A WARRIOR'S MINDSET

KEY TO WINNING IN SPACE

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"To be prepared for war is one of the most effective means of preserving peace."

-George Washington

It would have been a shot heard around the world, except no one could hear it happen in space. On January 11, 2007 China conducted its first anti-satellite missile test on its own defunct weather satellite spreading thousands of deadly shards of space debris across highly used orbits. This event manifested what many space theorists have long warned—the space domain is not a sanctuary, space assets are vulnerable, and those who rely on space have the most to lose if attacked. It also challenged policy makers who long thought demonstrated attacks on satellites would be unrealistic because of their Cold War associations with nuclear escalation. Conversely, the event brought to light that holding vulnerable capabilities at risk might make an adversary think they have newfound tools for deterring the U.S. to stay out of conflict. Most importantly, it was a wakeup call to Airmen who are responsible for defending our nation in the

domains of air, space, and cyberspace.

The reality is that today's space domain is contested and the United States and its allies can no longer view space as a sanctuary in which to operate with impunity.

Addressing a contested space environment will require a warfighter mindset. This brief essay highlights how today's Airmen fashioned a warrior mindset over the past century in the air domain and links our rich history to the challenges we face in today's space domain. With an eye towards the future, this essay also outlines solutions on adapting a warfighter mindset to meet such challenges.

Conflict in the Last Century was Defined by Air Power

With innate warfighting mindsets for air operations, today's Airmen often forget how they became part of the world's most powerful Air Force. Air power[1] dominated 20th century warfare. We all know how it started with two

[1] AFDD 1-1 Defines airpower as the ability to project military power or influence through the control and exploitation of air, space, and cyberspace to achieve strategic, operational, or tactical objectives. Air power as delineated in this paper is deliberate and applies to the application of aerial platforms (e.g., not space or cyberspace) to provide combat effects.

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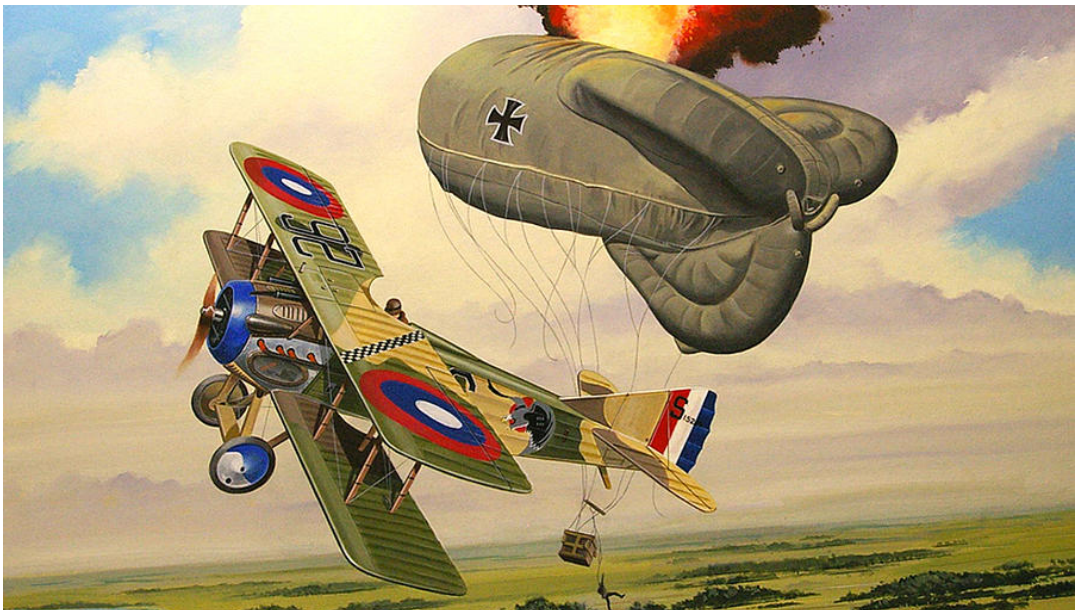
American brothers from Dayton slipping the surly bonds of earth on December 17, 1903 for twelve seconds in a contraption that resembled more a bird than what we think of as an airplane. This first sustained, powered flight would kick off a century of air power which ended with airplanes that could circumnavigate the globe nonstop[I], fly autonomously, carry millions of passengers each day, and evade radars.

