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#### Advantage one is Miscalculation---

#### The fusion of military and commercial debris clean-up technology is fueling a space race

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The set of government or commercial solutions to counter orbital debris – whether lasers, nets, magnets, tethers, robotic arms or co-orbiting service satellites – have only fueled the prospects for a stealthy race for dominance in outer space. The same technology that captures or zaps or drags away the debris can do the same to a functioning spacecraft. Since nobody can be sure about the intent behind such proposed “commercial” space debris cleanup technologies, governments will race to get ahead of their market competitors. It matters how and with what intent you counter space debris with dual-use technologies, and more so at a time of flux in the world order. Both the old and new space powers can easily cloak their military intentions in legitimate concerns about, and possibly commercial solutions to, debris hazards. And there are now a number of open assessments about space junk removal technologies that can double up as military programs, such as lasers or hunters. This fusion of the market and the military is not a conspiracy but a reality. If you are a great power like the United States that is heavily dependent on space assets in both the economic and military realms, then you are vulnerable to both orbital debris and the technologies proposed for its cleanup. And both your allies and your rivals know it. This is how we have ended up in a counterspace race, which is nothing like your grandfather’s space race. In a fundamental way, this new race reflects the volatile geopolitics of peer or near-peer competitors today, and there is no getting away from it in any domain. Just as on Earth, in the cosmos the world’s top space powers – the United States, China, Japan, Russia, India – have moved from merely space situational awareness to all-out battlespace awareness. If things stay the course, accidental or deliberate events involving orbital debris are poised to ravage peaceful prospects in outer space.

#### Specifically, RPO technology is proliferating---developing norms now for commercial use solves mistaken misinterpretations that trigger conflict

Weeden 18—Director of Program Planning at the Secure World Foundation [Dr. Brian Weeden, August 2018, Outer Space; Earthly Escalation? Chinese Perspectives on Space Operations and Escalation, Chapter 8: Norms of Behavior and Potential Conflicts in Space, A Strategic Multilayer Assessment (SMA) Periodic Publication, <https://nsiteam.com/social/wp-content/uploads/2018/08/SMA-White-Paper_Chinese-Persepectives-on-Space_-Aug-2018.pdf>] AMarb

Future Efforts to Build Norms for Space Conflicts

Future conflicts in space could have devastating consequences for the long-term sustainability of space and the ability to use space for benefits on Earth. Thus, it is important that the United States looks to ways to prevent space from becoming the flashpoint for future conflicts, or from future conflicts on Earth from extending into space. Although not the entire answer, initiatives to develop norms of behavior can help in this regard. These future norm-building efforts can be grouped into two categories: efforts to create norms that help prevent future conflicts in space, and efforts to create norms that help manage the disastrous impacts from future conflicts in space. Norms to help prevent future conflicts Norm-building efforts that help prevent future conflicts would essentially be extensions of the concepts and recommendations from the GGE on Space TCBMs. The main goal would be to develop norms that reducing the risks of misunderstanding, mistrust, and miscalculations that could spark or escalate conflict in space. I describe three areas on which to focus. (1) Norms of behavior for rendezvous and proximity operations (RPO) in space. RPOs involve the deliberate altering of a satellite’s trajectory so that it comes close to another space object. In recent years, RPO technologies have started proliferating to more countries and private sector entities and are being explored for a wide range of civil and commercial applications such as satellite servicing and removal of space debris. Developing norms of behavior for civil and commercial RPO would not only increase the safety and efficiency of such activities, but also help discriminate them from potential hostile military activities in space. (2) Norms of behavior for how militaries interact with each other in space. In a period of growing competition, innocuous or accidental behavior could be mistaken as a hostile or aggressive act, and during actual crisis, a mistake or accident could serve as the spark that escalates a situation towards armed conflict. An excellent model for this type of norm would be the Incidents at Sea Agreement, which was a treaty signed by the United States and Soviet Union in 1972 that outlined how American and Soviet ships and aircraft should interact with each other ("Agreement Between the Government", n.d.). The Incidents at Sea Agreement included steps to avoid collisions, maintaining safe distances, use of signals when maneuvering in close proximity, and avoiding activities that could be interpreted as hostile attacks. As the United States, Russia, China, and other countries increase their national security activities in space, they should consider negotiating a similar bilateral or multilateral “incidents in space agreement” to outline steps that can be taken to reduce misperceptions and increase stability in space (Listner, 2009).

#### Space conflicts go nuclear

Laura Grego 15, a physicist in the Global Security program at UCS. She is an expert in space weapons and security; ballistic missile proliferation, and ballistic missile defense, "Preventing Space War", https://allthingsnuclear.org/lgrego/preventing-space-war

So says a very good New York Times editorial “Preventing a Space War” this week. Sounds right, if X-Wing fighters come to mind when you think space conflict. But in reality conflict in space is both more likely than one would think and less likely to be so photogenic. Space as a locus of conflict The Pentagon has known that space could be a flash point at least since the late 1990s when it began including satellites and space weapons in earnest as part of its wargames. The early games revealed some surprises. For example, attacking an adversary’s ground-based anti-satellite weapons before they were used could be the “trip wire” that starts a war: in the one of the first war games, an attack on an enemy’s ground-based lasers was meant to defuse a potential conflict and protect space assets, but instead was interpreted as an act of war and initiated hostilities. The games also revealed that disrupting space-based communication and information flow or “~~blinding~~” could rapidly escalate a war, eventually leading to nuclear weapon exchange. The war games have continued over the years with increased sophistication, but continue to find that conflicts can rapidly escalate and become global when space weapons are involved, and that even minor opponents can create big problems. The report back from the 2012 game, which included NATO partners, said these insights have become “virtually axiomatic.” Participants in the most recent Schriever war games found that when space weapons were introduced in a regional crisis, it escalated quickly and was difficult to stop from spreading. The compressed timelines, the global as well as dual-use nature of space assets, the difficulty of attribution and seeing what is happening, and the inherent vulnerability of satellites all contribute to this problem. Satellite vulnerability & solutions Satellites are valuable but, at least on an individual basis, physically vulnerable. Vulnerable in that they are relatively fragile, as launch mass is at a premium and so protective armor is too expensive, and a large number of low-earth-orbiting satellites are no farther from the earth’s surface than the distance from Boston to Washington, DC.

#### Even if attacks do not occur worst-case thinking ensures retaliation when RPOs come too close in proximity

MacDonald 18—Adjunct Professor in the Energy, Resources and Environment Program, Johns Hopkins SAIS, former Assistant Director for National Security at the White House Office of Science and Technology Policy and served as Senior Director for Science and Technology on the National Security Council staff [Bruce W., August 2018, PART I THE BASICS: SPACE AND ESCALATION IN STRATEGIC CONTEXT, Chapter 2. Space and Escalation, <https://nsiteam.com/social/wp-content/uploads/2018/08/SMA-White-Paper_Chinese-Persepectives-on-Space_-Aug-2018.pdf#page=21>] AMarb

Another dimension of the problem is the issue of the scale of the attack, both qualitatively and quantitatively. While jamming one or two satellites in isolation appears unlikely to quickly escalate into all-out space war (given the longstanding role of electronic warfare in past conflicts), attacking multiple intelligence-gathering satellites would carry a far higher risk of escalation. Somewhere between these two extremes, however, is an uncertain and unknowable boundary that divides offensive space actions that modestly threaten stability from those that are clearly destabilizing and escalatory. In this unpredictable environment, a country with no desire to spark an all-out space war may still prompt rapid escalation with modest offensive actions that inadvertently cross an unknown threshold. In addition, for technological, commercial, and other reasons the space and cyber domains are evolving far more rapidly than the conventional and nuclear domains, potentially rendering space and cyber strategies ineffective or irrelevant within a few years. In both space and cyberspace, we may learn firsthand how much escalation is too much only after it is too late to stop. Evolving space dynamics could undermine whatever current understanding we may have of crisis and strategic stability in space, and this imperfect grasp of general principles can only add to our uncertainty about the space and cyber offensive capabilities of particular adversaries. Therefore, uncertainty, bluffs, and worst-case thinking are bound to remain prominent forces in the strategic landscape of space. For example, rendezvous and proximity operations on satellites will become more common in the years to come, but they could easily be viewed in a crisis as potentially hostile acts—or in fact be used to commit hostile acts.

