribute to the rapidly growing need for enhanced global space situational awareness and space traffic coordination, preventing collisions, mitigating the risks posed by space debris, and responding to threats to space-based assets.

In the paper "SNARE (Sensor Network Autonomous Resilient Extensible): Decentralized Sensor Tasking Improves SDA Tactical Relevance" AMOS 2021 [Carden, Burchett, Reed], the authors present a method to improve how the U.S. Space Force Space Sensor Network (USSF SSN), which report to the Combined Space Operations Center (CSpOC), tasks its space sensors – shifting from once per day tasking (SP TASKER method) to the dynamic and decentralized SNARE method, now in an operational prototype phase. SNARE offers the potential for significant improvement in SDA using the SSN.

However, due to the physical placement of space sensors, some portions of orbits may be difficult or impossible to observe with a fixed set of sensors, regardless of the efficacy of dynamic tasking. This challenge is a significant Limiting Factor (LIMFAC), and this paper introduces candidate methods to supplement fixed networks with ad hoc requests of other sensors, for example, from allies. Further, dedicated sensors with dynamic tasking (e.g., SNARE), even if supplemented with targeted ad hoc requests from allies and partners (governmental, commercial, academic), will still yield only a subset of the the potential of a global SDA of even larger cooperative methods.

This paper introduces the GSDA concept, a decentralized and modular approach to foster an SDA network covering Earth and Cislunar regions incrementally. GSDA can "cultivate partnerships that build enduring operational advantages" by using SNARE-like decentralized dynamic sensor tasking and ad-hoc requests to vetted sensors grouped into GSDA ecosystems interconnect across Earth and Cislunar regions. The primary architectural feature is a GSDA protocol overcoming barriers to collaboration by enabling a GSDA-compliant ecosystem plug-in to a global network of interconnected GSDA ecosystems. The primary technical features include decentralized tasking (SNARE & ad-hoc) and decentralized data technologies for information sharing and data storage. In turn, these features result in expanded mutually beneficial and trusted capacity, capability, and resiliency of our space forces.

Governments of spacefaring nations will likely drive the initial GSDA ecosystems, although commercial and/or academic interests could drive GSDA ecosystems. The paper explores the initial configuration to start GSDA's growth: the instantiation of a U.S., Australian, and U.K. set of GSDA-compliant ecosystems into an AUKUS GSDA. The AUKUS partnership can provide a framework for cooperation in space situational awareness, including sharing data, coordination of activities, joint exercises, and technology

development. An AUKUS SSA partnership can act as a "critical force multiplier" to expand our competitive advantage in response to growing strategic competition.

1 INTRODUCTION

Understanding the nature of spaceflight, which is constantly developing and evolving, requires having space domain awareness (SDA). Sharing data and working together to improve space situational awareness (SSA) and space traffic management (STM) is becoming increasingly crucial as space-related activities continue to increase. It is difficult to overstate the significance of this development.

Space domain awareness, also known as SDA, is an essential component of our efforts to navigate the congested pathways of space in a manner that is both secure and expeditious. It is becoming increasingly congested with satellites, spaceships, and other things that fly about our Earth and beyond at very fast speeds as the last frontier draws closer and closer. This problem is made worse with every rocket that is launched, every new satellite that is created, and every piece of a rocket that is discarded. Sharing data and working together to improve space situational awareness (SSA) and space traffic management (STM) is becoming increasingly crucial as space-related activities continue to increase. It is difficult to overstate the significance of this development.

Over the course of the past few years, there has been a significant increase in activity in space. The number of rocket flights has considerably grown in recent years as a result of the proliferation of commercial space enterprises such as SpaceX, Blue Origin, and Rocket Lab. For instance, in the year 2020, SpaceX plans to carry out over 25 separate launches and deploy hundreds of Starlink satellites in an effort to make the entire planet accessible via the internet. Even though they are relatively new, these constellations contribute significantly to the motion of space.

Additionally, nations from all around the world are showing an increased interest in outer space. The successful anti-satellite missile test that India carried out in 2019 under the codename "Mission Shakti" produced a significant amount of debris in space, illustrating how essential it is to have robust SSA. In addition, in 2019, the European Space Agency was forced to adjust one of their satellites' trajectories to prevent it from colliding with a Starlink satellite. This demonstrates how significant STM is.

