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Building U.S. Space Force Counterspace Capabilities: An Imperative for America's Defense

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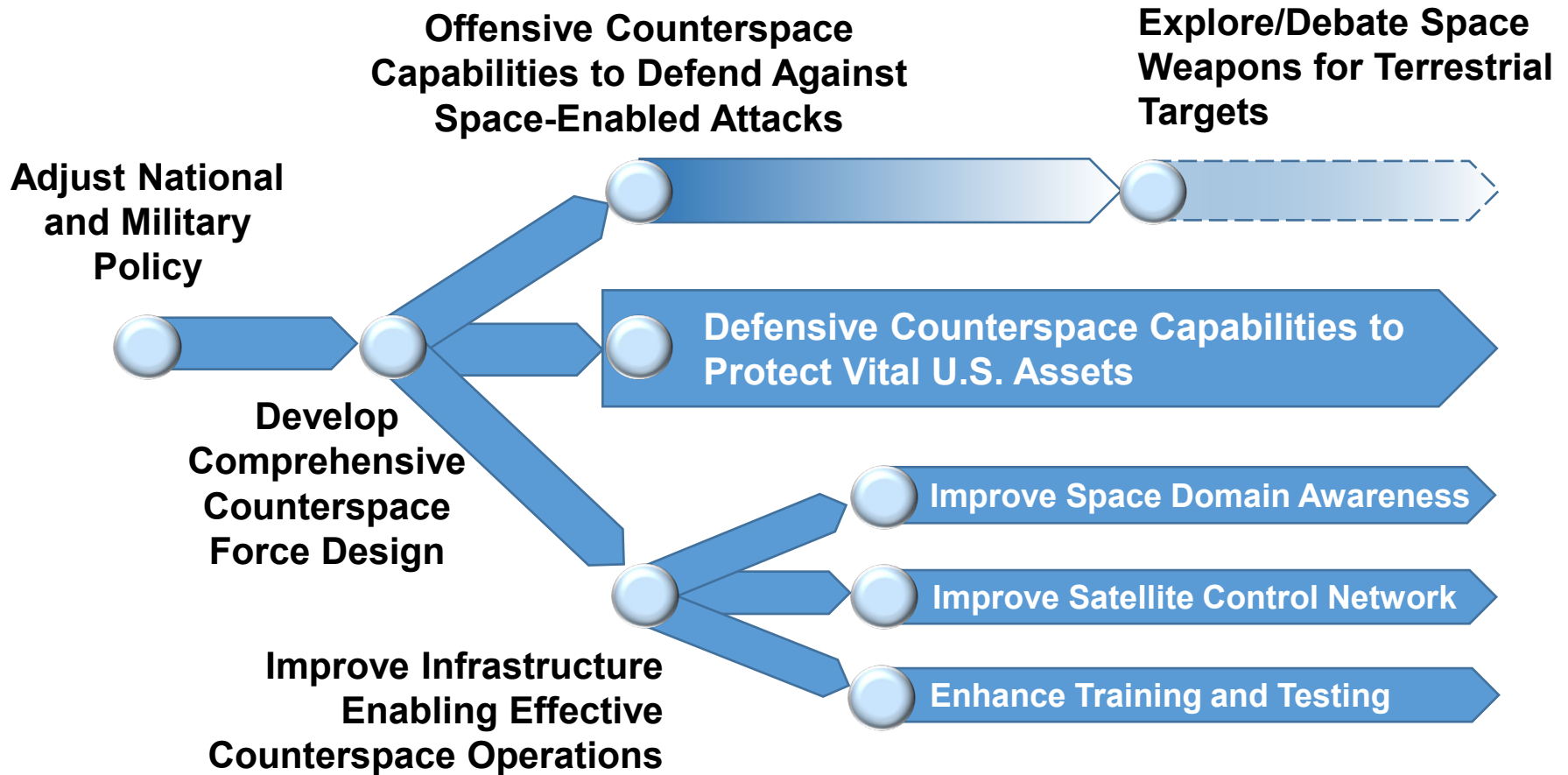
The Space Force needs defensive and offensive counterspace capabilities to credibly deter China