#### Independently, China’s space operations create a security dilemma in East Asia---cooperation builds trust and to avoid escalation

Fabian 19 (January 2019 A Neoclassical Realist’s Analysis Of Sino-U.S. Space Policy Christopher David Fabian, <https://commons.und.edu/cgi/viewcontent.cgi?article=3456&context=theses> MASTERS THESIS:, A NEOCLASSICAL REALIST’S ANALYSIS OF SINO-U.S. SPACE POLICY by Christopher David Fabian Bachelor of Science, United States Air Force Academy, 2013 A Thesis Submitted to the Graduate Faculty of the University of North Dakota In partial fulfillment of the requirements for the degree of Master of Science Grand Forks, North Dakota May 2019, accessed 8/7/19, jmg)

The confluence of current Sino-U.S. relations and the state of space technology creates a structural security dilemma: the United States is excessively reliant on space support to conduct military operations in East Asia, which incentivizes China to pursue the development of technological and tactical innovations to deprive the U.S. of its operational advantage. This development threatens the U.S.’s conventional deterrent threat in the region, undermining strategic relations with key East Asian allies. The U.S. lacks a symmetrical response to China’s ASAT threat and must develop other means of deterrence, increasing the likelihood of horizontal escalation. Simultaneously, the offense-dominance of the space domain results in the lack of first-strike stability. These factors increase the likelihood that space will serve as a flash-point for a regional conflict in East Asia, and attempts to mitigate this threat are unlikely to succeed due to the inherent dual-use of most space technologies. Cognitive biases further worsen this security dilemma. Furthermore, China’s historic “century of humiliation” and rising technonationalism explain its position of losses seeking gains, making Chinese decision makers more likely to take over-weighted risk in order to overturn the existing status quo. Key cultural differences proliferate conflict between the U.S. and China, further altering leaders’ decision calculus and creating an opportunity for self-fulfilling prophesy. Despite this grim prescription, arms race and conflict between the two nations is not inevitable. The implementation of top-down TCBMs (((((((TCBM=Transparent Confidence Building Measures…INSERTED BY CARD CUTTER)))))))) designed to build trust and transparency can direct both nations towards a globally optimal outcome. This analysis is by no means exhaustive. In some cases, dozens of peer reviewed sources were boiled down to a sentence or two for the sake of brevity and conciseness. For example, the interaction of space law and this international relations focused analysis was only examined at a surface level. In many cases, sweeping generalizations replaced the minutia on which a legal analysis often hinges. As a result, this analysis is more effective for understanding the structural dynamic of Sino-U.S. space policy, than it is presenting detailed proposals and recommendations that a space lawyer would consider actionable. However, it does explain why current proposals for changing the space law régime have failed to gain consensus from China, Russia, and the United States. Future research should incorporate the “lessons learned” from this analysis in an attempt to develop a space code of conduct that can garner the agreement of the major spacefaring powers. Also, it is clear from this analysis that establishing a threshold in order to distinguish between chicken and the security dilemma is vital to avoid uncontrollable escalation. Future research must attempt to establish a clearly defined escalation ladder for space warfighting. It must also find methods to conduct strategic messaging between the U.S. and China so that these new rules 146 of the game can be ritualized. In order to do this, the game theoretical framework must expand to account for a sequential game. Furthermore, it should be notable that two very important events were mentioned only superficially in this analysis; the U.S. withdrawal from the INF treaty and India’s ASAT demonstration, which both occurred in early 2019. An examination of the treaty withdrawal would be a natural topic for further research, because it has the potential to significantly upset the current strategic status quo; leading to increased regional tension, a realignment of strategic posture, the proliferation of nuclear material, and creating an opportunity for strategic miscalculation. These factors are fundamental to this analysis; therefore, an inevitable influx of new information will necessitate a reexamination of this topic within a very short time. Luckily, the current framework is adequate to account for this development. On the other hand, the Indian ASAT demonstration is a milestone event in the space law and policy world that will require an expansion in the scope of this analysis. The ASAT demonstration raises questions about the proliferation of ASAT technology and the rise of India as a major regional competitor. In order to account for this, the game theoretical framework would need to expand to include India, Japan, Russia, and possibly Europe as players. This expansion adds considerable computational complexity and ultimately uncertainty. As a parting statement: India’s ASAT test and the withdrawal from the INF treaty are indicative of a major strategic upheaval; an increasingly multi-polar world and strategic rebalance is coming faster than many anticipate. Rapid technological advances in spacelift, computing, and man-machine integration will impact the space domain in unpredictable ways. China remains opaque, but it is impossible to avoid the sense that Xi Jinping’s rise to power is the most significant event in China since Mao’s death. The complete collapse of the Chinese 147 economy and social structure, leading to global recession; a rapid Chinese expansion leading to regional conflict; a slow, peaceful Chinese usurpation of the U.S. led world order; or continued competitive, but peaceful coexistence between the U.S. and China are all equally likely outcomes. These trends were completely obvious with the benefit of hindsight, but what they mean for the future remains unclear.

#### East Asian arms racing goes nuclear

Tan 15—Associate Professor at the University of New South Wales [Andrew T.H. Tan, 2015, *Security and Conflict in East Asia*, Chapter 3: Arms Racing in East Asia, Routledge International Handbooks, Google Books] AMarb

The arms race in East Asia is dangerous owing to the increased risk of miscalculation as a result of misperception. Chinese policymakers appear to be convinced that Japan is dominated by right-wing conservatives bent on reviving militarism (Glosserman 2012). At the same time, there is also a perception within China that given its growing strength, it should now aggressively assert what it perceives to be its legitimate claims in the East and South China Seas. Thus, China's nationalist discourse perceives that the problems about disputed territory emanate from other powers, not China (Sutter 2012). The consequences of conflict between China and Japan, on the Korean peninsula or over Taiwan, however, will not stay regional. As a key player in East Asia, the USA, which has security commitments to Japan and South Korea, residual commitments to Taiwan, and troops on the ground in East Asia and in the Western Pacific, will be drawn in. The problem is that any conflict in East Asia is not likely to remain conventional for long. In fact, it is likely that it would rapidly escalate into a nuclear war because three of the key players, namely China, North Korea and the USA, possess nuclear weapons.

#### The plan solves---

#### 1—Detection---cementing civilian norms with China helps us spot outliers but avoids escalation

Audrey Schaffer 19, and a Little bit of Brian Weeden, Director, Space Strategy and Plans, Office of the Secretary of Defense, Brian Weeden 19, SWF Director of Program Planning, “US-China Engagement in Space” <https://swfound.org/media/206424/us-china-engagement-in-space-transcript.pdf>, accessed 9/5/19, jmg

Bruce: [73:59] Keeping that? Sometimes people learn something early on, and they don't give up with what they've learned. I'm all one for really sensitive technologies. Of course, we have to be careful with them. When it's released to the larger world or the larger world has passed it by, all it does is cripple our capabilities. That's my comment. [74:22] My question is that the Indian ASAT test two days ago was a very timely and a very significant event. I'm glad to see it get the attention that it deserves. It highlights for me a couple of areas, where in the course of my career, I've seen this ongoing hostility in the space world, at least the military space world, of restrictions. [74:48] That concerns me. I was one who thought certainly a code of conduct is something that would not be that difficult to agree upon. Yet it's amazing the resistance within the US government circles about that, that was seen as covert arms control, and that thing. These issues are going to be with us. I always thought Europe is the space leader. No. It was the United States. [75:23] Europe picked up the baton, because the United States fumbled it, basically. Our allies are looking for leadership. When we don't provide leadership, we see this happening -- I'll be careful what I say here -- in other context, national security context within the United States, the way we've been treating our allies. [75:43] What can we do to not pick up the idea of arms control at the exclusion of larger security considerations? There are reasons to be, at least, careful. By the way, China has not exactly covered itself with glory either. I have no particular grief for they've been pushing with Russia. [76:04] What does the panel think? What do people think about what we can do to, at least, give some kind of norms and codes of conduct a push so that we can see some progress in this area? Thank you. [76:17] [laughter] Audrey: [76:17] I am sighing because I feel like I get asked this question probably in every panel. I always give the same answer. Obviously, it is not a satisfying one if I keep getting the questions. Bruce: [76:31] I've been in your shoes before, so I feel for you. [76:35] [laughter] Audrey: [76:35] Well, thank you, Bruce, because you'll have to be patient if I give you the same answer I gave you last time you asked me this question. Bruce: [76:46] Oh no. 27 29 March 2019 | US-China Engagement in Space Audrey: [76:47] Look, I'm a very strong believer in the role of norms and standards to start to bring some predictability and stability to what happens in space. That's well recognized actually in the US Space Traffic Management Policy, SPD3. [76:58] It talks about the development of norms and standards, of going back to National Space Policy PD4. It talks about sustainability and stability in space being part of our national interest. US policy in that regard is actually quite clear. [77:12] Now in terms of the practical answer to your question of, how do we actually get there, my view is that we need to focus on safety and sustainability practices, and not focus as much on the security dimension because I think that's where you get tripped up politically. [77:32] With the growth in commercial activities in space both what had already happened and what is projected to happen, I think there's a real opportunity to focus norms, if you will, less on reducing tensions between states and more on how do we make space a safe and predictable operating environment for anybody who wants to go up there? [77:56] If those kinds of norms and standards became more routine or more acceptable, I suppose, that would actually benefit those security relationships as well because those activities that were abnormal would be more visible, which, of course, for us helps our ability to detect potentially hostile activities. [78:17] Just creates a more stable operating environment for the Department of Defense as well, who has humongous constellations of satellites upon which we rely as well.

