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UNITED SPACE: MILITARY AND COMMERCIAL SECTORS WORKING TOGETHER TO HARNESS INNOVATION IN SPACE RESEARCH AND DEVELOPMENT

by

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A Research Report Submitted to the Faculty

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Master of Military Operational Art and Science

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PREFACE

I have had the privilege to be a part of the United States Air Force for more than 30 years with a career that took me to a couple of space bases and also to Headquarters Air Force Space Command. I have been stationed at or near both East and West coast launch facilities. Additionally, I had opportunities to attend several launches or see them from close by, including the Space Shuttle challenger 1986, and the Space Shuttle Discovery with John Glenn on board in 1998 and the final launch of Titan IV heavy in 2005. I have seen first-hand the power of our space programs and the ability to have mission success and recovery from failure when the team works together. Those space events have stayed with me and have impacted my career choices.

I hope that some of the ideas and recommendations from this paper are implemented and improve the U.S. military and commercial partnerships. This is a turning point in history as the door is open to developing alliances, reassessing research and development, acquisition, and all of our space programs to determine best practices and pave the way for the successful lift-off onto this new frontier.

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I want to express my appreciation to my parents, friends/family, and especially my children, for their on-going support, love and interest in space. They were good sports to attend space launches, support my hobby and programs about space. They have also helped me during this entire master's program as I took the challenge to come back to traditional learning after an extended absence. Finally, I would like to thank Col Raj "Buck" Agrawal, Lt Col Scott Willocks and Air University's 2019 space focused research class for their tireless guidance and counsel on space programs. I also appreciate the vital leadership from each of my instructors and classmates for their insights throughout this process. This has been a great learning experience. I encourage all space enthusiasts to keep looking up.

ABSTRACT

The U.S. military is starting a new era of space exploration and development in the fiscal year 2020. The leading edge of space must be sharp and have the focus to meet the unique challenges of defending Earth from any threats from space while also researching and developing new technologies. This requires a united front between the U.S. military and the commercial industry.

The next twenty years will shape the future of the U.S. military and the commercial industry that have interests in space. The U.S. military near-peers of China, Russia, and Iran continue to become active in space programs, which requires the U.S. military to confront the increased risk and threats across the space domain. The commercial industry is working to establish space programs that are projected to create a trillion dollars in revenue by 2040. However, both approaches must culminate in a united space where the U.S. military and commercial sectors work together to harness innovation in space systems and programs, including research and development. To better align programs, reduce costs but, always also protect and defend the U.S.

The Air Force has the unique opportunity to unite the Air Force and the Space Force military and commercial industry systems and programs now that critical legislation has appointed an Assistant Secretary of the Air Force for Space Acquisition and Integration. This is an opportunity for the Air Force to launch the Space Force infused with a rich heritage of innovation and excellence but, modernized to take-off in this newest version of the space frontier.

"We set sail on this new sea because there is new knowledge to be gained, and new rights to be won, and they must be won and used for the progress of all people".