- Space is vital to all U.S. military operations *and* essential to modern life
- Countries like China and Russia are actively fielding and employing weapons specifically intended to deny the United States and others from accessing the benefits of space
- Existing efforts to (1) establish norms of responsible behavior, (2) increase the resilience of the U.S. space architecture, and (3) improve space domain awareness are necessary, but not sufficient to deter aggressive actions
- Like all other military services, the Space Force needs defensive and offensive capabilities in their domain of operation
 - This will also drive required improvements in the USSF's space domain awareness capabilities, satellite command and control, and testing and training infrastructures
- Ultimately, Space Force counterspace capabilities are needed to protect U.S. national interests in space and defend our Soldiers, Sailors, Airmen, Marines, and Guardians from space-enabled attacks

It's oxymoronic to establish a new military service without arming it with the weapons to accomplish its mission



Path to Build Counterspace Capabilities



Developing credible counterspace capabilities requires more than just weapons—improvements in supporting infrastructure and growth in personnel and facilities are critical



Space Weapons and the Law

- 1967 Outer Space Treaty
 - Prohibits placement of weapons of mass destruction in space or on celestial bodies
- Ban on Kinetic Energy Direct Ascent ASAT Testing
 - Necessary to address long-lived debris generated by irresponsible acts, putting the satellites of all spacefaring nations at risk
- Various Liability Conventions
 - Hold nations responsible for damages caused by space activities from
- International law is a combination of formal conventions, general principles, AND custom or practice
 - The unchecked actions of Russia and China have laid the legal foundations for normalizing space weapons

What is a “Space Weapon?”

For the purposes of this paper, a “space weapon” is a device or system, operated in, to, or from space, **used by a combatant to disrupt, damage, or destroy an adversary capability**. There are three basic operating modes of space weapon employment: terrestrial (ground, maritime, or air)-to-space, space-to-space, and space-to-terrestrial. Space weapons encompass a variety of **kinetic and non-kinetic** (e.g., radio frequency jamming, laser, cyber, or high-powered microwave) means of delivering **temporary or permanent effects**.

Notes: Attacks are considered “from space” if they begin from an orbital trajectory, even if the weapon does not complete an entire orbit, a capability known as fractional orbital bombardment.

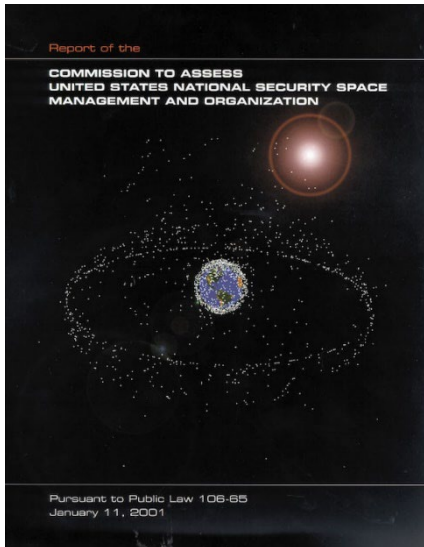
Terrestrial weapons attacking terrestrial targets can achieve a space effect but are not considered space weapons.