It didn't take long after that remarkable Wright Brothers flight at Kittyhawk for humankind to apply air power in conflict. Early 20th Century air capabilities resembled high technology of the prior century—balloons. While slow to get off the ground (literally) the Germans in 1910 had fourteen military dirigible airships in their fleet while the entire rest of the world had only twelve. [II] That year during an exhibition, a young Army lieutenant airplane pilot shot a target on the ground with a Springfield rifle he brought on board, catching the eye of the press, but leaving the Army unimpressed. Two years later the Belgians experimented with mounting a machine gun in the front of a pusher-type Farman aircraft and shot up a white sheet staked to the airfield. The Belgian

military too was unimpressed and the local quartermaster insisted the pilot and gunner be court-martialed for destroying military property.[III] Military brass simply didn't understand the burgeoning competition looming in the air, and there was no need at the time to look up to envision such challenges. That changed in 1914 once human beings gruesomely challenged each other across the classic warfighting domains of sea and land. When World War I commenced, most of the belligerents of the time had some form of military aviation.

Some of the first air targets in WWI were observation balloons. The French's first casualty was a dirigible, the Montgolfier, which was brought down by friendly fire when it flew too close to its infantry in an attempt to cheer them up.[IV] Nevertheless, observation and reconnaissance capabilities were clearly important to the fight and they quickly became obvious targets by each side's aerial fighters. As a result, warfighting within the air domain became a reality over the trenches—and classic attrition warfare extended into the sky. Aircraft which targeted reconnaissance capabilities were in-turn challenged by other aircraft. Dogfighting became a household name, and European and American

powers celebrated their first aces—Rickenbacker, Luke, Bishop, Baracca, von Richthofen, and dozens others.



Balloon Busters of WWI

With the simple goal of poking out an enemy's eyes, air power cut its teeth during WWI's four years. While not decisive to the overall war effort, it set warfare on a new path. Many traditional military leaders failed to contemplate the military game changer air power was, but visionary strategists and tacticians

turned the interwar years into some of its greatest heydays. Brimming with corporate competition and an insatiable appetite to breach physical limits, air pioneers in the 1920s and 1930s were obsessed with distance, duration, altitude, speed, risk and reward. Their efforts paid off and were the seed corn for future, mainstay air operations. A young Lt. Jimmy Doolittle led the way for instrument flying, Capt. Lowell Smith and Lt. John Richter accomplished the first mid-air refueling from a plane flown by Lt. Virgil Hine with Lt. Frank Seifert, and Billy Mitchell ominously exhibited how mighty warships could be sunk by air power when in 1921 he bombed the defunct German World War I battleship, Ostfriesland. Along with Mitchell, other military theorists and advocates such as Giulio Douhet and Hugh Trenchard envisioned air power starting and winning future wars.

Air power advocates saw their visions come to fruition as they applied lessons learned from WWI. The opening salvos of WWII were from the air. From 1939 to 1940, German Blitzkrieg tactics and air power capabilities spearheaded agile ground maneuvers as Germany attacked Poland, Denmark,

and Norway and overflew and maneuvered around defenses to invade France. The Japanese bombing of the Pacific fleet at Pearl Harbor, Hawaii on December 7, 1941 kicked off a Pacific campaign for the United States in which aircraft carriers were decisive, and outmoded battleships were not, especially since five were lost within the first 90 minutes at Pearl Harbor. America's Pacific war was over as Army Air Force bombers presented the last salvos in 1945 when two B-29 bombers, the Enola Gay and Bockscar, dropped atomic bombs on Hiroshima and Nagasaki, Japan. Intelligence and reconnaissance, transport, air-to-air, and bomber capabilities, air power strategies, and tactics would play a decisive part in keeping a tenuous peace during the subsequent Cold War and shape the century's remaining battles over far-flung lands like Korea, Vietnam, the Balkans, and the Middle East.