Countries and organizations need to collaborate on these efforts to be successful. As the near-collision that took place in 2019 demonstrated, it is highly crucial to have shared data and operational protocols in place. The United Nations Office for Outer Space Affairs (UNOOSA) and the Space Data Association are constantly working to improve SSA; therefore, countries and enterprises need to collaborate and share data to keep up with these organizations' efforts.

Understanding, managing, and ensuring the safety of our space assets through improved SDA is, therefore, not just beneficial for the future of humanity in space; it is essential. This is because as we continue to expand our reach into space and become more reliant on satellites for things like GPS, weather forecasting, and global communication, it is becoming increasingly obvious that this is the case.

The United States, Australia, and the United Kingdom have formed a pact for naval nuclear propulsion information sharing named AUKUS. If modelled similarly, this trilateral alliance could have a lot of promise to help tackle the challenges that make the space environment less stable. Each nation possesses unique advantages, technological capacities, and strategic geographic positions that, when combined, have the potential to significantly advance humanity's understanding of what's going on in space.

The United States has a lot of knowledge and resources to provide due to its advanced space technology, space projects that have been ongoing for a long time, and the large number of commercial space enterprises. Because of its location in the southern hemisphere, Australia is the ideal site for monitoring

and tracking satellites in geosynchronous orbits and polar orbits. Because of its location in the southern hemisphere, it is able to assist the United Kingdom in tracking objects. The United Kingdom is located in the northern hemisphere, and it has an advanced technological infrastructure as well as decades of expertise in studying space.

The technology-focused trilateral AUKUS agreement could be used to enhance space cooperation and develop space capabilities that are mutually beneficial. Agreements on complementary technologies, such as quantum computing, artificial intelligence, and hypersonics, have already demonstrated space-related momentum. Cooperation in space and improved interoperability through AUKUS would support the United Kingdom's new designation of space as part of its Critical National Infrastructure. The 2022 UK Defense Space Strategy emphasized Britain's desire to be "at the heart of Allied space efforts", including alongside Australia. (Citowicki, Triple constellation, 2022)

In the event of a crisis, the United States would benefit from the shared increase in capabilities of its two allies becoming capable of reconstituting mutually beneficial space-based assets. This includes Global Navigation Satellite Systems (GNSS) that provide essential PNT services for transportation, finance, agriculture, emergency management, and more. In addition, AUKUS allows for the investigation of opportunities to enhance and streamline space "innovation cycles and co-development processes" for the development of mutually reinforcing crisis-response capabilities. (Citowicki, Triple constellation, 2022)

Through AUKUS, measures could be taken to enhance space resilience against military or natural crises by ensuring that countries maintain minimum viable capabilities across key elements of the supply chain for the space industry. This may involve concentrating on the components necessary to reconstruct vital space-based assets, as well as systems for disaggregating and enhancing existing capabilities. This process should involve AUKUS governments collaborating to integrate new and emergent technology firms into the supply chain of the space industry.

Australia is already home to numerous projects that would benefit from such collaboration, including HEO Robotics, which has developed technology to inspect and identify unidentified space-based assets, and Western Sydney University's development of 'events-based' neuromorphic cameras.

These three nations could, if they collaborated, build a network of sensors, radars, and tracking systems that are compatible with one another, provide a clear picture of the world outside of Earth in real-time, and work together. Such a three-part approach would make it easier to detect and monitor smaller space debris, make it easier to foresee future crashes, and enable satellite launches and operations to function better together. It would also make it easier to find and track larger space debris.

Supporting best practices, establishing standards for decreasing space debris, and ensuring international space treaties are implemented are all examples of how a unified policy approach from AUKUS can help set the tone for responsible activity in space. With their combined diplomatic clout, these nations have the potential to steer a worldwide movement toward environmentally responsible space operations and enlist the participation of other nations with space programs.

The purpose of this study is to delve deeply into the ways in which the AUKUS union may be able to contribute to the maintenance of the space environment over the long term. We will construct a strategy for how this cooperation can be a model for the rest of the world's efforts to keep track of space traffic and maintain track of space domain awareness. This plan will be developed by looking at the combined technological powers, policy frameworks, and collaborative projects of the United States, Australia, and the United Kingdom.

2 PARTNERING TO WIN AND A REINTERPRETATION OF AUKUS FOR SPACE

Taking inspiration from the Chief of Space Operations' Line of Effort (LOE) note, the AUKUS coalition can pioneer a similarly profound collaborative method for developing a Space Information Sharing Ecosystem (SISE). The main goal would be to increase collective space capacity, capability, and resiliency.