There are very few international limits on space weapons



How we got here

- U.S. thoughts on space weapons have ebbed and flowed since the Sputnik launch in 1957, based on perceived threats and national interests
- During the height of the Cold War, the United States pursued the development of weapons in space to defend against nuclear ballistic missile attacks as part of the Strategic Defense Initiative (aka the “Star Wars” program)



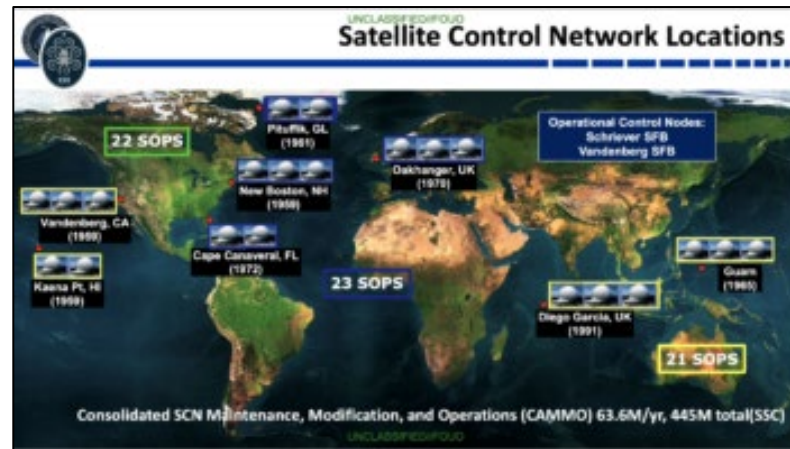
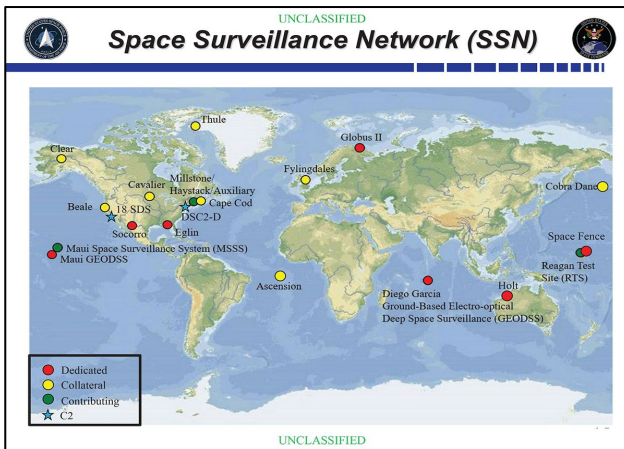
- The end of the Cold War resulted in the U.S. cancellation of Cold War-era space weapons
- “The Space Commission” warned of growing threats and called for new policies and capabilities to defend U.S. space assets
- 9/11 and subsequent focus on counterterrorism operations overshadowed concerns about protecting U.S. access and freedom of action in space

A decades-long prevailing view that space was a peaceful domain or even a sanctuary



Legacy U.S. Military Space Architecture

- Designed for operations in an uncontested domain, the legacy space architecture consists of satellites that are “big, fat, juicy targets,” a sparse space surveillance network (SSN), and a saturated satellite control network (SCN)—**all ill-suited for the modern reality of space as a warfighting domain**
- For decades, the DOD concentrated on developing exquisite space systems and integrating those capabilities to support or enhance military operations
- While some systems possess anti-jam and radiation hardening, the majority have no defensive capability and very limited fuel for maneuver



Both the existing SSN and SCN lack the necessary capacity and coverage to respond to conflict in space



What's at stake?

Military Operations: U.S. Ability to Fight and Win

- Loss of space capabilities has global, not regional, consequences
- The United States has *designed* and *sized* its military based on the assumption of uninterrupted access to space capabilities and services
- Joint operations rely on ISR, PNT, Comms, MW, Weather capabilities from space





What's at Stake?