Conflict in this Century is Linked to Space Power

Fast forward to today. Joint warriors know space capabilities are now a critical enabler of America's expeditionary might. It is inconceivable to think of

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US forces being successful without space, and describing how space is integrated into a modern fight would require volumes. Examples include GPS weapons which provide forces more accurate and effective strikes without the risk of excessive collateral damage. Satellite communications enable Airmen to fly robotic, armed aircraft over battlefields from across the globe. Space-based ISR is accomplished from the highest vantage points and allows persistent coverage of the Earth. Simply put, space capabilities make up today's battle network to enable command, control, communications, and intelligence with great success.

The problem is that the space assets which we depend upon were designed in an era where space was an uncontested domain and the only real threats were the rigors of launch, a harsh space environment, and unlikely, but dangerous, threats of nuclear detonations in space. Today's mainstay satellites were designed for long term uses (thereby limiting technology refresh cycles), are rather large, pack multiple capabilities on single busses, fly in predictable orbits, are expensive to replace on a mass scale, and often lack inherent defenses.

Further, challengers have taken keen notes over the past 15 years

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observing the United States wage a global war since the start of 2001's Operation Enduring Freedom. Potential belligerents have learned space capabilities make U.S. force projection a dangerous reality for them in conflict. Deputy Secretary of Defense, Bob Work, describes the destabilizing dilemma such conditions pose:

The growing vulnerability of our space assets is both a strategic and operational problem. Strategically, space system vulnerability contributes to crisis instability because it provides incentives for preemption of our space assets. The temptation will be mighty strong for an adversary to try and take out what has become an absolutely critical capability for the joint force. And operationally, the loss of these capabilities will critically undermine our warfighting plans and operations, thereby undermining conventional deterrence.[V]

Much like the lumbering dirigibles at the start of the last century, our space assets could become tempting targets in future wars that inevitably extend to space. Through a series of Chinese demonstrations over the past decade, it doesn't take a rocket scientist to envision what modern anti-satellite weapons could do. A 2016 Department of Defense report to Congress states in addition to

directed energy weapons and satellite jammers, China is rapidly developing anti-satellite capabilities and the 2007 ASAT test wasn't a solo experiment:

In the summer of 2014, China conducted a space launch that had a similar profile to the January 2007 test. In 2013, China launched an object into space on a ballistic trajectory with a peak altitude above 30,000 km, which could have been a test of technologies with a counterspace mission in geosynchronous orbit.[VI]

While the Chinese government has not publically acknowledged anti-satellite weapons, some in China, especially People's Liberation Army defense academics, exhibit their own warrior mindset when they stress the necessity of "destroying, damaging, and interfering with the enemy's reconnaissance…and communications satellites…to blind and deafen the enemy." [VII]

Satellites in all orbits are at risk. Military space strategists need to take notice and ask themselves what is different from early air exchanges in the last century between aircraft and their rudimentary targets. While technologies have certainly advanced and physics are quite different (maneuvers are defined by

Kepler in space versus Bernoulli in the air), basic tactical strategies are not. No one wants a war in space, and the repercussions of kinetic attacks in that domain could be catastrophic—especially by long-lived debris. Conversely, hoping conflict won't ultimately extend to space is not a viable nor prudent course of action. As was in the air during the last century, the opening salvos of future 21st century full-spectrum exchanges can conceivably start in space. It's still not too late to adopt a warfighting mindset for a new warfighting domain.