— John F. Kennedy

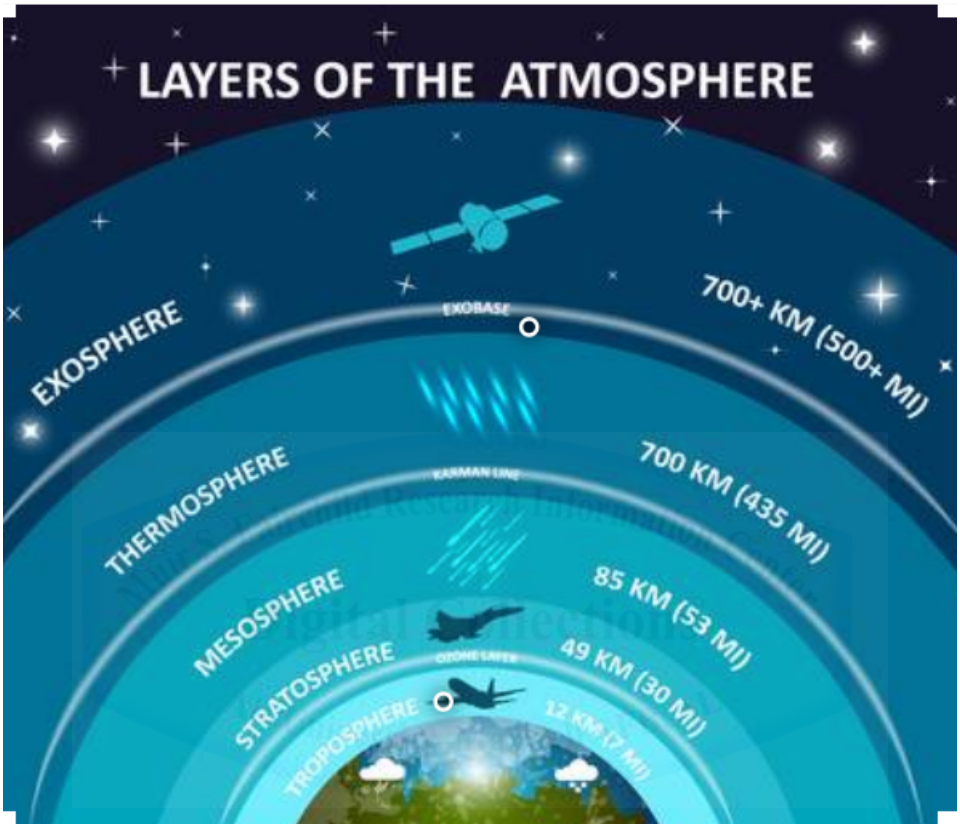

Figure 1 Near Earth Atmosphere Layers

INTRODUCTION

Space is the new frontier for development and exploration. The United States military and commercial industries are assertively leading the way in researching and developing space to improve information, communications, and technology operations across the planet. As the global security dynamics shifts to this new frontier to meet the growing threats in the space domain, the National Defense Authorization Act for FY2020 establishes a U.S. Space Force as a new component of the Air Force.[1] This is the first new service since 1947. The U.S. is at a turning point in the history of space exploration and development, where new industries are

being born to use space in non-traditional ways. The established state-run industrial space sector is no longer the only game in town: commercial space is becoming competitive. Together, the government and private industry can facilitate the birth of this new industry.[2] The next twenty years are critical for establishing the ground rules for this new rendition of the space industry and the way it will operate. Analysts at Morgan Stanley's space investment team, project the global space economy could surpass $1 trillion in value by 2040. [3] This research uses a problem/solution methodology to analyze three key issues in the research and development processes for space programs, which are the common between the U.S. military and the commercial industry space programs. This research will evaluate: 1) how the U.S. military and commercial industry space sectors can be better integrated; 2) where cost savings may be attained in research and development labs, acquisitions, or in centralizing space programs; 3) and evaluate the requirements for the U.S. military to protect and defend U.S. interests in space.

The U.S. military has a renewed opportunity to strengthen partnerships and find the best ways to integrate military and industry methodologies in space exploration and development. The processes must develop rapid acquisitions and effective programs but, discard the ineffective practices that are laden with bureaucratic red tape to build a united space force. The promise of innovative opportunities, especially in research and development today is on par with the historical Army-Air Corps days of World War I where airpower and flying were developing a whole new advanced way of operating. The early Air Force operational vision of offensive capabilities, like bombing targets from overhead and eliminating threats by shooting from planes, was unconventional at the time but, early air power theorists went way beyond traditional observation of air power at the time. The Airman's perspective fundamentally advanced air

capabilities and added air as an operational domain. 70+ years of building that independence now advances the U.S. military and commercial industry out into the space domain.

The 2018 National Military Strategy (NMS) states that space is a domain that must be protected, just like the land, sea, and air are today. The vision of the Joint Force articulated in the 2018 NMS is a combined multi-service military capable of defending the homeland and projecting power globally, now and into the future. This substantive policy lays the groundwork for the U.S. military to maintain an advantage over competitors and adversaries; the NMS introduces the notion of joint combined arms, defined as the conduct of operational art through the integration of joint capabilities in all domains *including space*.[4] The space domain combines with the cyber domain to enhance and supplement traditional land, sea, and air operations to create a "multi-domain operation" as the new normal.