#### 2—Behavior Alteration---commercial norms cause military operators to follow them which results in less risky behavior

Larsen 18 (Paul Larsen taught air and space law for more than forty years respectively at Southern Methodist University and at Georgetown University. “MINIMUM INTERNATIONAL NORMS FOR MANAGING SPACE TRAFFIC, SPACE DEBRIS, AND NEAR EARTH OBJECT IMPACTS” 2018. <https://scholar.smu.edu/cgi/viewcontent.cgi?article=4101&context=jalc>) ME/jmg.

Separation of military uses of outer space from its civil uses leaves military uses to international regulation in the United Nations (UN) Disarmament Commission and other UN committees, as well as to multilateral and bilateral arrangements outside of the UN, in addition to national regulation. It also leaves military operators free to use whatever regulations are developed for civil space at their discretion. Experience shows that military users appreciate the greater safety that results from using the uniform international air navigation standards.35 In fact, the military is also threatened by unregulated space activities that lead to military traffic collisions with other space objects and space debris. Any improvement in civilian traffic rules and space debris avoidances would diminish interferences with military operations. Order in outer space would also leave military operations free to follow civilian traffic rules, as has actually happened in military aviation, maritime traffic, and space telecommunication.

#### 3—Starting bilaterally---direct cooperation with China creates responsible behavior that can attribute malicious RPOs

Weeden 17—Director of Program Planning at the Secure World Foundation [Dr. Brian Weeden being interviewed, 7/31/2017, “Governing in a Crowded Space: The OST and Development of the Legal Regime for Space”, A Virtual Think Tank (ViTTa) Report, <http://nsiteam.com/social/wp-content/uploads/2018/04/NSI_Space_ViTTa_Q19-Q23_Legal-Regime-in-Space_Final.pdf>] AMarb

Interviewer: So, let’s transition to some of our space law and norms questions. Unquestionably, space is becoming increasingly crowded. So, I’m wondering, do you think the international treaties, agreements, laws, etc. that are currently in place to govern space are sufficiently suited to keep pace with an increasingly crowed and rapidly evolving space domain? And, if not, what kinds of international legal codes or norms, or updates and/or ratifications to current laws, are needed to govern this increasingly crowded space domain? B. Weeden: So, that’s kind of a complicated question. I think the existing treaties lay a sufficient framework for international principles. The challenge is that a lot of the principles they established haven’t really been further defined over the last 50 years. Take, for example, the peaceful usage question. As I said earlier, we enshrined peaceful uses of outer space in the Outer Space Treaty with definitely some planned of strategic ambiguity incorporated—we, the US, knew that it would include military intelligence activities, and we were okay with kind of making the aggressive stuff off limits, but there are still countries today in the UN COPUOS that will argue that peaceful use means non-military, despite the fact that the military has been involved in space for over 50 years. So, that’s one example. There is a lot of stuff in the liability regime that exists, but it’s never been further clarified. So, if you think about it, we have the US Constitution, but we also have dozens and dozens of Supreme Court cases where people have gone to the court to challenge part of the Constitution or to challenge a law based on a premise in the Constitution, and the courts have ruled on how things in the Constitution should be applied and how things should be interpreted. However, there is none of that for the liabilities stuff in space—there is not a single court case in the international courts on liability from a space accident. There have only been two cases that could have been launched: one is the 1979 crash at the Cosmos satellite carrying the nuclear reactor into northern Canada and the second is the 2009 Cosmos collision. In the first case, basically the US and Canada raised the issue with the Soviets and the Soviets basically paid a few million dollars, but an actual liability claim was never brought within the international organization. In the second case, the US Cosmos collision, basically the US and Russia got together and said, “Hey, I am good. Are you good?” “I am good.” “Okay great.” And the US and Russia just kind of settled it out of court. So, we have nothing about how this stuff is applied or defined. I think across the board, that’s the biggest challenge that we have with space. It’s not that the underlying international treaties are wrong or bad, it’s that a lot of stuff these treaties lay out has never been further implemented, either in national law or through actual court decisions and determinations on how they apply. Another example I will bring up is the asteroid mining space resource use. There’s a big debate going on right now. Article 2 of the Outer Space Treaty says that there is no such thing as national appropriation, but there is a significant portion of the lawyers and economists that will say, “I can go out and I can fish the ocean without claiming the ocean as my own territory,” and they are basically applying that same analogy to saying, “I can go to the Moon or I can go to an asteroid and I can mine some of it up. I can track water or whatever else and then fly off to go use that water without actually having a title or deed to the asteroids or the Moon.” The US has put some of this in national law, and so has Luxemburg, but this is a very active area of debate where, again, there is tension between this broad kind of principle at the top, but no one has ever really clarified it before—there’s not a lot of state practice in how to interpret certain things. So, in my mind, that is the biggest challenge we have in the space world. Again, I think as it becomes more normalized, we are going to find that, because people are going to start doing stuff. There is probably going to be some accidents and some incidents that are going to go to the courts. There are going to be more things regarding the laws on asteroid mining, where countries are going to say, “this how we take the supplies,” and other countries may disagree, which will lead to debates and maybe some court cases, and in the end we will probably find out what’s going on. So, as far as what new stuff is needed, I don’t really think there is a lot of work needed at the treaty level. I think a lot of the new stuff is more at a much lower level. So, for example, I think of things that exist in other domains that don’t exist in space. A perfect example is something in the maritime domain called the Incidents at Sea Agreement, which was signed in the late 1970s between the US and Soviet Union after several incidents where US ships and Soviet ships got in to situations at sea that could have precipitated either a serious accident or collision or triggered some sort of armed conflict. So, the US and Soviet Union came up with this agreement where they outlined how they would maneuver in close quarters with each other and how they would interact on the high seas, and it really kind of helped stifle some of the worst chances for accidents or misperceptions. We just don’t have anything like the Incidents at Sea Agreement for the space domain. This whole category of rendezvous and proximity operations is going to be a huge issue. It’s probably one of the biggest issues to deal with in the near term, both because you have commercial companies that are planning things like satellites servicing, satellite refueling, and outer-orbit inspections that are going to involve docking and getting close to other satellites, and then there is the whole national security concern over exactly the same thing. So, for example, when a Chinese satellite is doing stuff in space and perhaps coming close to US satellites, what is the space equivalent of an Incidents at Sea Agreement that is going to kind of give a bright line of ‘you should do this, this is how you behave responsibly, and this is how we do it normally,’ and if there is deviation from that, it suddenly becomes an indication or warning that something is not right. We just don’t have anything like that at the moment that I know of in the space world.

#### China says yes---economic incentives

Brian Chow 19, an independent policy analyst with over 25 years as a senior physical scientist specializing in space and national security. He holds a PhD in physics from Case Western Reserve University and an MBA with distinction and PhD in finance from the University of Michigan and Henry Sokolski the executive director of The Nonproliferation Policy Education Center, 10/12/2019, “Op-Ed | Priority-One for Space Policy Should Be to Protect U.S. Satellites,” SpaceNews.com, October 12, 2019, <https://spacenews.com/op-ed-priority-one-for-space-policy-should-be-to-protect-u-s-satellites/>.

Would China and Russia ever agree? Skeptics say no. The current lack of space rules, they note, favor Moscow and Beijing’s efforts to threaten our satellites to deter us from intervening unilaterally or on behalf of our allies. As authoritarian governments, they can switch their dual-use commercial spacecraft to an offensive mode far more easily than we.

Perhaps, but China and Russia also claim they want to expand their commercial space operations. A [June 2019 report](http://www.npolicy.org/article_file/Commercial_Space-_Space_Controls_and_the_Invisible_Hand.pdf) found that “in the next two decades, the United States will still have the largest market share in practically every space industrial sector.” If the Western countries adopt space control rules designed to reduce the chance of collisions, China and Russia would have to choose: Observe these tighter rules to enhance their share of the Western commercial space market or stand out as international space security pariahs and rely on domestic and small non-Western markets.