Meeting the Challenges of a Contested Domain

As warfare may extend to space in 21st Century conflict, developers, technologists, strategists, and tacticians would be wise to take the time now to address increasing, demonstrated challenges. Long used in the Department of Defense for structuring solutions to problems in a military context, broad solutions in a D-O-T-M-L-P-F framework should be considered:

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Doctrine

Military space doctrine should evolve with an eye towards the future. It should not be unnecessarily constrained by policy nor be based on today's capabilities, else it would quickly be outmoded in the throes of real conflict. Look back at the last century and apply how air power doctrine was formed and apply lessons learned in the years between WWI and WWII. Perhaps modeling a space doctrine center filled with accomplished, space-smart warfighters and strategists after the 1920-1940 Air Corps Tactics School would be a good start. While not all inclusive, framing space doctrine along the tried-and-true Clausewitzian Principles of War is prudent and pragmatic, and the following are some recommendations for reinforcing a warfighter's mindset:

Unity of Command – Concentrate efforts under a responsible commander who can focus on the space domain, and give commanders authority to act in a timely manner. Today's space policies and procedures drive decision-making to defend space assets to the highest levels, often beyond the control of military commanders. Commanders need the means to act

decisively and swiftly to preserve and project space power.

Objective – Align the unity of effort of space stakeholders. Political and military goals should be complementary and in sync. A National Military Strategy should empower action and clearly define defense objectives.

Offensive – Military forces don't win by being reactionary. Expand space control capabilities that present friendly forces an advantage and defeat adversary efforts to interfere with or attack space capabilities. Develop means and tactics that rebuff an adversary's timing, tempo, and initiative while sustaining friendly freedom of action.

Mass – Account for attrition in space. Make rapid reconstitution a viable means to resupply forces and maintain capacity and capability. Concentrate combat power for a decisive advantage and leverage capabilities in all warfighting domains to preserve and project space power.

Maneuver – Agilely maneuver in physical and electromagnetic space mediums to drive an advantage and inherent defense.

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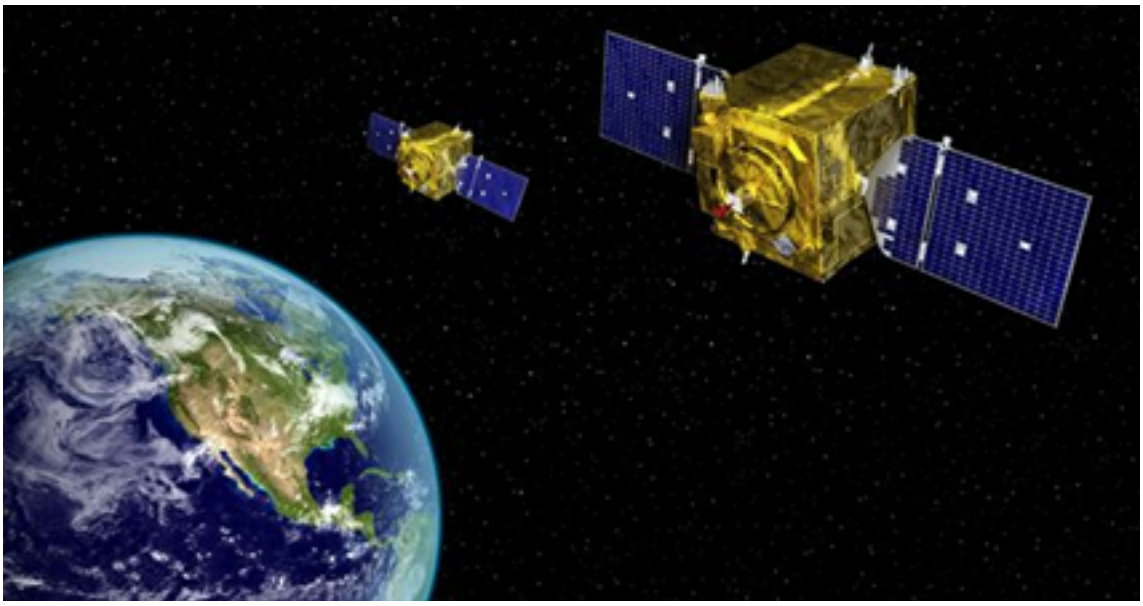
MSgt Brian Popham, of the 380th Space Control Squadron, calibrates his weapon system to report potential sources of electromagnetic interference against joint satellites used for combat effects.