Growing Commercial & International Space Sector

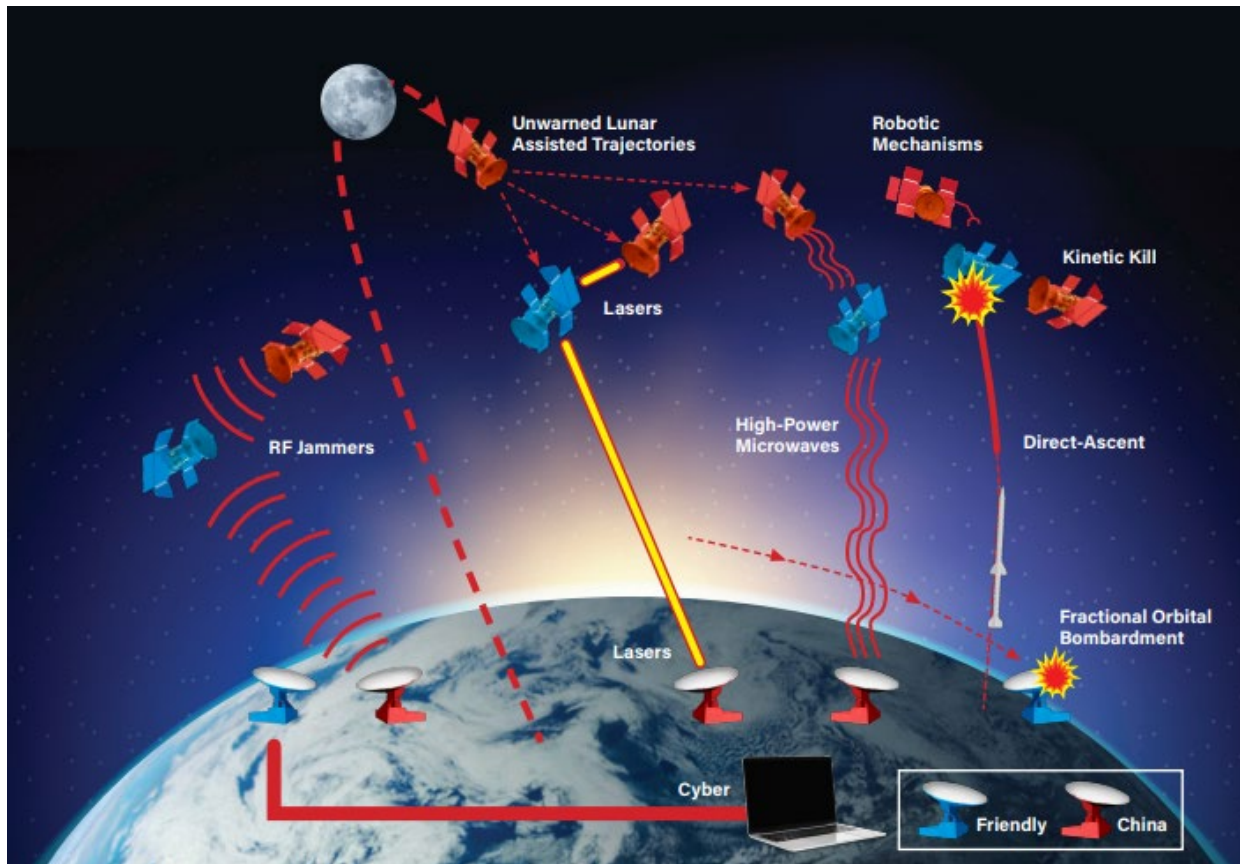
- Breakthroughs in digital technology and a reduction in launch costs ushered in rapid growth of the space industry
- Once the sole purview of superpowers, space is now accessible to a broad range of spacefaring nations, private organizations, and academic institutions
- Commercial and international partners can now provide communication, intelligence, weather, space domain awareness, and launch services
 - The Space Force is integrating ~\$4B/year in commercial space capabilities
- The current global space economy is \$447 billion and is on a trajectory to reach \$1 trillion by 2030
 - In 2022, there were 177 launches placing 2,215 payloads into orbit
 - The Space Force is now tracking over 48,000 objects in space
- Part of the Space Force mission is to preserve free and unfettered access to space—similar to the U.S. and allied navies preserve access to the sea

Unlike other domains--commercial, civil, foreign, and military space activities all constantly share the same operating environment