#### Unilateral declarations create ambiguity, causes resolve-testing---both escalate

James A. Lewis 13, a senior fellow and Program Director at the Center for Strategic and International Studies, where he writes on technology, security and the international economy. Before joining CSIS, he served at the Departments of State and Commerce as a Foreign Service Officer and as a member of the Senior Executive Service. Lewis has authored more than eighty publications since coming to CSIS. “Reconsidering Deterrence for Space and Cyberspace”, James. A Lewis, written in conjunction with five other essays on Sino-U.S. relations in space and released in a 2013 publication for the Stimson Institute. The original title of the compilation is “Anti-satellite Weapons, Deterrence and Sino-American Space Relations”, <https://www.stimson.org/sites/default/files/file-attachments/Anti-satellite%20Weapons%20-The%20Stimson%20Center.pdf>

Declaratory policy is the best tool for shaping opponent perception of risk and credible threats. The declaratory statements of nuclear deterrence were robust, delivered by the president or the secretaries of defense or state. At their core they linked specific and immensely damaging responses to specific opponent actions. They explicitly laid out US capabilities to inflict unacceptable destruction. Observable programs and expenditures underpinned US statements. These explicit statements did not prevent ASAT and cyberattacks, with their more limited effects, do not face the same taboo on use, nor do they generate the same fear regarding first use. Risk and benefit are asymmetric and favor the attacker. 71 opponent testing of the limits of deterrence, particularly at the periphery of vital interests, nor did they deter actions that fell below the threshold of the use of force, but they provided a degree of clarity that made it easier for opponents to calculate risk and redlines. General statements delivered in national strategies without presidential or cabinet secretary-level reinforcement do not have the same effect. National strategies tend to be vague purposely and are not associated clearly with consequences. Ambiguity in deterrent threats, often held up as strategically artful, actually may encourage opponent miscalculation and lead to greater risk taking. Take, for example, the Obama administration’s declaratory policy for space, issued in 2010: The United States will employ a variety of measures to help assure the use of space for all responsible parties, and, consistent with the inherent right of selfdefense, deter others from interference and attack, defend our space systems and contribute to the defense of allied space systems, and, if deterrence fails, defeat efforts to attack them.13 It is unlikely that the threat to “employ a variety of measures” strikes fear into the hearts of opponents. Imprecision is defended as necessary since giving opponents explicit redlines would tell them what they could do with impunity. This ignores the likely conclusion that opponents, judging from their actions, had already deduced an implicit redline: that in peacetime, Washington will do nothing against actions that fall below the threshold of the use of force. While Washington believes that imprecision reinforces freedom of action, opponents may judge that the generality of US declaratory policy reflects a deeper indecision as to how Washington will respond to malicious actions against satellites. Declaratory policies for cyberspace are similarly imprecise. The first general declaration had weight as it was delivered in a groundbreaking speech by President Barack Obama in May 2009.14 In this speech, the President said that cyberspace would be treated as a ‘strategic national asset” where the United States would “deter, prevent, detect and defend against attacks.” Although general, this was an important first step. It was followed, however, by an international strategy for cyberspace in May 2011 that stated: When warranted, the United States will respond to hostile acts in cyberspace as we would to any other threat to our country. All states possess an inherent right to self-defense, and we recognize that certain hostile acts conducted through cyberspace could compel actions under the commitments we have 72 with our military treaty partners. We reserve the right to use all necessary means – diplomatic, informational, military, and economic – as appropriate and consistent with applicable international law, in order to defend our Nation, our allies, our partners, and our interests. In so doing, we will exhaust all options before military force whenever we can; will carefully weigh the costs and risks of action against the costs of inaction; and will act in a way that reflects our values and strengthens our legitimacy, seeking broad international support whenever possible.15 The mass of caveats that open and close the declaratory statement – “when warranted,” “appropriate and consistent with international law,” “exhaust all other options before military force,” “carefully weigh the costs of action” – undercut its deterrent value. Most of these caveats are self-evident, they detract from the clarity of the statement and opponents could easily misinterpret or undervalue the implied threat. Then-Secretary of Defense Leon Panetta made the clearest declaratory statement on cyberattacks in an October 2012 speech.16 Panetta said that if the United States detected an imminent threat of cyberattack that would cause significant physical destruction or kill American citizens, it would take preemptive action. In nuclear parlance, this is the equivalent of “launch on warning.” His statement was directed against Iran, which was then engaged in a series of massive denial of service attacks – the most basic form of attack – against major US banks and a telecommunication company.17 It is telling that, while the Iranian activities subsided for a brief period, they soon resumed and were expanded to include probing of US critical infrastructure companies for exploitable vulnerabilities. Tehran did not cross the threshold set by Panetta and, judging from continued Iranian actions, the threat did not deter nondestructive attacks or intrusive preparations for attacks that could disrupt or destroy. This partial record suggests that in peacetime, opponents will likely estimate that an action that does not rise to the level of the use of force and some physical destruction will not provoke or justify a military response by the United States. Cyber espionage or cybercrime, for example, falls below the threshold set by international law that would justify a military response. A military response to espionage would be unprecedented in international affairs, as nations do not regard espionage as an act of war or as the use of force. The risk, of course, is that an opponent with a different cultural background, less experience in international relations and with a higher tolerance for risk might miscalculate the threshold of actions triggering responses. The likelihood of miscalculation is greater given the diversity of potential opponents Washington now faces, and miscalculation also limits the scope of deterrence by affecting the credibility of any deterrent threat.

#### On-orbit servicing enhances deterrence but requires rules of the road otherwise they’re destabilizing

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Rendezvous and proximity operations increasingly will become a feature of space operations. Certain kinds of on-orbit operations could enhance space deterrence and crisis stability, such as replenishment of consumable and on-orbit repairs, by making the satellites at least somewhat more resilient. Other kinds of on-orbit operations, such as activity in the vicinity of adversary space assets, could be destabilizing. Prior notifications, rules of the road and a code of conduct might help clarify peaceful or malicious intent. Keep-out zones adjacent to foreign spacecraft might also be advisable. There is no obvious analogue to such operations in the nuclear domain. Offensive space counterforce targeting of key space infrastructure supporting nuclear forces would be extremely destabilizing, suggesting preparations for nuclear conflict, whether true or not. In the same way, cyber warfare targeting supporting nuclear infrastructure would be highly destabilizing. Asymmetries of space-based capabilities could pose additional complications and dangers. For example, the United States places high value on its missile warning satellites, while China as yet has no comparable capabilities. Breaking contact with, or attacking, communication links between national command authorities could have the most severe escalatory potential in a crisis or limited warfare.

### 2

#### Plan: The United States federal government should seek an agreement to establish rules of the road for commercial rendezvous and proximity operations with the People’s Republic of China.

### 3

#### Advantage two is Commercial Servicing---

#### OOS is inevitable – whether or not it springboards a new space economy depends upon alleviating national security concerns

Davis 20—Senior analyst at Australian Strategic Policy Institute [Malcolm, 2/12/2020, “Spy games in the grey zone of outer space”, ASPI Australian Strategic Policy Institute, <https://www.aspistrategist.org.au/spy-games-in-the-grey-zone-of-outer-space/>] AMarb

Undertaking RPOs is going to be an essential requirement for orbital refuelling and repair missions, which will emerge as a lucrative commercial activity in the next decade. The ability to repair a satellite on orbit, or to de-orbit it to avoid a build-up of space debris, is a legitimate enterprise for would-be space startups, and will be an important element of a space-based economy. A commercial spacecraft will manoeuvre into close range with a target satellite, and then dock with it to carry out repairs or to refuel it. That sort of capability is going to become more commercially attractive to sustain the mega-constellations of thousands of satellites that will be deployed in low-earth orbit in the next decade. For innocent commercial activity, this technology is highly desirable. It will allow dead satellites to be restored to operational use, generating profit for the company providing the service. But it will also lead to further development of spacecraft technology that can be applied for military purposes. And how does one distinguish an on-orbit servicing craft from a co-orbital anti-satellite weapon (ASAT)? Co-orbital ASATs would be equipped with electronic warfare capabilities, or a directed-energy weapon such as a high-powered microwave, to neutralise an adversary’s satellite in a counterspace attack at close range—precisely the type of event suggested by Cosmos-2542. Let’s consider where that leads. A ‘soft kill’ in space warfare is infinitely preferable to a ‘hard kill’, which physically destroys a target satellite, creating clouds of space debris. China’s January 2007 ASAT test created about 40,000 pieces of space debris larger than a centimetre across, and up to two million fragments wider than a millimetre. Large-scale use of hard-kill ASATs could create enough space debris to dramatically boost the prospect of a ‘Kessler syndrome’ event that could deny humanity access to space for generations. It makes no sense to develop hard-kill ASATs. The Russian RPOs against USA-245 with Cosmos 2542, and similar events in the past, reinforce the potential for an intelligence-collection technology to be applied for other purposes, and to further develop soft-kill co-orbital ASAT capabilities. Such technology could be hidden within intelligence collection, as part of space domain awareness, or even masked within entirely legitimate commercial activity. The challenge of managing grey-zone activities in orbit is an issue that space policy, law and regulatory bodies must come to terms with. The University of Adelaide–led ‘Woomera manual’ and the ‘MILAMOS’ project led by Canada’s McGill University are moving in the right direction to deal with these issues, alongside international efforts within the UN Office for Outer Space Affairs. Building confidence and transparency between states about commercial companies undertaking activities that have national security implications would be a good step to avoiding suspicion and insecurity in the future.