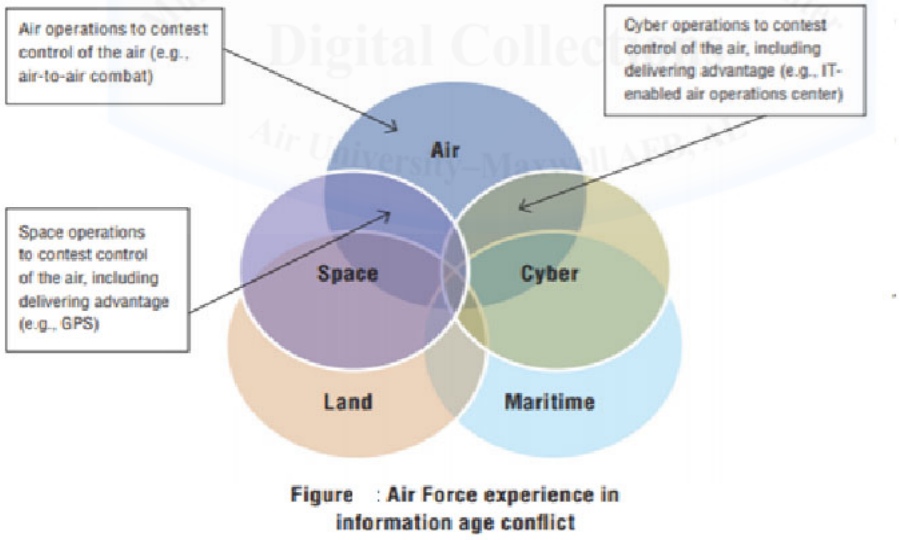

Figure : Air Force experience in information age conflict

Figure 2 Air Force experience information age.

Space does not replace the air domain; it extends the advantage and adds to its capabilities.[5] Each domain has some overlap, but each domain is also dependent upon one

another and all are contested. The U.S. military is responsible for protecting and defending the United States' interests across all domains.

The United States has established the U.S. Space Command to preserve space as a global common ground. U.S. Secretary of Defense, Mark Esper, appointed Gen. John "Jay" Raymond as the Space Force's first chief of space operations and has said that the new branch will be a "technology-focused service."[6] The logo for the U.S. Space Force, which draws heavily on the new military branch's Air Force heritage, and also bears a striking similarity to the "Star Trek" insignia. "The delta symbol, the central design element in the seal, was first used as early as 1942 by the U.S. Army Air Forces; and was used in early Air Force space organization emblems dating back to 1961. Since then, the delta emblem has been a prominent feature in military space community emblems."[7] Colonel Agrawal said that the Air Force commissioned Captain Eugene Roddenberry of Army-Air Corps Service, 1942-1945, 5th Bombardment Group, Heavy [8] to create the early Air Force version of the Air Force Bomber emblem. Later, Captain Roddenberry was approved by the early Air Force to reuse this emblem when he started the Star Trek series and the Starfleet designs are supposed to be a direct descendant of them.[9] Today, the delta space emblem is as iconic as the 1966 Star Trek series tagline, "… to boldly go where no man has gone before," "Star Trek" has represented the hope of what space — "the final frontier" — can mean for humanity in a few centuries.[10] This iconic emblem has become synonymous with military and commercial industry space programs. The next twenty years will establish the path for the U.S. military and commercial industry to use space in non-traditional ways, starting in research and development departments. There must be a concentrated effort to accelerate the most innovative and effective programs to expand space capabilities and services while at the same time reducing the operational expenses as the U.S. continues to embrace the space frontier.

Problem History/Background

Space provides resilient, defendable and affordable space and cyberspace capabilities for the Air Force, Joint Force and the Nation.[11] The Joint Publications 3-12 and 3-6 capture the current state of U.S. space operations with the new emphasis on exploration and development. The early airpower struggles of WWI and WWII are similar, except now each event is on-line and being scrutinized in near real time.

The historical records show that the early airpower adopters from World War I, General's William "Billy" Mitchell, Giulio Douhet, and Hugh Trenchard introduced the concept of strategic bombing and were advocates for independent air forces. Those theories shaped military aviation for all time. But, in the early 20th century, while airpower was in its infancy, the Army and Navy did not believe that airplanes would ever be more than a low capability support tool. The Army and Navy believed that air programs belonged under the control of the U.S. Army or Navy. The outspoken U.S. military advocate for airpower and independent air service was General Billy Mitchell. General Mitchell was slandered, defamed, and court-martialed for his enduring expressions and unwavering belief in airpower as a separate air force.
History captures several legendary early airpower events but, the 1921 sinking of the unsinkable Ostfriesland Battleship was a first: It was a controversial military exercise which demonstrated to the world the power of aerial warfare in the naval domain. The bombs critically damaged the ship, and it sunk, making the potential of airpower apparent.