China's Extensive Counterspace Threats

- China has the largest and fastest growing counterspace capabilities of any nation
- China believes an “overawing space strike” is a form of deterrence

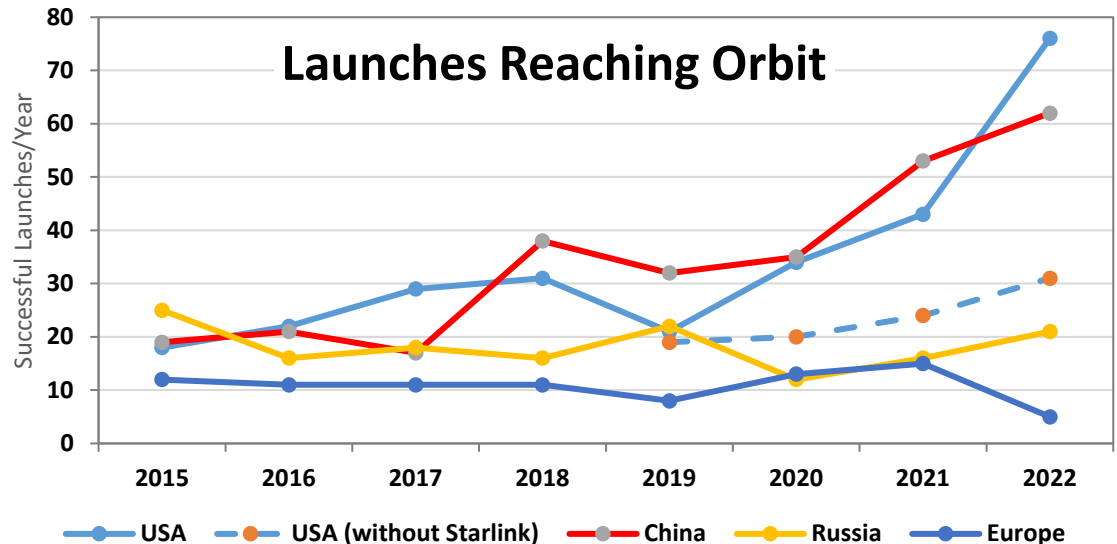


- China's space threats include kinetic and non-kinetic weapons on Earth and in space
- They've demonstrated KE ASAT, ground-based lasers and RF jammers, on-orbit robotic arm, cyber attacks, and fractional orbital bombardment
- China is also aggressively pursuing additional on-orbit threat capabilities



China's Growing Use of Space

- China does not distinguish between its military and civil space programs
 - The People's Liberation Army (PLA) controls the planning and direction of *all* Chinese space activities, even the scientific missions
- By learning from the U.S., China has accelerated their own space programs and is the second most active nation in space
- China now integrates ISR, communication, and navigation from space into PLA operations
- China also has their own version of the X-37 space plane, a communication satellite on the far side of the moon, and are developing a rival to Starlink

