## Solar Flares DA

#### Space superstorms are inevitable in the immediate future – solar maximum makes the risk uniquely high

Kettley 19 [Sebastian Kettley, science reporter citing Dr Kaku, a theoretical physicist at the City College of New York. “Space weather WARNING: 'All hell will break loose' when solar flare CRIPPLES Earth.” January 25, 2019. https://www.express.co.uk/news/science/1077603/Space-weather-warning-solar-flare-hit-earth-michio-kaku-sunspot]

Major solar flares triggered by a solar maximum in [space](https://www.express.co.uk/latest/space) will wreak havoc on Earth and it is only a “matter of time”. Dr Kaku, a theoretical physicist and book author at the City College of New York, has warned modern technology is defenceless against such reckless power. Solar flares are highly-charged streams of gaseous energy particles violently ejected from the Sun out into the solar system. When solar flares strike the atmosphere, they create beautiful displays of light near the North and South Poles, known as aurora. But solar flares also have the power to wipe out communications satellites, disable electronic devices and cause aeroplanes to malfunction. At their worst, solar flares can blow out power stations, disable GPS navigation and ground emergency services. Speaking live on Coast to Coast AM Radio, Dr Kaku said solar flares on this scale are rare – they only strike once every 100 to 200 years. But the last known solar flare this powerful struck 150 years ago, suggesting the planet could be due another solar attack soon. Dr Kaku said: “These are rare events, maybe once in 100 years or once in 200 years, but is it is inevitable.” And once the solar flare does strike, the effects will be much more devastating than the aftermath of Hurricane Katrina. In 1859, a major solar flare struck the planet, lighting up the night skies from the North Pole all the way down to Cuba. The flare was caused by a so-called Coronal Mass Ejection (CME) from the surface of the Sun and has caused one of the largest geomagnetic storms on record. Dr Kaku said: “It’s a matter of time, you know, we’ve had a big one 150 years ago in 1859. We’ve had a huge solar flare that hit the Earth. One of these days one of these solar flares is going to hit the Earth Dr Michio Kaku, Theoretical physicist “Back then they only had telegraph poles but even they got shorted out and you could read the newspaper in Cuba at night by the light of the Northern Lights, the Aurora Borealis, as far south as Cuba. “From that, we physicists can recalculate how big that solar flare of 1859 must have been. “If we were hit by another one like that, it would fry our satellites, communications would go down instantly, power plants would be shorted out, and in the worst case – remember this a worst case scenario – we physicists believe that it could be 20-times worse than Hurricane Katrina. “So image 20 Hurricane Katrinas ravaging the Earth simultaneously and you can begin to estimate the kind of damage if there is a direct hit from one of these solar flares. “And we’re headed toward the maximum, so more flares are going off the Sun – we had a big one last month.” The solar maximum is a period of the tumultuous solar activity during an 11-year-long cycle. During a solar maximum, the highest number of sunspots appears and the amount of energy radiating from the star has been known to change the weather on Earth. According to Dr Kaku, the solar maximum is the most likely window of opportunity for a major solar flare to hit the Earth. He said: “So far we’ve dodged the bullet, so far we’ve been able to miss these sale flares, but these solar flares are like bullets and sunspots are like rifles. “Think of rifles shooting bullets into outer space and missing Earth. “Of course outer space is quite big but one of these days one of these solar flares is going to hit the Earth like what happened in 1858 and all hell can break loose.”

#### Private sector key to early warnings.

USGPO 19’ – Chairwoman Kendra Horn, “SPACE WEATHER: ADVANCING RESEARCH, MONITORING, AND FORECASTING CAPABILITIES”, U.S Government Publishing Office, October 23rd, 2019, [https://www.govinfo.gov/content/pkg/CHRG-116hhrg38122/html/CHRG-116hhrg38122.htm] Accessed 12/14/21

Our Nation's infrastructure is not all that is threatened by space weather events. I proudly represent the Johnson Space Center, the home to NASA's Astronaut Corps. These are the astronauts who currently work on the International Space Station (ISS) more than 200 miles above the Earth's surface and will one day serve on missions to the Moon and Mars. While we have developed techniques and technology to reduce the threats posed by increased radiation exposure due to a severe solar event, we have more work to do to mitigate these hazards to our astronauts. As the Ranking Member of the Space and Aeronautics Subcommittee, I've supported efforts to spur the commercialization of low-Earth orbit by private sector companies. These new entrants into the space economy have a vested interest in protecting their assets. However, they also offer an opportunity to provide data and resources to our Federal agencies as we seek to improve our space weather efforts. As this Committee potentially considers legislation relating to space weather monitoring and research, we must be certain that whatever legislation that we mark up is not a top-down legislative mandate and ensures a role for the commercial sector. The Weather Research and Forecasting Innovation Act, which was passed by this Committee and signed into law 2 years ago, serves as a template for how we could accomplish this. The Weather Act took steps to integrate commercial weather data into NOAA's forecast models, and a similar model should guide us when developing space weather legislation. NOAA is also advancing our research to operations processes. This includes a new program, the Earth Prediction Innovation Center or EPIC. EPIC will use partnerships with academia, the private sector, and relevant agencies to test and validate new capabilities and transition these capabilities from research to operations, thereby improving our existing forecast and warning capabilities. NOAA is also exploring with NASA the potential for a space weather testbed to further accelerate the transfer of research to operations and operations to research. Strong public-private partnerships are essential to maintain and approve the observing networks, conduct research, create forecast models, and supply the services necessary to support our national security and our economic prosperity…NOAA is committed to working toward the growth of the private sector as our national infrastructure and technological base becomes more sensitive to the impacts of space weather, thus demanding more improved space weather services. NOAA will continue to explore partnerships with the commercial and academic community as we work to maintain and improve our operational capabilities. In closing, NOAA appreciates the ongoing support we have received from Congress for our critically important space weather program. We will continue to work with other Federal agencies, the private sector in this effort to develop and strengthen our activities in space weather research and forecasting, and I look forward to answering your questions.