Mitchell's advocates and promoters have pointed to the sinking of the *Ostfriesland* as being a significant milestone in the history of American airpower.[12] The advancing airpower capabilities of the 1900s slowly convinced the skeptical officers of the day that airpower was capable of much more, but, the subsequent support of independent air operations was slow. For

years Mitchell continued to push for a separate service and in 1946 Congress posthumously awarded Mitchell a special Congressional Medal of Honor in recognition for his "outstanding pioneer service and foresight" in the field of American military aviation.[13] The Army Air Corp finally became the United States Air Force September 18, 1947.[14]

For the last 70+ years, the Air Force has continued to excel in aviation and the understanding of air and space but it also pioneers the understanding of the atmosphere around the Earth while maintaining a fiercely independent and innovative spirit that Gen Mitchell presented long ago. The Air Force recognized and built air capabilities that have advanced to a point where space has become such a valued domain that it has earned recognition as a separate service. The Air Force has had control and oversight over many space capabilities under the Air Force Space Command, and U.S. Space Command as a Combatant Command since its inception. The space programs must stay on the leading edge; as these programs have outgrown traditional air centric oversight. The global understanding of the layers of the atmosphere has matured beyond the simple fact that the atmosphere is the protective shield that makes the Earth a livable place. The Earth is enveloped by an atmosphere that is composed of five layers, namely troposphere, stratosphere, mesosphere, thermosphere, and Ionosphere. This includes the exosphere where the Earth's atmosphere meets space. This is important to note because the troposphere, the layer closest to Earth, stops at 7 miles from Earth. The next layer where most jet aircraft fly in the stratosphere and ends at 30 miles above the Earth.[15] But space-based operations start operating at the thermosphere layer, which begins at 435 miles above Earth. The International Space Station and the NASA Space Shuttles (retired) orbit in this layer. Due to changes in the density of air in this layer, satellites experience a drag force, so satellites operate even higher in the exosphere, which is 500 miles above the Earth. The capabilities of devices and

tools that operate above 435 miles are very specialized compared to lower levels of the atmospheric requirements. Space based assets operate the most effectively at 435 miles above the Earth.

Over the years, U.S. forces have increasingly come to rely on space-based assets. Spy satellites provide critical intelligence; global positioning satellites provide accurate navigation needed for precision-guided munitions, and communications satellites provide communications for globally distributed forces. These capabilities have come to define how U.S. forces fight, and many of the military advantages hinge on them. Protecting the space assets to ensure uninterrupted access is now more essential than ever for the U.S. nation's success.

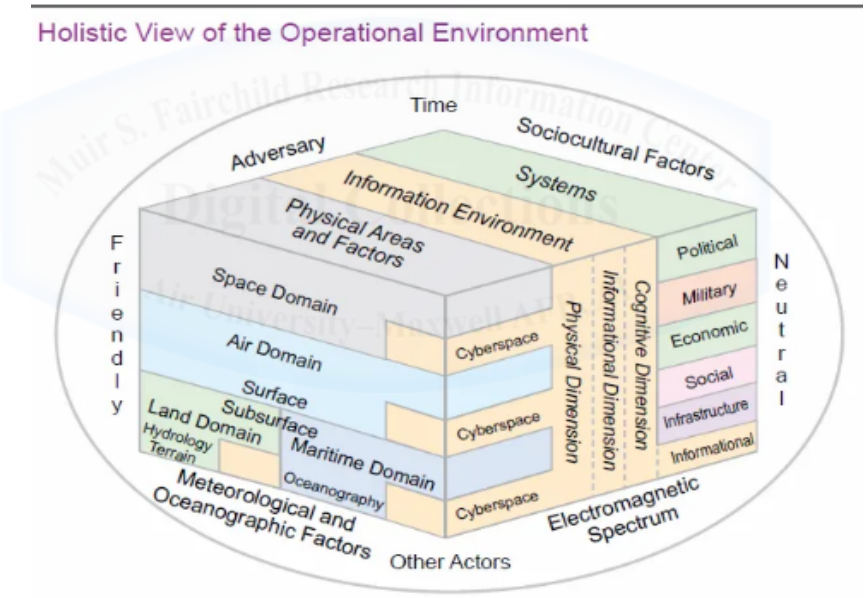

Figure 3 Holistic view of the Operational Environment

The space domain extends the air domain, and a holistic view of the operational environment visibly demonstrates this symbiont relationship. Each domain of the land, sea, air, cyberspace, and space all depend on each other but, just as land is very different, the water and air and space also hold unique capabilities, requirements and missions. Based on an improved

understanding of science and technology, space is operating in a lane separate from the air. It is time to acknowledge the advancements of space and re-align space to nationally prioritize this mission on a successful track under the Space Force.