The following is an interpretation for a Space-related AUKUS Alliance:

Combat-Ready Forces and the Guardian Spirit: Stress the necessity of combat-ready forces and the guardianship spirit. This is about ensuring that each member of the AUKUS alliance is ready and equipped to preserve and advance common interests in space.

- a) **Collaborative Space Power:** The AUKUS alliance's spacepower is essentially collaborative. Without joint efforts, no one nation can attain space domination or security. The three countries can capitalize on each other's strengths by pooling their resources, intelligence, and expertise.
- b) **Relying on Core Structures:** Each AUKUS alliance member has distinct core structures and capabilities that can be used. The United States Space Force, for example, is significantly reliant on partnerships. Similarly, the United Kingdom and Australia have distinct space capabilities and institutions that might be used for mutual advantage.
- c) **Long-Term Operational Advantages:** The goal should go beyond mere coordination or deconfliction. Partnerships should result in long-term operational benefits.
- d) **Remove impediments:** Policies addressing over-classification, incompatible systems, and other traditional impediments should be implemented. This guarantees that information is shared and collaborated on smoothly.
- e) **Direct Collaboration:** Collaboration should extend beyond policy. On-the-ground engagement, such as international exchanges, deployments to industries, university alliances, shared training opportunities, and so on, will aid in the development of trust and mutual respect.
- f) **Trust-Based Partnerships:** Emphasize that partnering is more than just a business transaction. It is a bond founded on trust and mutual benefit, assuring collaboration even in the face of geopolitical, financial, and antagonistic pressures.

2.1 Technology Safeguard Agreement (TSA)

Similar to the UK-US Technology Safeguards Agreement (TSA), the Australia-US Technology Safeguards Agreement (TSA) could be crucial to such cooperation. Such an agreement can facilitate the development of a Space Information Sharing Ecosystem (SISE).

First, consider the possibility of deeper cooperation to comprehend the complex processes of this ecosystem. The completion of the Australia-US TSA would demonstrate mutual trust and understanding. In any paradigm of information sharing, trust ensures openness and deference.

Trust is not a prerequisite for operational efficacy. The Australia-United States agreement, inspired by the United Kingdom-United States TSA, may operationalize synergies by allowing US space firms to operate seamlessly from Australian launch sites. Synergy promotes resource efficiency and the natural exchange of information. SISE is centered on this exchange of ideas and techniques.

Technology influences space. The TSA could facilitate the transmission of US-Australian space launch technology. The relationship between tech-driven growth and information exchange is synergistic, as such exchanges increase capacity and necessitate vital information flow.

However, the exchange of sensitive technology requires robust security. Even in allies like the United Kingdom and Australia, the TSA's legally enforced framework safeguards U.S. spaceflight technologies.

This assurance of confidentiality encourages governments to share sensitive but essential minimum viable information set of space-related information. The absence of a TSA has impeded space-related commercial activity. (Citowicki, AUKUS: Stepping boldly into space. , 2022) An Australia-US agreement would eliminate this barrier to collaboration in the space industry. By eliminating these barriers, information flows readily and the emergent probability of success for a SISE is improved.

Under AUKUS, the TSA may accelerate its engagement with leading U.S. space entities. Knowledge, innovations, and best practices would be woven together via in-depth interaction. An Australia-US TSA is a Space Information Sharing Ecosystem would facilitate cooperation and the exchange of technologies and global space domain awareness a reality. Trust, operational synergies, knowledge transfer, protective frameworks, and increased commercial interactions make it possible for nations to collaborate on such problems.

3 SPACE DOMAIN AWARENESS BACKGROUND

3.1 Current State of SDA

Current SDA efforts involve multiple stakeholders: governments (both civil and military), commercial entities, academic researchers, and individuals. Additionally, bilateral and multilateral SDA sharing agreements, such as consortiums, are in place to enhance these efforts. However, as space activities increase, operators must be equipped with advanced SSA to effectively maneuver their Resident Space Objects (RSO), especially when giving way for debris or other non-maneuverable RSOs.