Economy of Force – Employ all available means to preserve and project space power—from developing quick, assured space access (rapid launch) to leveraging allied and commercial partnerships in space.

Security – Keep an adversary from acquiring an unexpected advantage and set conditions that compel them to avoid conflict. Deter via strength. Generate capabilities and tactics that make space assets defendable and resilient. Integrate intelligence means at all levels, from strategic to tactical, and break

down security stove pipes that hinder domain awareness and unity of effort.

Surprise – As in all other domains, create conditions to act at the time and place of our choosing—and don't be reactionary. Build robust Space Situational Awareness (SSA) and Indications and Warning (I&W) capabilities to keep an adversary from enjoying the benefit of surprise. A great example is the Air Force's GSSAP satellites which characterize deep space orbits and perform "neighborhood watch" missions in space.



Geosynchronous Space Situational Awareness Program (GSSAP) Satellites (Artist Rendition)

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Simplicity –Avoid unnecessary complexity in organizing, planning, and executing military space operations. Streamline space command and control, avoid elements in the kill chain that slow decision making and sap resources, assume risk, and establish a culture where mission-type orders to the lowest levels enable rapid action.

Organization and Training

Doctrine is a good place to start honing a warfighter's mindset, but there is no better way to mold warriors than with organization and training focused on warfighting. The problem is current space operations are organized around providing steady-state capabilities, and threat-based training can be thin. This is a logical outcome of operating for years in a sanctuary where most upsets were due to system anomalies or caused by the space environment. This year, Air Force Space Command commander, General John Hyten, intends to alter a vector headed for potential risk and instituted his vision for developing tomorrow's space warfighters resulting in Air Force Space Command's adoption of the Space Mission Force (SMF).

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Executing SMF starts with the acknowledgement that Air Force Space Command must "transform [its] culture and build the expertise and skills necessary for our space forces to operate freely, and if necessary, defend themselves in the global commons of space."[VIII] The 50th Space Wing instituted SMF in February, 2016 and the 21st Space Wing followed on July 1st 2016 for one of its combat units.

Starting with a focus on threat-based advanced training, SMF establishes a Ready Spacecrew Program that changes how units are organized and how forces are presented to combatant commands. Instead of carving out time for rudimentary training while simultaneously running operational systems, SMF execution places space operations crews in a rotation cycle where they train together in a robust and challenging training environment for a period of time. They then spend an equal amount of time applying lessons from that advanced training as they perform real world operations as part of the Space Mission Task Force. Further, SMF allows operators to progress up instructor, instructor/evaluator, and tactician paths and apply their skills through all cycles. The

best space operators will no longer "leave crew" and work in back-shop offices dedicated only to training and evaluating steady-state operations. They will continue to hone their skills performing real-world operations while advancing their fellow crew force to respond to increasing threats.

Material and Facilities

Shifting today's space architectures to be more defendable and decisive in conflict requires significant focus and investment. In addition to some tactics, techniques, and procedures which can be applied to today's systems, development of follow-on systems needs to be assessed from the ground up. To maximize returns on existing investments, it would be easy to keep building more exquisite capabilities that mimic yesterday's platforms—and keep assembly lines churning out yesterday's capabilities. Developers will have to assess against tomorrow's threats while balancing efficiencies gained from today's technologies and investments. This includes assessing threats to ground systems (especially physical and cyber threats), links, user equipment, and the spacecraft themselves.