#### Bilateral Coop with China is the fulcrum---only way to establish confidence necessary for space commercial investments

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China’s economic and military rise during the last several decades was made possible by the post-World War II economic order established by the US. However, as a great power, China is unsatisfied with the current US-led order that it did little to help shape. Beijing and Washington are increasingly at odds internationally as their competing interests and visions for the future begin to collide. New avenues for cooperation are desperately needed to foster mutual trust and create an environment where the US and China can coexist with minimal friction. Space presents an excellent opportunity for cooperation between Washington and Beijing. Our two nations will compete in this realm—there is no avoiding that. However, both parties will benefit greatly from having a standardized set of rules governing military and economic activities in space. Hopefully, if these two great powers establish a framework of behaviors and norms for space, the rest of the world will follow suit. To start, the US should extend an olive branch. As Brian Weeden and Xiao He point out in their article for War on the Rocks, “Washington still hopes that Beijing can be a constructive partner for greater international space security. While China still chafes at the largely American constructed rules-based order, it likewise has a clear interest in using its development of space capabilities to promote bilateral cooperation and to play a role the formation of new international regimes.”13 While Russia seeks to undermine international space initiatives, Beijing and Washington should look toward the future and create a bold plan for space governance. This does not mean intimate cooperation, but there should be norms and codes for how government entities and private corporations should act in space. Weeden and He go on to say that both sides should seek to establish confidence-building mechanisms to help build trust as well as processes for cooperation and deconfliction. On the economic front, private companies crave stability and clear rules. If the world’s two preeminent military and economic powers establish clear guidelines early on, potential financiers will have greater confidence to invest the large up-front costs for expensive space-based projects. This leads to the next point that both sides should promote: private sector cooperation in the space domain. It would be advantageous for both sides if private corporations in the US and China pursue space exploration together. Space-lift capabilities, space stations, asteroid mining, lunar stations, and other endeavors all require significant initial costs. By partnering, American and Chinese corporations could call upon the support of both the Chinese and US governments in seeking out new resources such as solar power, rare elements, and numerous other fields for scientific discovery that would be of great benefit to people everywhere. A private-sector partnership should be plausible as long as intellectual property rights are respected and the governments involved don’t micromanage the projects. Deep US–Chinese economic integration is often cited as one reason war between our two nations is unthinkable. Why would the same logic not extend to space?

#### Unilateral actions create a higher degree of military uncertainty which lowers investment in the space economy

Weeden 13—Director of Program Planning at the Secure World Foundation [Dr. Brian Weeden, Tiffany Chow Agnieszka Lukaszczyk, and Victoria Samson, Sept 23-27, 2013, “INTERNATIONAL PERSPECTIVES ON ON-ORBIT SATELLITE SERVICING AND ACTIVE DEBRIS REMOVAL AND RECOMMENDATIONS FOR A SUSTAINABLE PATH FORWARD”, Secure World Foundation, <https://swfound.org/media/119604/iac-13-e3.4.7-presentation.pdf>] AMarb

• Current international legal and policy framework does not forbid ADR or OOS, but does not specifically address several areas – ADR and OOS activities are in a legal “grey area” with lots of uncertainty – Uncertainty is an obstacle to investment and advancement • “Blue sky” discussions of the legal and policy challenges are only useful only to a point – Useful for framing issues and discovering gaps – Not very useful for figuring out how to address those gaps – Targeted discussions focused on specific, real-world examples or projects are more useful • Transparency and Confidence Building Measures (TCBMs) are crucial for safety and security – Need to improve Space Situational Awareness (SSA) for all space actors – Need to enhance coordination between space actors • Important to develop norms of behavior – Improving safety (best practices, sharing of lessons learned) – Minimizing the opportunities for misperceptions and mistrust • Need to involve all the relevant stakeholders in developing national regulatory mechanisms, TCBMs, and norms • Need to have one or more technical demonstration missions to serve as focusing exercises – Should involve more than one country – Should involve governments as well as private sector – Should be as open and transparent as possible • Would force participants to solve specific legal and policy challenges • Lay groundwork for establishing TCBMs, norms, and other crucial governance elements • Remove the grey areas to enable more investment and private sector innovation

#### Scenario I – Commercial Space

#### Commercial space innovation stops extinction

Charles Beames 18, Chairman of the SmallSat Alliance, Executive Chairman of York Space Systems, former Principal Director of Space and Intelligence in the Office of the Undersecretary of Defense for Acquisition, Technology, and Logistics (OUSD(AT&L)), Col. (ret.) in the USAF where he served 23 years in space & intelligence leadership positions around the world, 8/8/18, “Op-ed | SmallSat Alliance is on a path toward a new space horizon,” <https://spacenews.com/op-ed-smallsat-alliance-is-on-a-path-toward-a-new-space-horizon/>

We find ourselves still at the dawn of a new space century, mindful of the victories and setbacks of our past, eager to pass the torch to the next generation of space visionaries, scientists, engineers, and enthusiasts. We look to the future not just to see how much bigger, faster, or higher we can reach, but also how the United States, and specifically the U.S. space community, can again inspire the nations of the world to align with us, as it did in the 20th century.

The SmallSat Alliance is an alliance of companies developing, producing, and operating in all segments of the ‘next generation’ space economy; championing renewed U.S. leadership in the burgeoning commercial space economy, and advocating for the transformation of government-led space capabilities. We are experienced space professionals who have chosen to join with others leveraging our decades of hard-won experience, to develop smarter ways to explore space in the 21st century.

A wonderful outgrowth of the legacy space program is the commercial, entrepreneurial, and job-creating commercial space business that it bequeathed. These next-generation enterprises range from multi-million-dollar startups providing rideshare opportunities or components for small satellites to multi-billion-dollar space data-analytic platforms reinventing urban car service and agricultural production. The early returns of this economic revolution are already on our doorstep: space data capabilities are exponentially growing elements of the 21st century world economy.

Beginning with the dreams and funding by successful tech entrepreneurs, enormous venture investments are already delivering wondrous benefits to the world.

Commercial Space – Profit and Non-Profit

There are really two major categories in the commercial sector, the profit driven and the non-profit. The classic for-profit companies include not only those designing, building, launching, and operating satellites but also the tech sector that is turning that raw space data into gold through machine-learning analytics. Since for-profit companies are no longer dependent upon the revenues generated by the Cold War space race culture of a bygone era, this new generation of space companies is able to more efficiently capitalize on Moore’s Law, the nonstop exponential growth in chip density, and the associated networking technology co-evolving with it. This new generation is building profitable businesses helping to clean up our oceans of garbage and debris with satellite surveillance, reconnoitering to assist in enforcing laws that protect our oceans from illegal, unregulated, unlicensed fishing, something that is rapidly depleting the world’s most valuable and essential lifeforms. It’s leading in the innovative use of low-cost satellite constellations to produce ubiquitous remote-sensing data, enabling small business owners to be more profitable and less wasteful. For example, precise timing signals from space are already optimizing transportation of people, goods, and services, with even further gains anticipated with the introduction of artificial intelligence to assist drivers, perhaps even someday replacing them entirely.

The non-profit sector is the other side of commercial space, concerned more for the general welfare of society, but every bit as integral to this new space enterprise. Much like every century before it in human history, ours is not without its unique challenges, some of which have been a consequence of the last, and all of which the space data domain can be leveraged to help solve. Examples are endless, but one challenge that this new space community is uniquely well-adapted for is to further inform worldwide resource allocation for the 21st century and beyond. These two primary resources are sustainable water and the materials needed for adequate housing for an ever-increasing human population. As cities and urbanization continue to expand, governmental planning challenges such as transportation design optimization for goods and services are only the beginning. Additionally, through using inexpensive remote sensing technologies, some members are designing space data analytics to mitigate human suffering from plagues, contain outbreaks, and combating illegal poaching. Some are connecting with other non-profits to curtail human trafficking for the sex trade or forced labor for migrant debt repayment. Still others are helping non-governmental organizations in their work to expose the use of children as soldiers. Addressing these challenges has little to do with resuscitating dreams conceived by long deceased science-fiction writers and much more to do with turning “swords back into plowshares” to solve real threats to humanity.

Other non-profit initiatives include pursuing an even more foundational understanding of who we are and how to be the best custodians of our environment. Much as exploring and monitoring the world’s oceans has advanced civilization through a better understanding of human life and the planet, so too does exploring and monitoring from space. Low Earth orbit (LEO) provides a unique vantage point to look back on the planet and understand what is happening, anticipate what might happen and prepare for the future. In addition to better understanding Earth, responsible and rapid exploitation of the low Earth orbit domain will enhance the understanding of the solar system and the rest of the universe. Small satellites already offer low-cost platforms to study and explore what lies beyond the Earth. Other members are pioneering the use of zero-carbon, hydrogen-based reusable propulsion systems to ensure we don’t worsen our atmosphere using kerosene-fueled rockets for the coming tsunami of satellite launches. Finally, a mission ensuring the general welfare and planet survival for the next thousand years is finally confronting the existential threat that asteroids and comets pose to humanity. These extra-terrestrial, deep-space threats are passing dangerously close to our planet, and today we have no solar map of them and no defense.

#### China will utilize space to degrade US power projection---deterrence requires resilience through commercial satellites otherwise terrestrial escalation is inevitable

Elsa Kania 18, Research Fellow with Georgetown’s Center for Security and Emerging Technology and an Adjunct Senior Fellow with the Technology and National Security Program at the Center for a New American Security, 9/29/18, “China Has a ‘Space Force.’ What Are Its Lessons for the Pentagon?,” https://www.defenseone.com/ideas/2018/09/china-has-space-force-what-are-its-lessons-pentagon/151665/

The U.S. military must find new ways to leverage commercial innovation in order to contend with China in space.