4 THE AUKUS PARTNERSHIP IN SPACE DOMAIN AWARENESS (SDA)

Space domain awareness (SDA) can be an essential mechanism for the AUKUS alliance to work together and help reach its goals. Even though the Pact focuses mostly on maritime, undersea, and high-tech capabilities, the possible benefits of working together in the space domain can both help achieve the strategic goals of this alliance and make them stronger even though most of the information in the fact sheet is about maritime, undersea, and high-tech skills. (House, 2022) What to do:

1. **Getting better at advanced skills:** many advanced technologies, like artificial intelligence, self-driving cars, quantum technologies, and electronic weapons, have uses and effects in space.
 - a. Quantum technologies are used to find out where something is, how to get there, and what time it is. These same technologies are also used in satellites. SDA can help people work together to make it easier to make more accurate tracking systems that can withstand the effects of possible hostile acts in space.
 - b. Artificial intelligence and automation have helped with managing space traffic, predicting how satellites will move, and figuring out where space junk might pose a risk of collision.
 - c. The term "electronic warfare" covers a wide range of activities, some of which may use satellite communications and sensors in space.
2. **Making things safer and more stable:** Since AUKUS's goal is to make the Indo-Pacific area safer and more stable, it is crucial to consider the growing importance of space in the security factors of the area. The bigger goal of ensuring the Indo-Pacific is free and open aligns with the peaceful use of space and ensuring space-based assets are safe from dangers.
3. **Making it better to share information:** There's a lot of information in the Space Domain. Since AUKUS proposes to "expand and speed up the sharing of sensitive information," integrating space domain awareness is one way to ensure that all three countries have the same understanding of real-time space activities and, as a result, increase their collective situational awareness.
4. **Reaffirming commitments to other countries:** In the same way that AUKUS puts a focus on the "highest non-proliferation standards" when it comes to nuclear propulsion, a combined position on

space can help show their dedication to the peaceful, sustainable, and responsible use of outer space. By encouraging people to follow space treaties and conventions, AUKUS can improve its ability to push for "an international system that respects human rights, the rule of law, and the peaceful resolution of disputes without force."

Integrating space domain awareness into an AUKUS architecture can, in effect, help the alliance reach its goals of advanced capability development, security, stability, and international partnership. On the other hand, the resources and knowledge of an AUKUS Space-related cooperation could make it easier to ensure that activities in the space domain are safe and sustainable. This possibility for synergy could help make the alliance a major player in Earth and space security issues.

5 INCORPORATING SPACE INFORMATION SHARING ECOSYSTEM (SISE) INTO THE AUKUS FRAMEWORK

Incorporating the Space Information Sharing Ecosystem (SISE) design concept into the AUKUS framework presents an enticing proposition for advancing the collaboration's strategic objectives. The example given below illustrates how SISE and its doctrines may be compatible with AUKUS's objectives:

5.1 Importance Regarding AUKUS's Objectives:

The AUKUS treaty emphasizes respect for international systems, human rights, the rule of law, and the peaceful resolution of disputes. This commitment can be met by implementing an open and transparent system for space information exchange, such as SISE. Such a system will promote transparency and cooperation among diverse stakeholders in the increasingly contentious space domain.

5.2 Innovative Capabilities and Information Exchange:

The inventory of AUKUS's advanced skills includes several cutting-edge competencies, such as Artificial Intelligence, Quantum Technologies, Advanced Cyber, and Information Sharing. When sharing information about potential cyber threats or employing AI for satellite data analysis, SISE's decentralized information-sharing platform utilizing permissioned blockchain can greatly assist. This is notably true regarding the sharing of information regarding potential cyber threats.

5.3 Avoiding the Formation of Independent Information Islands:

Information silos, which occur when data are organized in a unique way to a single nation or organization, are one of the greatest obstacles that must be surmounted for in international agreements such as AUKUS to succeed. It is conceivable that the negative effects of these silos will hinder the cooperation's effectiveness. SISE solves the issue by emphasizing transparency and utilizing a decentralized information exchange system.

5.4 From Unauthorized to Authorized Multilateral Cooperation:

Since AUKUS is a trilateral agreement, it stands to benefit from the shift away from bilateral information exchange, which can be limited and time-consuming, and toward the more comprehensive ecosystem approach that SISE has recommended. Consequently, the three nations would be able to share timely, relevant, and actionable data.

5.5 The necessity of space domain awareness (SDA)

As space becomes a more contested domain, the necessity of space domain awareness (SDA) grows to the point where it is of the utmost significance. Suppose we ensure that the three nations have access to a shared and up-to-date understanding of activities and hazards in space. In that case, we may improve their ability to respond to issues collaboratively. These obstacles could be brought on by space debris or by the activities of potential adversaries.