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Bob Work captures the Department's vision when he stated, "We will work harder to make our space architectures and our operations more resilient… hard to find, hard to catch, hard to hit, and hard to kill." In addition to retooling battle management and command and control of space systems, he lays out a blue print to "build dynamic, layered, defense-in-depth [means] that encompass the full range of passive measures required for denial—such as different orbits, mobility, deception, distributed architectures—as well as active measures, such as threat suppression and damage limitation."[IX]

Like the commercialization of air over the past century, we are starting to see commercial space players reverse the trend of government space investment trickling down to industry. A space industrial base is no longer the government's to solely sustain as industry is developing rapid-access tourist flights, assured resupply, global high-speed and bandwidth communications, and high-resolution remote sensing means. Today's commercial satellites, launch systems and infrastructures are beginning to rival, and in some cases exceed, government capabilities and are designed from the outset to be more efficient and affordable

(e.g., profitable). Leveraging public-private partnerships to reduce development costs and risk while taking advantage of shorter technology cycles is now more palatable than ever.

Leadership and Personnel

Finally, and most importantly, inculcating a warrior mindset requires visionary and active leadership of a properly-resourced force. This starts with the realization that our young joint forces will be the ones who will have to fight in tomorrow's contested space domain—and they need to be the ones to own those challenges. Old ways of doing business will not work for tomorrow. There's some talk that since space is vulnerable, we need to plan to fight wars without it and only bolster capabilities on the land, sea and air. Such thinking is foolhardy and sounds like the opinions of some in navies of yore who ignored the potential of the aircraft carrier, and thought the solution to growing naval threats was to build bigger battleships.

To inspire personnel to innovate, leadership needs to empower Airmen

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to present solutions from the bottom-up. Today's interconnected youth are inherently more technologically savvy than prior generations and are similar to air power pioneers; military space tacticians want the ability to experiment, take risks and innovate. For these Airmen, leaders might simply get out of the way and knock down doors to challenge cultural and organizational inertia. An example of this can be found in the 21st Space Wing where commanders declared 2016 as the "Year of the Space Tactician" and focused on motivating, incentivizing, and resourcing subordinates to define their own futures as operators. Consequently, future leaders are emerging and squadrons are producing more tactics improvement proposals than ever before, retooling capabilities and facilities for threat-based planning and ops, weaponeering their systems for more decisive action while uncovering inefficiencies, and challenging the status quo on training, evaluations, and tactics development. Airmen are starting to feel empowered to affect their missions and believe they have top cover to institute change. As a result, leadership and personnel are synchronizing actions and are growing together as a tactical, warfighting team.

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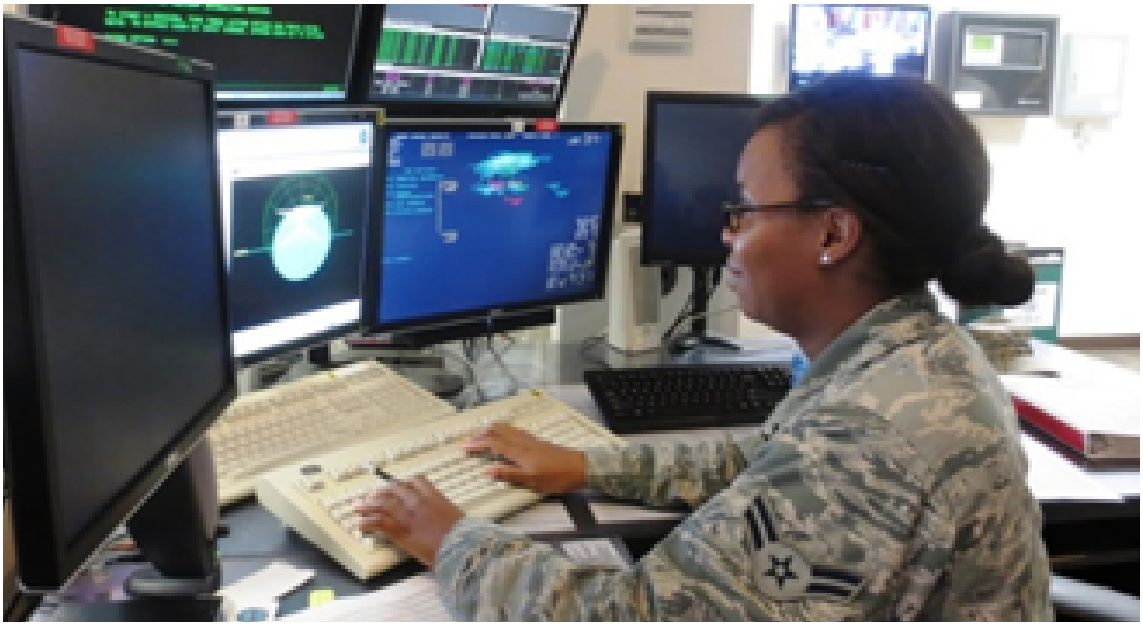