The Joint Chiefs of Staff has established the military definition of space and the overall plan for joint force activities in space. This authoritative doctrine provides the strategic vision: the plan, operations, and structure for space operations across the U.S. military, agencies, and support agencies operating in the 21st Century.[16] These military efforts are the foundation for integration of space between military operations and industry. The U.S. military must always balance the on-going and emerging threats in space. China, Russia, Iran and others are always a military concern. However, of primary concern is China announcing a specific goal to be a major global space power by around 2030, and China's primary state-owned space contractor stating that China aims to be a global leader in space equipment and technology by 2045.[17] These bold statements directly impact both U.S. military and U.S. commercial industry.

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Key Issues and Analysis

The space domain will build upon previous air domain lessons to re-establish itself and the space domain. The lesson learned today will help guide space operations over the next twenty years. The Chairman of the Joint Chiefs of Staff created joint doctrine to govern the activities and performance of the United States armed forces in joint operations, and this doctrine provides considerations for military interaction with governmental and non-governmental agencies, multinational forces, and other inter-organizational partners. [18] The military and commercial sectors must unite to harness innovation in space research and development programs to ensure the U.S. has viable programs that will be on track for increased acceleration

of space programs that expand space capabilities, control costs and deter adversarial behavior from near-peers.

The commercial industry is pushing for freedom to develop space with the aim to establish space and the future of this industry to be a profitable endeavor. But on the other hand, the industry is plagued with lost revenues, stolen trade secrets, intellectual capital theft, and stock devaluation. China, Russia, Iran and terrorist organizations regularly pilfer U.S. data and intellectual capital. In addition, foreign state actors and companies are unscrupulously reutilizing U.S. company data. An example of this type of activity occurred in Jan 2019 when a federal prosecutor's indictment charged the Chinese tech giant Huawei had stolen trade secrets from U.S. cellphone company T-Mobile and offered bonuses to employees who managed to swipe technology from other companies.[19] The loss of T-Mobile's data and continued theft of data in general cripples the industry and the U.S. military by undermining security, project success and corporate profits. The U.S. military, and the commercial industry must protect systems and data using the National Institute of Standards and Technology cybersecurity initiative. The U.S. military and commercial industry must tackle the legislation and financial concerns together to protect both military and commercial valuation.

The control of space programs now has critical legislation advocacy with the newly appointed Assistant Secretary of the Air Force for Space Acquisition and Integration. This person will serve as the Service Acquisition Executive (SAE) of the Department of the Air Force for space systems and programs.[20] Along with this appointment, new acquisition reform initiatives scale to enable innovation and supports a culture of modernization, critical thinking and creative compliance across space programs. This aligns space programs across the Air Force to be cooperative efforts in research and development labs, acquisitions, and centralizing space

activities. The space frontier introduces new paths to explore but, also encompasses new risks and communication pathways that must be protected.

The U.S. military and commercial industry are the primary sectors that must embrace interdependence, not independence, as these new space industries research and develop the future. A cooperative approach guides research and development programs towards a fast-track for delivery but also saves on the operational costs by combining teams which is critical to success. The U.S. military has established some partnerships with essential elements of space operations to monitor military-related activities, events, and training exercises. These space-based transmissions provide instant updates to Joint Force Commanders and Operations Centers around the world via satellites today. These combined military/commercial satellites provide vital communications during a military operation, peace keeping, and also increase capabilities not only for the military but, for commercial vendors as well. A good example of a combined platform that benefits both military and commercial services is Global Positioning Service (GPS) satellites. The use of satellites continues to grow. Satellites are routinely used by the military, commercial airplanes, and even automobiles for mapping their location, flight data, and routes today.