SISE established four pillars of shared information: comprehensibility, actionability, applicability, and timeliness. These principles may serve as governing principles for AUKUS as it expands its cooperation efforts. The Pact is efficient in both terrestrial and extraterrestrial realms. Implementing measures to ensure that information is simple to comprehend, actionable, pertinent, and up-to-date enhances the Pact's efficiency.

5.6 Aid in the Administration of Commercial and Civil Space Operations:

As the number of commercial space activities rises, the need to communicate information regarding space situational awareness becomes increasingly crucial for ensuring the success and safety of operations. AUKUS could adopt the concepts of SISE to enhance its collaboration with the private sector and other international partners.

5.7 Putting Safety and Non-Proliferation (sustainability) Front and Center:

One of the stated purposes of AUKUS in the submarine sector is the maintenance of the highest possible non-proliferation standards. In the sphere of space use, this may involve ensuring that AUKUS partners' space operations do not exacerbate the issue of space debris and that activities are conducted transparently and in accordance with international norms. This objective is consistent with SISE's priority on maintaining a safe and sustainable orbital domain.

Extending the Space Information Sharing Ecosystem into an AUKUS-like framework could advance the accord's strategic objectives and serve as a model for future international partnerships in space. This situation would benefit both parties. It has the potential to serve as a beacon of openness, cooperation, and security in the swiftly evolving space economy.

6 ACCEPTING THE POTENTIAL OF MINIMUM VIABLE INFORMATION

6.1 The AUKUS Treaty and the Essential Role of the MVI in International Space Cooperation

Within the framework of the AUKUS treaty, the complex information needs of those with a stake in the space industry assume center stage. In light of these demands, the "Minimum Viable Information" (MVI) concept has emerged as a crucial component. MVI strengthens AUKUS's commitment to information security by distinguishing between essential data (MVI) and data that may contain sensitive information. If they advocate for decentralized data exchange, AUKUS members can foster mutual trust while safeguarding national interests and ultimately promoting transparent and accountable space activities.

6.2 The significance of AUKUS and the necessity for norm-based behavior in space

In addition to emphasizing defense and security, the AUKUS framework inherently promotes establishing responsible standards, which is particularly important in complex domains such as space—establishing unambiguous standards aids in preventing disputes and misunderstandings in outer space. However, there is a problem: in order to conform to these norms, entities require precise information. Despite commendable efforts, such as the European Union's code of conduct for behavior in outer space, there are still glaring information silos. Due to its dedication to collaboration, AUKUS has the potential to play a transformative role in this circumstance. If AUKUS follows Dr. Moriba Jah's advice, it can integrate diverse knowledge sources into comprehensive repositories, increase space domain awareness, and align itself with existing standards.

6.3 Advocates for Enhanced Space Situational Awareness under AUKUS

In terms of space situational awareness, the traditional reliance on sensor-derived data omits a crucial component known as "intent to maneuver." A comprehensive method of MVI would include both positional and intent data. Due to its technological and strategic prowess, AUKUS is in a position to serve as a vehicle

for such initiatives, propelling innovations such as SISE. This location places AUKUS in a favorable position. These frameworks, which are consistent with the innovative ethos of AUKUS, have the potential to facilitate not only technological advancements but also the development of a socioeconomic fabric that can bridge the divides between nations.

6.4 Ensuring AUKUS Advances the Long-Term Sustainability of Space Activities and a Viable Space Economy.

By approving standards for the environmental sustainability of space activities in 2019, the international community made a significant step toward realizing a secure space future. Adopting systems such as SISE within the framework of AUKUS contributes to strengthening this commitment. It ensures that the three nations remain at the vanguard of efforts to promote responsible space activities.

As for Australia, a recent ASPI study examined the transformation of Australia's space sector over the past decade, from a reliance on foreign-provided satellite services and locally developed ground-segment capabilities, including for space domain awareness, to the growth of a sovereign space industry and the formation of the Australian Space Agency in 2018. The author observed that, since the establishment of the agency, Australia's commercial space sector has expanded significantly, but is now facing headwinds, with the recent cancellation of the National Space Mission for Earth Observation representing a significant blow to the country's space industry. Now, the Australian space industry must contend for continued funding. In this report, the author argues that the best way to accomplish success is to emphasize sovereign launch as a focal point for Australian space activities and to emphasize the potential opportunities presented by the Northern territories of Australia, including for defense and national-security needs in space. (Davis, M. 2023)

Two sites, Nhulunbuy near Gove in the Northern Territory and Abbot Point near Bowen in Queensland are currently under development due to their proximity to the equator and their potential advantages. Due to the velocity a rocket gains from the Earth's rotation, the closer a launch site is to the equator, the lower the cost per kilogram of payload delivered to orbit. (Davis, M. 2023)

Regarding space and defense, the report suggests that Australia increase its burden sharing in orbit. The establishment of sovereign space launch in the north will enable a much more expansive approach to defense space activities, including responsive space access for augmentation and reconstitution as part of enhancing deterrence through space resilience.