The Chinese military seems to agree that the current U.S. approach to space is hindered by some serious shortcomings.

If the United States is to maintain military advantage in space, as President Trump has promised – and as his new Space Force is meant to do – U.S. policy and strategic decisions should be informed by an understanding of China’s ambitions to become an “aerospace superpower” (航天强国) – and how the Chinese military has reorganized itself to seek dominance in space (制天权).

Start with the way space is characterized in China’s military strategy: the “new commanding heights in strategic competition.” Once a sanctuary for U.S. satellites that have fostered unparalleled military capability, space is now recognized by Chinese military strategists as a critical U.S. vulnerability. Without reliable space support, U.S. capabilities for global C4ISR and precision strike will fail, and the U.S. military could be reduced to a level of merely mechanized warfare, by the assessment of one Chinese defense academic.

This recognition has motivated the development of a range of “trump card” weapons (杀手锏). Some, like various cyber or electronic warfare attacks, could remain plausibly deniable in a crisis or conflict. But the Chinese People’s Liberation Army (PLA) has also been developing direct-ascent and co-orbital kinetic kill capabilities that could be directly damaging. These include the DN-2 ASAT missile, whose 2013 test first demonstrated a potential capability to target U.S. satellites in geosynchronous orbit, and the DN-3 hit-to-kill midcourse interceptor, tested successfully as recently as February 2018.

At the same time, China is also rapidly expanding its own architecture of space systems, which will increase its military capabilities but also create new potential vulnerabilities. So far in in 2018, China has undertaken a record 25 launches successfully. China is on track to create “a global, 24-hour, all-weather earth remote sensing system” by 2020, including satellites with EO, SAR, and ELINT payloads. BeiDou, China’s indigenous competitor to GPS, is expanding from a regional capability to a system with global reach. China has even launched the world’s first quantum satellite and plans to launch constellations of micro- and nano- quantum satellites in the years to come in order to expand its quantum communications infrastructure – and perhaps set the stage for a future ‘quantum Internet.’

The PLA recognizes the importance of space-based information support to enable joint operations and expand power projection. This prioritization was shown by the 2015 establishment of the Strategic Support Force (PLASSF, 战略支援部队), which has integrated PLA space, cyber, and electronic warfare capabilities. This reflects a unique innovation in force structure – and a paradigm that PLA thinkers believe could be superior to the current U.S. approach.

In particular, the PLASSF will be integral to enabling the integration of the PLA’s system of systems (体系) that will undergird its joint operations. Its commander, Gen. Gao Jin (高津), has emphasized the PLASSF will provide a vital ‘information umbrella’ (信息伞) for the whole military’s system of systems, recognizing this as a “key force for victory in war.” Xi Jinping himself has declared that the Strategic Support Force will be “an important growth point for our military’s new-quality combat capabilities.”

Indeed, the Strategic Support Force’s design and structure are meant to enable the integrated development of the battle networks that are critical to today’s “informatized” (信息化) warfare. In particular, the PLASSF is intended to enable the “information chain” that connects the initial intelligence, reconnaissance, and early warning capabilities with information transmission, processing, and distribution, and then, after an attack on an adversary, with the options for guidance, damage assessment, and follow-on strikes.

The PLA’s focus on the criticality of C4ISR has been informed by close study of U.S. ways of warfare, and the structure of the PLASSF is designed to be superior to the U.S. model. The current U.S. approach is seen as hindered by the lack of integration, coordination, and resourcing, as well as certain redundancies, in its own space systems and support capabilities, by the characterization of a Chinese military expert.

By contrast, the PLASSF’s Space Systems Department (航天系统部), evidently a de facto ‘Space Force’ for the Chinese military, has consolidated control over a critical mass of China’s space-based and space-related capabilities. The establishment of a unified structure through the Space Systems Department seems to reflect a response to organizational challenges that resulted from the prior dispersal of these forces, systems, and authorities across the former General Armament Department and General Staff Department.

Within the PLA, debates about whether to build a space force date back to the mid-2000s; both the PLA Air Force and Rocket Force appeared to seek the lead in this new domain. For instance, in 2009, then-PLA Air Force Commander Xu Qiliang had argued for the creation of a space force in response to increasing competition in space. In certain respects, its structure may thus reflect an organizational compromise, creating a new structure that centralized the control of these strategic capabilities directly under the Central Military Commission.

If successful, the Strategic Support Force will serve as an “important support brace” for future PLA joint operations. The PLASSF is intended to create “historic levels of data fusion and timely sharing of information,” increasing the “enjoyment” of these support resources throughout the military, including through enabling more effective integration of information and intelligence.

This system of systems will be ever more vital as the PLA looks to enhance its capability to project power beyond the first island chain. This greater leveraging of space does creates a higher degree of dependence and thus potential vulnerability for the PLA. However, in likely conflict scenarios in the Indo-Pacific, there would likely be major asymmetries in vulnerability between the U.S. and China, since the U.S. would be more reliant upon space to project power, whereas the PLA could possess more alternatives to compensate for a potential disruption of space-enabled capabilities, including the use of UAVs for ISR or data relay at a local level.

Looking ahead, Chinese military strategists also recognize that space deterrence will integral to the PLA’s posture for strategic deterrence and critical to achieving an advantage in a crisis or conflict scenario. PLA strategists have argued, “Whoever is the strongman of military space will be the ruler of the battlefield; whoever has the advantage of space has the power of the initiative…” Some PLA thinkers anticipate the first blow in any future war will likely be struck in space. The Strategic Support Force, which will likely have responsibility for certain PLA counterspace capabilities, particularly options for cyber attacks and electronic warfare, could thus serve the tip of the spear for Chinese military power.

The U.S. Response

As the U.S. considers new options to optimize its own force posture in anticipation of the future operational environment, the Chinese military’s new paradigm for space should be taken into account. The PLA has chosen to integrate and consolidate a critical mass of authorities and capabilities for space within a single organization. This approach may have certain advantages, including likely greater resources, centralized development and employment of space systems, and dedicated approach to personnel and training. Of note, the PLASSF Space Systems Department oversees the Space Engineering University, which will train and educate students in specialties ranging from command information systems to remote sensing technologies, while perhaps developing the PLA’s future space leaders and war-fighters through its Space Command Academy. However, this new structure may not resolve prior bureaucratic shortcomings in the PLA, and the PLASSF’s ongoing process of force development could be lengthy and challenging.

For the U.S., there are similarly compelling rationales to recognize the criticality of space and accelerate efforts to ensure the resilience of our space-enabled C4ISR architecture. The question of whether a corps, combatant command, or new military service would be the most appropriate organization will require more extensive consideration, which is beyond the scope of this piece. However, it is clear that the U.S. military must explore new options to leverage commercial innovation, while also concentrating on alternatives to bolster options for C4ISR beyond space, as my CNAS colleagues Adam Routh and Paul Scharre have argued respectively.

PLA strategists seem to believe that the U.S. can’t or wouldn’t fight without its satellites. For the U.S., to bolster deterrence in the Indo-Pacific will require proving that prediction wrong. At the same time, the PLA’s own growing reliance on its space systems will create new vulnerabilities. However, the Chinese military may remain better postured with alternatives to sustain C4ISR capabilities, since the U.S. would confront the challenges of power projection, while the PLA would be playing a ‘home game’ in likely conflict scenarios. While Sino-U.S. security dilemmas and strategic competition play out in this new ‘high ground’ of military power, it will also be critical to explore the implications of this rivalry and contention in space for future strategic stability, given the risks of misperception and unintended escalation.

#### Independently, the commercial space industry spurs technological innovation

Joshua Hampson 17, Security Studies Fellow The Niskanen Center. “The Future of Space Commercialization.” Niskanen Center. 1/25/2017. https://republicans-science.house.gov/sites/republicans.science.house.gov/files/documents/TheFutureofSpaceCommercializationFinal.pdf

The size of the space economy is far larger than many may think. In 2015 alone, the global market amounted to $323 billion. Commercial infrastructure and systems accounted for 76 percent of that 9 total, with satellite television the largest subsection at $95 billion. The global space launch market’s 10 11 share of that total came in at $6 billion dollars. It can be hard to disaggregate how space benefits 12 particular national economies, but in 2009 (the last available report), the Federal Aviation Administration (FAA) estimated that commercial space transportation and enabled industries generated $208.3 billion in economic activity in the United States alone. Space is not just about 13 satellite television and global transportation; while not commercial, GPS satellites also underpin personal navigation, such as smartphone GPS use, and timing data used for Internet coordination.14 Without that data, there could be problems for a range of Internet and cloud-based services.15

There is also room for growth. The FAA has noted that while the commercial launch sector has not grown dramatically in the last decade, there are indications that there is latent demand. This 16 demand may catalyze an increase in launches and growth of the wider space economy in the next decade. The Satellite Industry Association’s 2015 report highlighted that their section of the space economy outgrew both the American and global economies. The FAA anticipates that growth to 17 continue, with expectations that small payload launch will be a particular industry driver.18

In the future, emerging space industries may contribute even more the American economy. Space tourism and resource recovery—e.g., mining on planets, moons , and asteroids—in particular may become large parts of that industry. Of course, their viability rests on a range of factors, including costs, future regulation, international problems, and assumptions about technological development. However, there is increasing optimism in these areas of economic production. But the space economy is not just about what happens in orbit, or how that alters life on the ground. The growth of this economy can also contribute to new innovations across all walks of life.