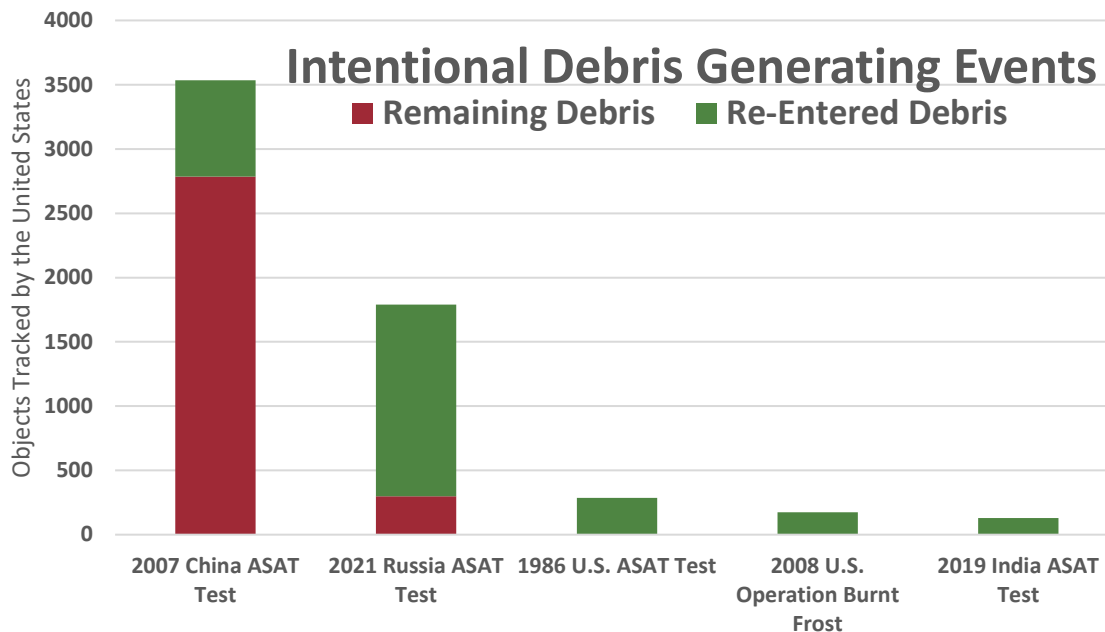


Any growth in China's space programs should be considered an expansion of its military space capability



Responsible Stewards of the Space Domain

- A key U.S. national interest is the preservation of the space domain for current and future generations
- **Diplomatically**, the United States and other spacefaring nations are trying to define norms of responsible behavior to stabilize space operations
- With the growing number of satellites in LEO and the amount of long-lived debris caused by *irresponsible behavior*, the *probability of collision increases*

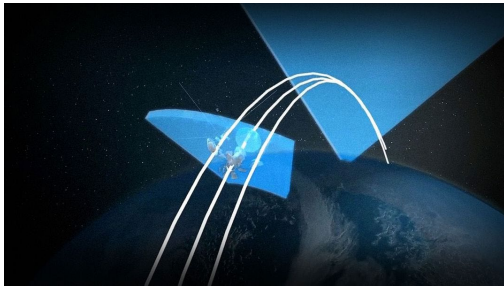
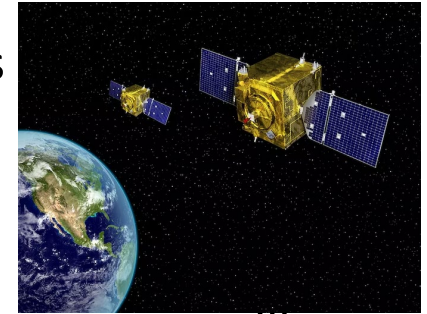


- A norm preventing the creation of long-lived debris was a high priority
- Additional norms (e.g., weapons or proximity operations) are needed
- Norms require a means to monitor and enforce them



Competitive Endurance: Avoid Operational Surprise

- Space is vast and there is virtually no first-person awareness in the domain—everything depends on data
- Space is becoming increasingly congested, stressing the limited capacity of the Space Surveillance Network (SSN)
- The ongoing expansion, addition, and replacement of aging space surveillance systems largely keeps pace with the increasing congestion in the domain
- Sufficient space domain awareness to truly avoid operational surprise requires additional sensing around high value assets and in key operational regions
- Most critically, the Space Force must replace the aging Space Defense Operations Center (SPADOC) and Command, Analysis, Verification and Ephemeris Network (CAVENet) systems