The current dynamic geopolitical environment in the Indio PACOM region necessitates a collaborative and unified strategy for space exploration and defense. Recognizing Australia's strategic position and technological capabilities, a new AUKUS alliance for space could increase burden sharing in space to advance mutual defense and economic interests and strengthen the alliance's position in space.

- Establishment of Space Launch Independence in Northern Australia:

Northern Australia's geographical location makes it an optimal location for space launches, allowing for a variety of orbital inclinations.

The benefits are:

- **Rapid Launch Capabilities:** Enables a quicker response to global events and hazards through the deployment or replacement of satellites.
- **Cost-Efficiency:** Shared launch facilities and technologies can reduce the alliance's overall expenses.

- Strategic Positioning: Offers AUKUS a dependable launch location outside of traditional theaters, thereby enhancing security and redundancy.

Table 1 provides a structured view of the potential economic benefits. It can serve as a quick reference for stakeholders, policymakers, and investors.

Table 1: Economic Benefits of Sovereign Space Launch Capability in Australia

Area of Impact	Description & Benefits
Infrastructure Development	- Economic growth from construction and maintenance of launch facilities. - Upgradation of roads, airports, seaports, and communication systems, promoting broader regional development.
Creation of High-Tech Jobs	- Attraction of top talent, leading to knowledge spillovers. - Specialized courses offered by universities, fostering research and innovation.
Boost to Tourism	- Potential for space tourism. - Educational tourism through space centers and launch facilities.
Stimulating R&D and Innovation	- Creation of research hubs in aerospace, astrobiology, and related fields. - Encouragement for private sector participation in space-related innovations.
Diversifying the Economy	- Development of new supply chains for rockets and satellites. - Potential to offer launch services to other countries, boosting exports.
Attracting Foreign Investment	- Attraction of partnerships and investments from spacefaring nations and companies. - Opportunities for joint ventures with international agencies and corporations.
Strategic Alignment with Defense	- Enhanced national security through integrated space and defense strategies. - Attraction of defense contracts, bolstering the defense industry.
Enhanced National Pride and Branding	- Boosting Australia's global image as a high-tech, forward-looking nation. - Cultural and educational impact motivating future generations.

Consider what a trilateral partnership can do for Australia's economic terrestrial issues. Every space odyssey begins on the earth with infrastructure. As part of the AUKUS framework, Australia's space infrastructure would not be constructed in isolation. We would possess the combined financial and technological might of the United States and United Kingdom. We're not just talking about posh launch facilities, but also the ripple effect of improved roadways, airports, seaports, and communication systems. Essentially, a broader regional transformation.

With combined initiatives come combined employment opportunities. An AUKUS-led space initiative would attract the brightest minds in the globe. Additionally, consider the priceless experience our professionals would receive from international exchange programs. What about our young talent? Universities would most likely introduce innovative courses aligned with these new initiatives.

Tourism: the appeal of space extends beyond astronauts. Joint space events could transform Australia into a space tourism hotspot. Similar to NASA's Kennedy Space Center, our space centers would be educational hotspots for those eager to comprehend the complexities.

Research & Innovation: A trilateral research partnership would unite the brightest minds from three continents. Despite the fact that each nation has its own strengths, consider the quantum advances that are possible when these strengths converge. Innovative breakthroughs in aerospace and astrobiology are no longer merely possible, but probable.

Under AUKUS, economic diversification would give the Australian economy new wings. We could diversify our industrial base by becoming part of a complex supply chain tailored to satellite and rocket manufacturing. In addition, do you offer launch services on a global scale? It's not just about money; it's a strategic move.

Foreign Investments: The AUKUS seal may serve as a beacon for foreign investors. Ultimately, initiatives supported by not one, but three nations exude confidence. Such cooperation also paves the way for even more extensive international alliances.

A partnership in space involves not only exploration, but also protection. The integration of joint space defense initiatives with AUKUS's extant defense strategies ensures that our nation is protected both on the ground and in space.