Technological Innovation

Innovation is generally hard to predict; some new technologies seem to come out of nowhere and others only take off when paired with a new application. It is difficult to predict the future, but it is reasonable to expect that a growing space economy would open opportunities for technological and organizational innovation.

In terms of technology, the difficult environment of outer space helps incentivize progress along the margins. Because each object launched into orbit costs a significant amount of money—at the moment between $27,000 and $43,000 per pound, though that will likely drop in the future —each 19 reduction in payload size saves money or means more can be launched. At the same time, the ability to fit more capability into a smaller satellite opens outer space to actors that previously were priced out of the market. This is one of the reasons why small, affordable satellites are increasingly pursued by companies or organizations that cannot afford to launch larger traditional satellites. These small 20 satellites also provide non-traditional launchers, such as engineering students or prototypers, the opportunity to learn about satellite production and test new technologies before working on a full-sized satellite. That expansion of developers, experimenters, and testers cannot but help increase innovation opportunities.

Technological developments from outer space have been applied to terrestrial life since the earliest days of space exploration. The National Aeronautics and Space Administration (NASA) maintains a website that lists technologies that have spun off from such research projects. Lightweight 21 nanotubes, useful in protecting astronauts during space exploration, are now being tested for applications in emergency response gear and electrical insulation. The need for certainty about the resiliency of materials used in space led to the development of an analytics tool useful across a range of industries. Temper foam, the material used in memory-foam pillows, was developed for NASA for seat covers. As more companies pursue their own space goals, more innovations will likely come from the commercial sector.

Outer space is not just a catalyst for technological development. Satellite constellations and their unique line-of-sight vantage point can provide new perspectives to old industries. Deploying satellites into low-Earth orbit, as Facebook wants to do, can connect large, previously-unreached swathes of 22 humanity to the Internet. Remote sensing technology could change how whole industries operate, such as crop monitoring, herd management, crisis response, and land evaluation, among others. 23 While satellites cannot provide all essential information for some of these industries, they can fill in some useful gaps and work as part of a wider system of tools. Space infrastructure, in helping to change how people connect and perceive Earth, could help spark innovations on the ground as well. These innovations, changes to global networks, and new opportunities could lead to wider economic growth.

#### Tech innovation prevents an array of threats---extinction

Dylan Matthews 18, Co-Founder of Vox, citing Nick Beckstead @ Rutgers University. 10-26-2018. "How To Help People Millions Of Years From Now." Vox. https://www.vox.com/future-perfect/2018/10/26/18023366/far-future-effective-altruism-existential-risk-doing-good

If you care about improving human lives, you should overwhelmingly care about those quadrillions of lives rather than the comparatively small number of people alive today. The 7.6 billion people now living, after all, amount to less than 0.003 percent of the population that will live in the future. It’s reasonable to suggest that those quadrillions of future people have, accordingly, hundreds of thousands of times more moral weight than those of us living here today do. That’s the basic argument behind Nick Beckstead’s 2013 Rutgers philosophy dissertation, “On the overwhelming importance of shaping the far future.” It’s a glorious mindfuck of a thesis, not least because Beckstead shows very convincingly that this is a conclusion any plausible moral view would reach. It’s not just something that weird utilitarians have to deal with. And Beckstead, to his considerable credit, walks the walk on this. He works at the Open Philanthropy Project on grants relating to the far future and runs a charitable fund for donors who want to prioritize the far future. And arguments from him and others have turned “long-termism” into a very vibrant, important strand of the effective altruism community. But what does prioritizing the far future even mean? The most literal thing it could mean is preventing human extinction, to ensure that the species persists as long as possible. For the long-term-focused effective altruists I know, that typically means identifying concrete threats to humanity’s continued existence — like unfriendly artificial intelligence, or a pandemic, or global warming/out of control geoengineering — and engaging in activities to prevent that specific eventuality. But in a set of slides he made in 2013, Beckstead makes a compelling case that while that’s certainly part of what caring about the far future entails, approaches that address specific threats to humanity (which he calls “targeted” approaches to the far future) have to complement “broad” approaches, where instead of trying to predict what’s going to kill us all, you just generally try to keep civilization running as best it can, so that it is, as a whole, well-equipped to deal with potential extinction events in the future, not just in 2030 or 2040 but in 3500 or 95000 or even 37 million. In other words, caring about the far future doesn’t mean just paying attention to low-probability risks of total annihilation; it also means acting on pressing needs now. For example: We’re going to be better prepared to prevent extinction from AI or a supervirus or global warming if society as a whole makes a lot of scientific progress. And a significant bottleneck there is that the vast majority of humanity doesn’t get high-enough-quality education to engage in scientific research, if they want to, which reduces the odds that we have enough trained scientists to come up with the breakthroughs we need as a civilization to survive and thrive. So maybe one of the best things we can do for the far future is to improve school systems — here and now — to harness the group economist Raj Chetty calls “lost Einsteins” (potential innovators who are thwarted by poverty and inequality in rich countries) and, more importantly, the hundreds of millions of kids in developing countries dealing with even worse education systems than those in depressed communities in the rich world.

#### Scenario II – Global Rules

#### Climate change is inevitable---it causes nuclear wars that escalates only question is how we manage it

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President Donald Trump may not accept the scientific reality of climate change, but the nation’s senior military leaders recognize that climate disruption is already underway, and they are planning extraordinary measures to prevent it from spiraling into nuclear war. One particularly worrisome scenario is if extreme drought and abnormal monsoon rains devastate agriculture and unleash social chaos in Pakistan, potentially creating an opening for radical Islamists aligned with elements of the armed forces to seize some of the country’s 150 or so nuclear weapons. To avert such a potentially cataclysmic development, the US Joint Special Operations Command has conducted exercises for infiltrating Pakistan and locating the country’s nuclear munitions. Most of the necessary equipment for such raids is already in position at US bases in the region, according to a 2011 report from the nonprofit Nuclear Threat Initiative. “It’s safe to assume that planning for the worst-case scenario regarding Pakistan’s nukes has already taken place inside the US government,” said Roger Cressey, a former deputy director for counterterrorism in Bill Clinton’s and George W. Bush’s administrations in 2011. Such an attack by the United States would be an act of war and would entail enormous risks of escalation, especially since the Pakistani military—the country’s most powerful institution—views the nation’s nuclear arsenal as its most prized possession and would fiercely resist any US attempt to disable it. “These are assets which are the pride of Pakistan, assets which are…guarded by a corps of 18,000 soldiers,” former Pakistani president Pervez Musharraf told NBC News in 2011. The Pakistani military “is not an army which doesn’t know how to fight. This is an army that has fought three wars. Please understand that.” A potential US military incursion in nuclear-armed Pakistan is just one example of a crucial but little-​discussed aspect of international politics in the early 21st century: how the acceleration of climate change and nuclear war planning may make those threats to human survival harder to defuse. At present, the intersections between climate change and nuclear war might not seem obvious. But powerful forces are pushing both threats toward their most destructive outcomes. In the case of climate change, the unbridled emission of carbon dioxide and other greenhouse gases is raising global temperatures to unmistakably dangerous levels. Despite growing worldwide reliance on wind and solar power for energy generation, the global demand for oil and natural gas continues to rise, and carbon emissions are projected to remain on an upward trajectory for the foreseeable future. It is highly unlikely, then, that the increase in average global temperature can be limited to 1.5 degrees Celsius, the aspirational goal adopted by the world’s governments under the Paris Agreement in 2015, or even to 2°C, the actual goal. After that threshold is crossed, scientists agree, it will prove almost impossible to avert catastrophic outcomes, such as the collapse of the Greenland and Antarctic ice sheets and a resulting sea level rise of 6 feet or more. Climbing world temperatures and rising sea levels will diminish the supply of food and water in many resource-deprived areas, increasing the risk of widespread starvation, social unrest, and human flight. Global corn production, for example, is projected to fall by as much as 14 percent in a 2°C warmer world, according to research cited in a 2018 special report by the UN’s Intergovernmental Panel on Climate Change (IPCC). Food scarcity and crop failures risk pushing hundreds of millions of people into overcrowded cities, where the likelihood of pandemics, ethnic strife, and severe storm damage is bound to increase. All of this will impose an immense burden on human institutions. Some states may collapse or break up into a collection of warring chiefdoms—all fighting over sources of water and other vital resources. A similar momentum is now evident in the emerging nuclear arms race, with all three major powers—China, Russia, and the United States—rushing to deploy a host of new munitions. This dangerous process commenced a decade ago, when Russian and Chinese leaders sought improvements to their nuclear arsenals and President Barack Obama, in order to secure Senate approval of the New Strategic Arms Reduction Treaty of 2010, agreed to initial funding for the modernization of all three legs of America’s strategic triad, which encompasses submarines, intercontinental ballistic missiles, and bombers. (New START, which mandated significant reductions in US and Russian arsenals, will expire in February 2021 unless renewed by the two countries.) Although Obama initiated the modernization of the nuclear triad, the Trump administration has sought funds to proceed with their full-scale production, at an estimated initial installment of $500 billion over 10 years. Even during the initial modernization program of the Obama era, Russian and Chinese leaders were sufficiently alarmed to hasten their own nuclear acquisitions. Both countries were already in the process of modernizing their stockpiles—Russia to replace Cold War–era systems that had become unreliable, China to provide its relatively small arsenal with enhanced capabilities. Trump’s decision to acquire a whole new suite of ICBMs, nuclear-armed submarines, and bombers has added momentum to these efforts. And with all three major powers upgrading their arsenals, the other nuclear-weapon states—led by India, Pakistan, and North Korea—have been expanding their stockpiles as well. Moreover, with Trump’s recent decision to abandon the Intermediate-Range Nuclear Forces (INF) Treaty, all major powers are developing missile delivery systems for a regional nuclear war such as might erupt in Europe, South Asia, or the western Pacific. All things being equal, rising temperatures will increase the likelihood of nuclear war, largely because climate change will heighten the risk of social stress, the decay of nation-states, and armed violence in general, as I argue in my new book, All Hell Breaking Loose. As food and water supplies dwindle and governments come under ever-increasing pressure to meet the vital needs of their populations, disputes over critical resources are likely to become more heated and violent, whether the parties involved have nuclear arms or not. But this danger is compounded by the possibility that several nuclear-armed powers—notably India, Pakistan, and China—will break apart as a result of climate change and accompanying battles over disputed supplies of water. Together, these three countries are projected by the UN Population Division to number approximately 3.4 billion people in 2050, or 34 percent of the world’s population. Yet they possess a much smaller share of the world’s freshwater supplies, and climate change is destined to reduce what they have even further. Warmer temperatures are also expected to diminish crop yields in these countries, adding to the desperation of farmers and very likely resulting in widespread ethnic strife and population displacement. Under these circumstances, climate-related internal turmoil would increase the risk of nuclear war in two ways: by enabling the capture of nuclear arms by rogue elements of the military and their possible use against perceived enemies and by inciting wars between these states over vital supplies of water and other critical resources.