A1C LeeAnna McKinnon of the 20th Space Control Squadron weaponeers her space surveillance radar system to better monitor near-Earth and deep-space space threats

Conclusion

Who are the next warfighters to look up and embrace the challenge of defending America and its allies' interests in space? As with the air power pioneers of the last century, now is the time to think different and shift towards a warfighter mindset as potential adversaries are demonstrating the ability to challenge America's preeminence in space. They are now eye-balling our

"balloons"—those capabilities which provide joint forces an asymmetric advantage while being the most vulnerable. As in any other medium and global commons, we simply can no longer assume space capabilities which enable the world's most powerful global military force will be unchallenged and unscathed in future conflict. Leaders at all levels must too embrace change, build momentum, empower those who will become the next Rickenbacker, Luke, Doolittle, or Mitchell, and give them the tools, confidence, and backing they'll need to become a decisive force.

Combining air power lessons learned of the last century and the burgeoning space threats of today is a good start to spur thought. Further, a full review of the space enterprise is indeed prudent as doctrine, organization, training, material, leadership, personnel and facilities need to continue to be honed to ensure America wins in space. We owe it to our Airmen…and owe it to America and our allies.

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About the Author:

Colonel Troy L. Endicott is the commander of the 21st Operations Group, headquartered at Peterson Air Force Base, Colorado. He commands Air Force Space Command's largest operations group with 21 operating locations in 8 countries across the globe. The group consists of a work force of nearly 2,000 people who defend the United States through executing real-time space control, space surveillance, missile warning, missile defense, airfield and weather operations, and worldwide intelligence support, all while deploying combat-ready warrior Airmen.

He is a graduate of the Air Force Institute of Technology, USAF Weapons School, Army Command and General Staff College, and completed a National

Defense Fellowship at Harvard Kennedy School's Belfer Center for Science & International Affairs. He commanded one of the Air Force's first expeditionary space units in support of Iraq combat operations, commanded the 21st Operations Support Squadron, and served as a space control squadron Operations Officer.

[I] In December 1986, aircraft designer Burt Rutan flew the Voyager aircraft nonstop for 9 days around the world nonstop on a single load of fuel.

[II] James L. Stokesbury, A Short History of Airpower (New York: William Morrow & Company, Inc., 1986), 18.

[III] Ibid, 19.

[IV] Ibid, 28.

[V] Bob Work, "Remarks at the 2016 National Symposium—as prepared by the Deputy Secretary of Defense", http://www.defense.gov/News/Speeches/Speech-View/Article/723498/remarks-at-the-space-symposium.

[VI] Office of the Secretary of Defense, "Annual Report to Congress—Military and Security Developments Involving the People's Republic of China 2016," (Washington D.C.: April 2016), 37

[VII] Ibid, 37.

[VIII] General John E. Hyten, "Space Mission Force—Developing Space Warfighters for Tomorrow," (HQ Air Force Space Command, Colorado: 29 June 2016.)

[IX] Bob Work, "Remarks at the 2016 National Symposium—as prepared by the Deputy Secretary of Defense", http://www.defense.gov/News/Speeches/Speech-View/Article/723498/remarks-at-the-space-symposium.