National Pride: Finally, each accomplishment, satellite launch, and mission fulfilled as a result of this partnership increases our national pride. Such endeavors can motivate our youth, painting a picture of a nation that is not merely a part of the future, but is actively molding it.

As we stand on the cusp of a new space age, the AUKUS partnership holds the promise of not only reaching for the stars, but also ensuring that every Australian will benefit from the voyage. It is not only about space, but also about a brighter, more prosperous future on Earth. So, as we gaze upwards, let's dream large, for in unison with our AUKUS allies, the universe is not the limit; it is merely the starting point.

6.5 AUKUS's Instrument for Space De-escalation Used to Facilitate Clear Communication

Lessons from historical precedents demonstrate the importance of open and honest communication. Recent events, such as the launch of the Kosmos-2558 satellite, demonstrate that AUKUS can meet both the obligation and the role of a leading body in the face of the increasing complexity of space. If a space-related AUKUS successfully establishes open communication frameworks and advocates for comprehensive space information ecosystems, it could establish a safer and more collaborative outer space domain.

At its core, the agreement represents a commitment to a safer, more transparent, and more collaborative future. If it embraces concepts such as MVI and implements systems such as SISE, AUKUS has the potential to be a leader in promoting responsible behavior in space. As space missions and satellites increase, the AUKUS framework provides a guiding light for normative behavior. This framework emphasizes transparency, trust, and collaboration, all essential to continuing space exploration.

7 SNARE: A PARADIGM SHIFT IN SDA

Traditional vs. SNARE Tasking

Traditionally, the U.S. Space Force Space Sensor Network (USSF SSN) tasks its sensors once per day. However, the SNARE method introduces dynamic and decentralized tasking, now in the prototype phase, which can significantly enhance SDA's tactical relevance.

Limitations of Current Sensor Placement

The geographical placement of sensors poses challenges in observing certain orbital areas. This limitation emphasizes the need for additional cooperative methods to achieve comprehensive SDA.

8 GLOBAL SPACE DOMAIN AWARENESS (GSDA) CONCEPT

GSDA introduces a decentralized, modular approach that encourages an expansive SDA network covering Earth and Cislunar regions.

8.1 Core Features of GSDA

- Decentralized tasking (leveraging SNARE & ad-hoc methods)
- Decentralized data technologies for information sharing and storage
- A GSDA-compliant ecosystem plug-in for global integration
- Interconnected GSDA ecosystems

9 CULTIVATING ENDURING PARTNERSHIPS

Incremental Growth of the GSDA Network

The primary drive for initial GSDA ecosystems is expected to come from spacefaring nation governments. Yet, commercial and academic interests could play pivotal roles in the evolution of GSDA ecosystems.

AUKUS as a Catalyst for GSDA Growth

Beginning with AUKUS, the GSDA concept can be expanded to include other nations and stakeholders. The AUKUS partnership provides an ideal foundation for geopolitical growth in SSA, fostering cooperation, data sharing, and technology development.

10 CONCLUSION

The vastness of space has always stimulated human imagination, exploration, and innovation. As technology propels us faster than policy and further into orbit, however, a renewed emphasis on cooperation and shared standards is essential. If it included an emphasis on Minimum Viable Information (MVI) and transparent exchange, a new AUKUS treaty for space has the potential to fundamentally alter the nature of international space relations. But AUKUS is not just about space; it represents a new epoch of global collaboration. The incorporation of sophisticated systems such as SISE and the adoption of dynamic initiatives such as SNARE highlight the alliance's dedication to responsible, sustainable space exploration.

With its distinct geographical position, Australia has the potential to become a hub for space activity, ushering in not only technological benefits but also profound socioeconomic transformations. The cascading effects of space activities will shape infrastructure, education, tourism, and national pride on the ground. It is a vision in which space is not merely a frontier for the privileged, but a realm from which all Australians benefit.

Beyond AUKUS, the Global Space Domain Awareness (GSDA) establishes a framework by which all nations, regardless of their technological prowess, can participate in the enormous space network. GSDA's decentralized, modular structure exemplifies a world where space is not dominated by a select few, but rather a domain of shared responsibility and collective ambition.

In the past, space was a contest to see who could plant their flag in space first. Today, as threats multiply and the stakes rise, space travel is a collective endeavor. With initiatives such as AUKUS paving the way, it is anticipated that nations will realize that in the vastness of space, cooperation is not a luxury, but a necessity. In the end, as we reach for the stars, it will be the relationships formed on Earth that determine our success in the cosmos.