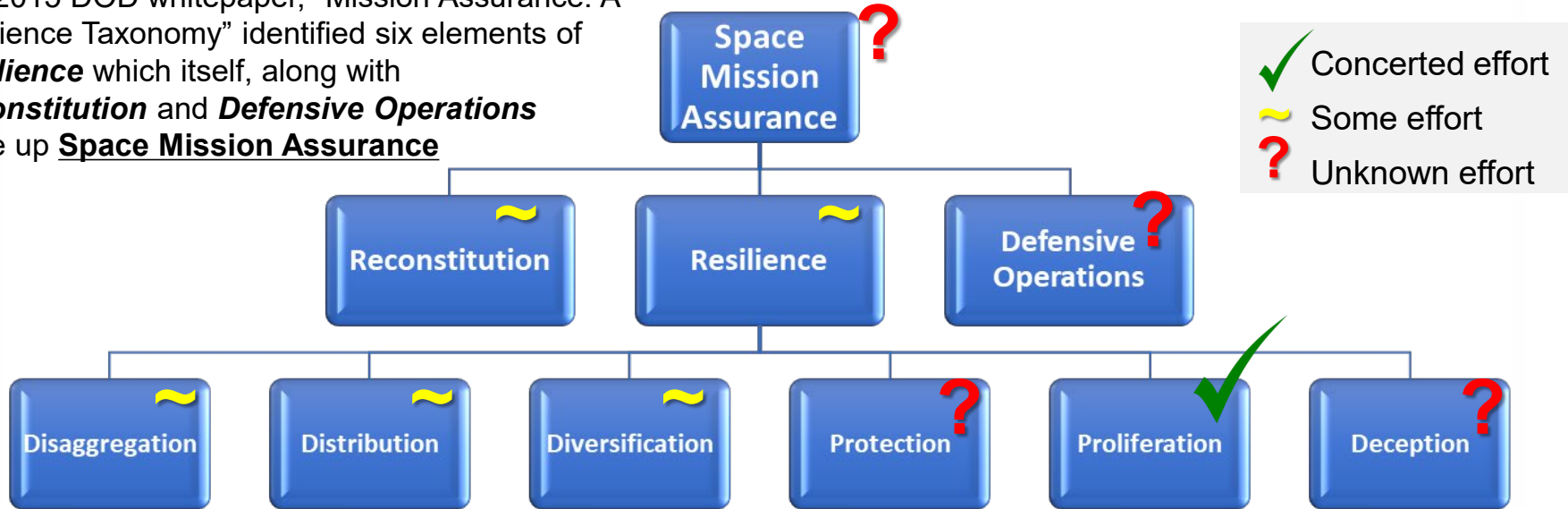
- Data from SSN, commercial, and international sensors must be combined and accessible to AI/ML algorithms to track patterns of behavior, provide timely warning of threats, and identify possible courses of action

No military force wants to be surprised by an adversary



Competitive Endurance: Deny First Mover Advantage

The 2015 DOD whitepaper, "Mission Assurance: A Resilience Taxonomy" identified six elements of **Resilience** which itself, along with **Reconstitution** and **Defensive Operations** make up **Space Mission Assurance**



- The Space Development Agency is fielding an architecture of proliferated Low Earth Orbit (pLEO) satellites
- Space Force is integrating Allies' and Partners' capabilities to improve resilience and offer some level of reconstitution
- VICTUS NOX aims to demonstrate launch of satellite within 24 hours of notification



Fighting to simply maintain equivalency with the adversary is not a war winning approach and undercuts the deterrent posture of the United States



Competitive Endurance Responsible Counterspace Campaigning

- The least developed area of the Space Force's *Competitive Endurance* initiative is the need to develop capabilities that can directly defend space systems and protect friendly forces from space-enabled attacks
- The Space Force operates the ground-based, Counter Communication System (CCS)—an electronic warfare system for reversible denial
 - CCS cannot realistically protect space assets nor deny the growing capabilities of PLA space systems
- The Space Force must balance operational necessity and preservation of the space domain to responsibly assure friendly access to space while defending joint and allied operations from adversary space-enabled attack

The **Law of Armed Conflict** provides guiding principles to minimize human suffering in war and applies to conflict extending to space. Two key principles, ***military necessity*** and ***proportionality***, are particularly relevant when considering warfare extending to space. *Military necessity* establishes that the objective in warfare is to weaken the enemy's military forces. This justifies actions that achieve this objective, so long as they also comply with the other principles. Similarly, *proportionality* attempts to limit collateral damage by prohibiting the use of excessive force. The force applied to attack a target must be proportional to the military advantage gained by attacking that target. Underpinning all the principles of the LOAC is the belief in ***reciprocity***—each side in a conflict will respond in similar manners.