The U.S. commercial industry giants Lockheed Martin, Northrop Grumman, and Raytheon are already operating a large portion of satellites with partnerships onboard via ViaSat, Global Eagle, and AT&T. These quasi intergovernmental consortiums, own and manage a constellation of communications satellites providing international broadcast services. Some of the newest innovators, Space-X's Elon Musk and billionaires Blue Origin's Jeff Benzo and Virgin Galactic's Richard Branson, are profiteers looking to develop space tourism. The U.S. military's research and development leaders must understand the various initiatives and work

with the satellite communication companies, the broadcast services and also with the newest innovators to evolve services, link capabilities, and even pursue advancements of technology in space as a united team. By joining forces, both the U.S. military and commercial sectors can increase acceleration and revenues while also expanding space capabilities and services and reducing operational expenses at the same time. The use of satellite services is expected to grow exponentially. According to Northern Sky Research, Global Satellite Capacity Supply and Demand, 16th Edition report, SATCOM wholesale capacity revenues will reach $24.7 billion by 2028. Assuming the same 6.8 percent estimate in growth from 2018-2028 time period, the industry would generate $54.5 billion annually by 2040.[21]

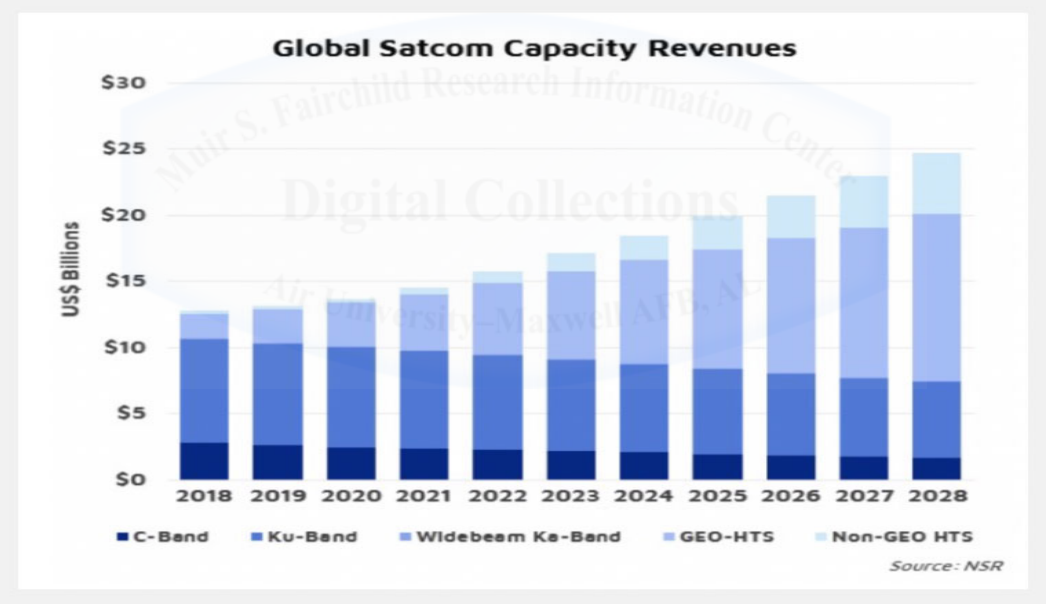

Figure 4 Projected Global Satcom revenues 2018-2028

There are endless opportunities for space exploration. Research and development programs are the incubators for new technology and initiate progress and growth in science and industry. The U.S. military and commercial sectors in space research and development are working diligently to develop/expand current space capabilities and innovative services. A promising partnership between the U.S. Naval Research Laboratory, National Aeronautics and

Space Agency and several contractors have deployed an emerged modulated laser communications technology as a payload on the U.S. Air Force's Space Test Program-Houston 6 (STP -H6) as part of an experimental pallet on the International Space Station from March 2019 - October 2020.[22] This technology offers more efficient gigabits-per-second data rates for deep space missions. Gigabits per second is a data transfer rate equivalent to one billion bits, or simple binary units, per second. These extremely high-speed rates of data transfer are uncommon, but new research projects have pushed computing capability toward this range for some technologies.[23] Program partnerships like these are crucial for success in emerging technologies that operate in space.

The commercial industry has stepped up to improve Space-based technology by introducing new resources, capabilities, and a better understanding of Earth. One very successful program has hundreds of thousands of organizations in virtually every field is-using the Geospatial Information System (GIS) to make maps that communicate, perform analysis, share information, and solve complex problems around the world. GIS is changing the way the world works through integrating and improving the data provided to decision-makers in both government and industry. The U.S. military and commercial sectors must strategically plan to operate cooperatively in space to make maps, analyze data, solve problems, and share geospatial data.[24] Sharing this strategic data provides a dependable database framework to accurately reference and utilize for space programs.