#### Satellite advancement and rules of the road stops warming wars from escalating

David Harary 19, Future Tense is a partnership of Slate, New America, and Arizona State University that examines emerging technologies, public policy, and society., 8-13-2019, "If Another Country Blows Up Our Satellites, We’re in Deep Trouble," Slate Magazine, https://slate.com/technology/2019/08/space-militarization-earth-observation-satellites.html

Every corner of our modern lives depends on environmental data from Earth observation satellites. They provide more than 90 percent of the data used by weather prediction models. The availability of much of our most basic resources, especially agriculture and water, now largely relies on meteorological and environmental forecasts made using this information. Today, remote sensing satellites are able to offer scientists data that range from sea surface height to soil moisture content. With this information, farmers can better plan for precipitation and temperature fluctuations, thereby increasing their yield. Businesses and regional planners can mitigate risks of flood zones. Ecologists can monitor the migration of invasive species. Knowing when and how long drought, flooding, extreme weather, or other natural disasters will occur is especially crucial. Timely access to global environmental data and information from satellites help federal, state, and local governments; businesses; nonprofits; and other organizations ensure the security of our property, resources, environment, economy, and lives. The array of instruments onboard the National Oceanic and Atmospheric Administration’s low-Earth orbiting and geostationary orbiting satellites, for example, provide meteorologists with measures of temperature, precipitation, wind speed, and other information they need to predict the strength of hurricanes. Without the dependable downlink and delivery of these data and forecasts, our national security would most certainly be severely hampered. Now, as we enter a new era of space militarization, these environmental satellites are also at risk. They’re clear targets for militaries across the globe. The ramp up for a new satellite arms race started in 2007 when China launched a missile that intentionally obliterated one of its own weather satellites. Since then, Russia and India have also developed, tested, and deployed technologies intended to hack, intercept, sabotage, shoot down, or even physically maneuver out of orbit satellites that provide a wide range of data. The United States and France have already claimed that Russia has spied on their satellites from space. Earth observation is becoming increasingly important as global security threats are more intertwined with deteriorating environmental conditions. So far, there have been no reports of anti-satellite weapons being used against a foreign country. But it seems like a matter of time. As a response to these capabilities, French President Emmanuel Macron recently announced the creation of a French space force that would be able to defend its satellites. It’s not the only one. Today, six countries operate specific military branches for space operations, including Russia’s Aerospace Forces and China’s People’s Liberation Army Strategic Support Force. President Donald Trump’s plan to create a so-called Space Force, which now seems increasingly likely to happen, comes at a period of heightened tension, capability, and risk beyond Earth’s atmosphere. Countries argue they need new military investments to defend assets in space that provide vital economic, environmental, geographic, telecommunications, or intelligence information. The development of these defenses foreshadows the space wars of tomorrow. Imaging satellites, in particular, offer huge advantages to their operators. All-seeing eyes from space are certainly an asset to any military. This makes Earth observation and environmental satellites high-value targets in the context of conflict and war. China’s successful shoot-down of its own weather satellite and attempted hacking of the U.S. weather satellite network in 2014 underscores the strategic importance these satellites have. Worse yet, the 1967 U.N. Outer Space Treaty, which governs the use of space through international law, is out of date. The treaty does not cover modern forms of space weaponization, including ones that threaten satellite infrastructure. Without comprehensive and modern governance and regulations in space, countries are largely free to do as they please without fear of legal repercussions. This is especially worrying when climate-driven insecurity is helping drive conflict and war across the globe. Consistent and timely observation of precipitation, temperature, and vegetation conditions, in particularly volatile and fragile states, can help to proactively manage and mitigate the potential rise of social and political tensions over scarce resources. For example, recent drought has already contributed to significant social and political tension in Central America. The drought has caused more than 2.8 million people in the region to go hungry. Such increased water and food insecurity has helped spark internal territorial conflicts, which have triggered greater migration toward Mexico and the United States. These challenges are only worsened by weak, corrupt, and ineffective governance in the region. The development of such unrest is particularly concerning, as these events can quickly turn deadly and bring about armed conflict. Satellites provide needed data at a scale, resolution, and timeline other data-capturing platforms simply cannot rival. Limiting or knocking out the capabilities these tools have means far worse forecasting abilities. Without this data, countries will be left with the significantly increased risk of improperly handling and managing resource shortages, natural disasters, and possible conflict and migration resulting from insecurity. Fortunately, there are a number of steps Earth observation platforms can take to adequately defend themselves against attacks in space. The most likely and gravest threat to satellite systems is through cyber hacking. Countries that bolster cyber defenses by embedding security in the design, architecture, and production of these systems are therefore best prepared for these risks. However, kinetic, physical and even laser defenses may also be needed as countries develop missiles, robotic arms, and other techniques specifically designed to subvert environmental intelligence gathering. As such, Earth observation satellites that append defensive maneuvering or interception capabilities would be best prepared. Another way to reduce potential physical security risk is to diversify and multiply the quantity of satellite platforms. With the new space race comes significant technological leaps. Most important is perhaps the development of CubesSats, or miniaturized satellites that often pack powerful technology into small cubes. Sensors are getting smaller and propulsion more compact, and with reusable rockets, the overall cost of launching into space is plummeting thanks to startups like Spire, Planet, and SpaceX. The result: exponentially more Earth observation platforms in space. Offensive targeting of many small satellites is much more challenging than targeting one large satellite. Lastly, we need strong multinational governance and greater diplomatic leadership to ensure that, as with the last space race, the international community sets out clear rules and fair practices for the emerging forms of space technology being utilized. Environmental and meteorological forecasting requires a global team effort. International laws and treaties that protect Earth observation assets in space can help provide the assurances they need going forward. In light of Chinese and Russian testing of maneuverable satellites in orbit, the U.S. and Japan have recently sought to develop joint space situational awareness capabilities. Such information-sharing pacts are significant first steps toward building multilateral networks that can defend assets in space. Earth observation is becoming increasingly important as global security threats are more intertwined with deteriorating environmental conditions. Opportunities for mass displacement, civil war, and even greater nuclear proliferation increase as a changing climate fundamentally shifts the geopolitical dynamics that govern countries and their resources. Environmental satellites provide the intelligence and acute warnings needed to mitigate these risks before they occur. Securing these signals in the sky is now more imperative than ever.