(source:

https://www.icrc.org/en/doc/assets/files/other/law_1_final.pdf)

A China that is capable of using space-enabled attacks with impunity to hold U.S. joint and allied operations at risk is a prescription for defeat



Recommendations for Responsible Counterspace Campaigning (1/3)

- **Senior U.S. civilian and military leadership should explicitly and publicly state the need to fielding counterspace systems.** Clear guidance is essential to deter potential adversaries and align the resources necessary to field the required counterspace capabilities--continued silence on the issue will risk further emboldening adversaries.
- **The Space Warfighting Analysis Center should develop a jointly informed and accessible counterspace force design.** This will require detailed analyses of threats, technologies, and the effectiveness and limitations of potential capabilities. Existing systems developed by the other services should also inform this force design to prevent unnecessary duplication of effort.
- **Space Systems Command and the Space Rapid Capabilities Office should partner with industry to develop the necessary defensive and offensive capabilities.** These capabilities should include both on-board and off-board defensive measures for high-value satellites. Offensive counterspace systems must be consistent with the principles of the Law of Armed Conflict and are required to defend joint and combined operations from adversary space-enabled attacks.



Recommendations for Responsible Counterspace Campaigning (2/3)

- **The Space Force must improve its space domain awareness capabilities** to enable effective defensive and offensive counterspace operations. This includes growth in sensors and processing capabilities to enable tracking and warning of threats and a more enhanced SDA architecture capable of faster processing of collections and observations around high-value assets and in key regions like GEO and cislunar.
- **The Space Force must improve its satellite operations capabilities.** This is essential to rapidly respond to threats and maintain positive control over its space weapon systems. The Space Force will need a higher capacity telemetry, tracking, and commanding (TT&C) architecture capable of maintaining contact with its current and future systems including space weapons.
- **The Space Force must improve its testing and training architecture.** Additional live, virtual, and digital elements in the National Space Test and Training Complex are required for Guardians to evaluate new counterspace systems and train all operators for the reality of space being a warfighting domain.



Recommendations for Responsible Counterspace Campaigning (3/3)

- **The defense industry must respond quickly to USSF requirements and requests for information.** Given the decades of relative neglect in the area of space weapons, the Space Force must leverage technologies and industries' lessons learned from other domain acquisition programs to accelerate counterspace weapons development.
 - **Congress must authorize and fund additional Space Force growth.** Increases to the Space Force's civilian and military personnel and the construction of additional facilities are needed for counterspace systems. Establishing the counterspace mission as a central task for the Space Force will create a requirement for growth beyond the originally anticipated force size of 18,000 personnel.
- **Additional factors for implementation of Recommendations**
 - Centralize development of counterspace forces to avoid unnecessary duplication
 - Avoid classification issues that can impede deterrence
 - Partner with industry and learn from other domains



Summary and Conclusions

- The criticality of space to U.S. national interests and the mounting threat to those interests are clear
- The United States must employ a full array of methods to deter this aggression, preserve stability, and assure its access to and use of space
- Norms, Resilience, and Space Domain Awareness are all necessary, but not sufficient to deter aggression or prevail in a conflict if deterrence fails
- The Space Force must begin immediate development of defensive and offensive counterspace capabilities and supporting elements to provide a credible deterrent and give future leaders options to respond in a crisis

This is not about conflict in space—It is about deterring conflict everywhere



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