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12 APPENDIX A: DRAFT AUKUS PACT SPACE EXTENSION (FOR EXPOSITION ONLY)

Space Information Sharing Ecosystem (SISE) Pact

The Government of Australia (“Australia”), the Government of the United Kingdom of Great Britain and Northern Ireland (the “United Kingdom”), and the Government of the United States of America (the “United States”) (collectively, the “Parties”),

Highlighting the previously established trilateral security collaboration under the banner of AUKUS, emphasizing the shared ambition to promote space exploration, research, and security;

Acknowledging that as part of this esteemed partnership, a collective endeavor has been initiated to identify and implement the best methodologies for the establishment and expansion of the Space Information Sharing Ecosystem (SISE);

Understanding that the United Kingdom and Australia, in alignment with the United States, are entering an era of enhanced international cooperation, significantly advancing the collective space knowledge, capabilities, and defense mechanisms;

Recognizing that the enrichment of a common understanding and promotion of space security will be propelled forward by the unreserved sharing of space information, research, and technologies;

Confident that such a generous exchange of space information will not jeopardize the individual or collective security and defense priorities of the Parties;

Reaffirming their collective commitment to the peaceful exploration and use of outer space, in compliance with international treaties and conventions; and

Incorporating relevant stipulations from the United States Space Act and other pertinent legislations, where applicable.

Have agreed as follows:

ARTICLE I Provisions General

In the context of the United States, the United Kingdom, and Australia cooperating in international frameworks for mutual space awareness and security, each Party may share and exchange information pertaining to the space domain with the other Parties in accordance with the terms of this Agreement. Such sharing is contingent on the understanding that it increases mutual space awareness without jeopardizing the defense or security of the communicating Party.

ARTICLE II Space Information Exchange

Each Party may share or exchange information deemed essential for the development, deployment, operation, regulation, and decommissioning of space systems and technologies. Upon mutual accord, parties may facilitate support to ensure efficient communication.

ARTICLE III Accountability for Information Use

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Any information shared or exchanged pursuant to this Agreement (including design schematics and technical specifications) is the sole responsibility of the receiving Party. The original Party neither indemnifies nor guarantees the accuracy, completeness, or applicability of such information for particular purposes.

ARTICLE IV Requirements

- A. Each Party shall comply with its own laws when cooperating under the terms of this Agreement.
- B. This Agreement does not supersede or nullify any potential exchange of space domain information authorized by other arrangements or agreements between the Parties.
- C. Cooperation under this Agreement shall adhere to International Space Safety standards and guidelines, ensuring that space activities remain benign and secure. In this context, relevant international agreements signed by Australia, such as the Outer Space Treaty, will be recognized.

Article Five Assurances

- A. Parties shall implement stringent security measures for classified space data shared or exchanged in accordance with this Agreement. This protection conforms to the Annexes of the Agreement and the national statutes of the Parties. Under no circumstances shall any Party's security standards be less stringent than those enumerated in the Annexes in effect upon ratification of this Agreement.
- B. Unclassified space domain information shared pursuant to this Agreement shall be afforded comparable protection to that provided by the disclosing Party. Parties shall discuss the appropriate safeguards for such data.
- C. Information pertaining to the space domain that is shared or exchanged in accordance with the terms of this agreement shall be transmitted via existing or to-be-established exchange channels.
- D. The receiving Party or its jurisdiction shall not disclose or transfer to unauthorized entities any space domain information received pursuant to this Agreement. A Party may limit the scope of information dissemination, designate categories of individuals with access rights, and impose any other necessary restrictions on information dissemination.

ARTICLE VI Information Dissemination

This Agreement shall not inhibit or restrict any Party's consultations or cooperation with other nations or international organizations on defense-related matters. Nonetheless, no Party shall share space domain information provided by another Party pursuant to this Agreement with other nations, foreign entities, or non-Party nationals. In addition, no Party shall share such information with a national of another Party without the consent of that Party.

ARTICLE VII Classification Policies

ARTICLE VIII Intellectual Property

ARTICLE IX Definitions

ARTICLE X Final Provisions

Agreement.

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Done at _____, this _____ day of _____, 20 __, in three originals.

For the Government of Australia:

For the Government of the United Kingdom of Great Britain and Northern Ireland:

For the Government of the United States of America:

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