Recommendations

"It is time for United States Air Force as a service, regardless of specialty badge, to embrace space superiority with the same passion and sense of ownership as we apply to air superiority today."

--- General Goldfein, 21st Chief of Staff of the Air Force

Space impacts multiple areas of economic, political, technological, and military operations. The National Defense Acquisition Act of 2020, signed by President Donald Trump on December 19, 2019, established a brand-new service component, the United States Space Force. The U.S. military has established essential elements of space operations to monitor military-related activities, events, and training exercises using space-based systems and tools.

Space-based transmissions provide instant updates and critical situational awareness to Joint Force Commanders and military operations centers around the world. The U.S. military services must all work together to protect and defend the United States of America and space-based information is critical in that effort. The U.S. military must never repeat the historical slander and defamation of ideas and unconventional thinking that was common in the early days of evolving airpower. The increased focus from the U.S. military has garnered the attention of the near-peer, China. The People's Liberation Army (PLA) of China has officially designated space as a new domain and established an organization to command its space forces. With this increased focus on space, the PLA may begin to develop a doctrine to govern the use of space in military operations. The higher priority is given to space, especially space control, by the PLA coincides with similar actions by the U.S. military, increasing the possibility of warfare in space and the risks escalation.in conflicts below the threshold of war.[25] The U.S. military operates across diplomatic, information, military, and economic boundaries that often shifts between influence, coercion, intimidation, or undermining near-peer interests while building the interests of U.S. friends and allies. Space research and development is a broad field influencing this multitude of efforts and holds many potential gains and risks to study.

Space programs provide vital communications during military operations, during peacekeeping, and to everyone connected by electronic communications devices. An example is

cellular phone service and specifically T-Mobile, AT&T, Verizon companies that work with the National 911 Program. This Federal "home" for 911 plays a critical role by coordinating federal efforts that support 911 services across the nation. Today, people communicate in ways that the designers of the original 911 system could not have envisioned: wireless phones, text and video messages, social media, Internet Protocol (IP)-enabled devices, and more.[26] This vital emergency management program saves lives by connecting first responders to cellular phone users wherever the emergency is occurring.

Another example of satellite communication is television service into residences. Many consumers have satellite television services from Dish, Charter, or Cox into their homes. These commercial companies provide satellite television services via an individualized satellite antenna or dish. These tools bring clear television and internet connection to areas that may not have other service providers in the area. The ingenuity of the U.S. military and commercial industry developing space programs for exploration and deployment is superior. These technology services are advancing the way humans live. Space research and development improves the lives of the U.S. populace by advancing technologies available to users.

The use of space in non-traditional ways expands its utility beyond military and communications tools. The research and development programs must shift to support space exploration that stretches beyond U.S. interests and out to the whole world. According to the U.S. Secretary of Defense, Mark Esper, space is "important not just to our security, but to our commerce, our way of life, our understanding of the planet, weather, you name it. So it's very important that it is treated that way and make sure that we're prepared to defend ourselves and preserve space.[27] The pursuit of emerging non-traditional space research and development programs offers opportunities to expand capabilities at reduced costs by initiating research on as

smaller scale. This can begin as a ground-based experiment that competes for launch opportunities on a cube satellite or as an experimental candidate on the International Space Station. A non-traditional partnership was developed between the Army and the University of Utah when the students developed a novel structural concept to ease assembly and disassembly of electronics as part of the Army Cost-Efficient Spaceflight Research Experiments and Demonstrations (ACES RED). The Army program is an iterative, periodic flight experiment and demonstration effort to test singular phenomena, technologies, and concepts for future Science and Technology (S&T) projects that are directly related to and in support of the United States Army Space S&T Roadmap Programs[28]. Embracing innovative non-traditional space programs improves the foundation of space as the space frontier gathers momentum.

Space is no longer a U.S. only investment. The United Nations Office for the exploration and use of outer space, states that exploration shall be carried out for the benefit and in the interests of all countries and shall be the province of all mankind. The appropriate role of the government in facilitating commercial space businesses is an ongoing debate. There must be a balance between facilitating commercial activities while ensuring the U.S. government has needed data and services. International cooperation and competition in space are affected by the world economic situation. [29] Military and commercial industry research and development communities that are space focused must make a concerted effort to integrate U.S. military and commercial industry space sectors to accelerate space program timelines, expand space capabilities, and deliver services more efficiently. Cost savings may be attained by combining research and development labs, acquisitions, or by centralizing space programs. Additionally, sharing space program ventures ensures that the U.S. military can protect and defend the United States' interests in this newest exploration and development program in the space frontier.

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Conclusion

The National Defense Acquisition Act of 2020, established the brand-new service component, the United States Space Force, under the Department of the Air Force. The Air Force was the last service component established more than 70 years ago in 1947. All of the other service components Army, Navy, Marines, Coast Guard, were created in the 1700s. This is the first time since 1947 that a new service component has been authorized. This new Space Force presents a rare occasion to re-assess the current processes and operations to select the best of the breed to integrate into the new business processes that will guide the launch of space operations for at least twenty years. This is an opportunity to reduce inefficiencies in research and development labs, acquisitions, or existing space-related programs; but also reinforce the requirements to protect and defend the United States of America with a unified approach that establishes a solid foundation for space operations.

The U.S. has valuable commodities in the space program. Partnerships between the U.S. military and commercial industry are crucial for success. U.S. near-peers Russia, China, Iran, and even troublesome terrorist organizations look to exploit or harm the U.S. on an on-going basis and utilize this research from the U.S. to support other immature space programs. The democratic freedom of the U.S. makes it susceptible to theft, and significant losses of intellectual capital, cyberattacks, and resources across land, sea, air, space, and cyberspace domains. Specifically, the Chinese have taken a pervasive and particular interest in space control programs. Earnest discussions on preventive programs, reduction of cyberattack surface, and understanding how to share data safely are more critical today than ever. The partnerships between military and commercial industry are critical to secure the U.S. space program and revisit processes for improvement.

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The U.S. military and commercial industries must lunge forward to explore transformative research and development processes that can be implemented across the space domain to streamline acquisitions programs and discard ineffective methods. These programs must complete the critical work to eliminate the restrictive processes that currently curtail creativity and dampen out of the box thinking. This joint partnership must utilize the newly established boost of dedicated Service Acquisition Executive (SAE) for space systems and programs to form a culture of creative compliance, scaling innovation from pockets of excellence, and mainstreaming the newest authorities provided by Congress. The revisions authorized by Congress establishes a dedicated executive for space programs that shape the required reforms and builds partnerships as space becomes more of a military priority.

The newly established Space Force must examine how the U.S. military will protect and defend the United States from space. The Air Force must embrace this change and the immediate need to shape the Space Force. The multi-domain operation of the land, sea, air, space, and cyberspace is the new normal. The U.S. military must not repeat the historical mistakes of the World War I era in the days when both the Army and Navy attempted to crush the burgeoning efforts of the Army Air Corps, the early airpower theorists, and the struggle to establish as an independent identity. The Air Force must support the Space Force to develop a separate identity.

The U.S. military has a rare and limited window to strategically revise the research and development vision and expand the aperture of possibilities with commercial partnerships. The effort works not only to reduce costs but advance scientific research and development to benefit a united space. The designation of a new service component is rare. The official appointment of the Space Force marks the beginning of a significant change to the current Department of Defense. The shifting of resources, personnel, and mission is challenging but necessary. The

initial United Space Force is operating under the Department of the Air Force. It is imperative that all U.S. military services, including the Air Force, embrace this new direction. The future space mission interacts with every function across the Department of Defense and interfaces with every commercial space industry program as well to forge a united space program.

The United States Space Force takes the U.S. military and commercial industry into a whole new landscape to explore, research, and develop the exosphere for human use. Space also offers the potential adventure of a lifetime and opportunities to change the world. The adventure of space opens the door to new opportunities where unusual and challenging experiences await both the military and commercial industry. Some partnerships are developing, but the procedures and processes to bring regular research and development and acquisition programs together are currently separated and disparate. The most cutting edge and advancing programs are now coming out of the industry, not the military (e.g., Elon Musk/Space-X's reusable launch process and materials). They are grabbing headlines and the attention of the traditional space titans. Traditional strongholds of military engineers and industry giants controlling military launch locations like the United Launch Alliance, Boeing, and Lockheed are no longer the presumed space contract awardees. Industrious commercial entities like Space-X, Virgin Galactic, and Blue Origin are actively developing and competing in space. The research and development capabilities with non-traditional ventures are high risk but offer high reward. The U.S. military must make methods malleable. The space-based acquisition programs must engage and benefit across the multidisciplinary scientific research and development programs. This is the time for the U.S. military and commercial industry to find the stars in space development and exploration. "The future is ours to create".[30]

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