#### Severe space weather is a great filter event that sparks resource wars, economic collapse, grid failure, pandemics, and nuclear miscalc

Loper 19 [Dr. Robert D. Loper, Ph.D. from the Air Force Institute of Technology, Assistant Professor of Space Physics, Spring 2019. “Carrington-class Events as a Great Filter for Electronic Civilizations in the Drake Equation.” Publications of the Astronomical Society of the Pacific. https://iopscience.iop.org/article/10.1088/1538-3873/ab028e/meta]

Eastwood et al. (2017), the National Academy of Sciences (2008), and the Royal Academy of Engineering (2013) outline the potential economic impacts of severe space weather. In particular, major direct impacts from a Carrington-class CME could be outlined as including the following. 1. Power grid failure due to destruction of large transformers by geomagnetically induced currents. The large transformers in question here generally cost about $1 million per unit and require about 18 months to manufacture, ship, and install. The National Academy of Sciences (2008) report estimates such a power grid failure would cost $1–2 trillion per year6 and last four to ten years. 2. Outages or failures of LEO (low Earth orbit) space assets due to enhancement of the inner Van Allen belt. A severe solar storm can also cause ionospheric uplift which can dramatically increase satellite drag (Tsurutani et al. 2012). Additionally, LEO spacecraft operation could be disrupted by solar energetic protons (SEPs) generated in the shock of the CME passage through the solar wind (Royal Academy of Engineering 2013). 3. Outages or failures of GEO (geosynchronous equatorial orbit) space assets due to enhancement of the outer Van Allen belt or due to SEPs generated in the shock of the CME passage (Royal Academy of Engineering 2013). 4. GPS outages due to GEO spacecraft outages or failures, or GPS degradation due to ionospheric uplift and enhancement, potentially lasting several days or longer. 5. Communications outages due to high-frequency and ultrahigh-frequency radio blackouts, as well as cellular communication network and internet collapse due to extended power outages beyond the limits of generators and stored fuel. In particular, although optical ﬁber cables are the foundation of much of the global communication network, electrical power is still needed to power optical repeaters and transmitters (Royal Academy of Engineering 2013). 6. Increased radiation doses to astronauts and airline passengers (Royal Academy of Engineering 2013). This is more of a risk for long-haul airline ﬂights or manned spaceﬂight. Major indirect effects could include, but are by no means limited to, the following: 1. water and waste water shortages due to reduced or eliminated pumping from power grid failure; 2. fuel shortages due to reduced or eliminated pumping from power grid failure, which could result in transportation stoppages; 3. food shortages due to transportation stoppages, which could contribute to increased death rates and incite rioting and/or looting; 4. reduced hospital care due to water shortages and power outages, which could contribute to increased death rates and rates of infection; and 5. a years-long power grid and internet degradation or outage might irrevocably damage the global economy, in turn greatly prolonging the time to restore the power grid beyond the estimate of four to ten years. If one recalls major disasters caused by terrestrial weather events like hurricanes Katrina (New Orleans, 2005) and Maria (Puerto Rico, 2017), one can imagine the sorts of major effects on people and life in those areas. The most striking difference is that, whereas humanitarian aid came to bear on these disasters, a Carrington-class event would be a global catastrophe with little or no aid forthcoming. Much greater loss of life could result, and our civilization could be driven back to a much more fractured and pre-electronic one. For the purposes of another planet’s Drake equation, our civilization would be eliminated from the calculation. Conversely, another planet whose electronic civilization were struck by a Carrington-class CME would be eliminated from our calculation. Riley (2012) estimates the probability of another Carringtonclass event occuring within the following decade at about 12%. This estimate preceded the solar storm of 2012, but a good rule of thumb would be to estimate this to be the probability of having a Carrington event during any given solar cycle. Love (2012) and Kataoka (2013) have calculated probabilities in rough agreement, but there are a wide range of probabilities in the literature, ranging from once per 60 years (Tsubouchi & Omura 2007) to once per 500 years (Yermolaev et al. 2018). This work will retain the result of Riley (2012), which is also used in National Academy of Sciences (2008) and Royal Academy of Engineering (2013). This roughly agrees with the “once in a century” designation usually given to the Carrington event. Royal Academy of Engineering (2013) indicates that this designator is not well understood given the relative lack of data, but also that there are several tens of Carrington-class CMEs every century that either miss Earth or have lesser impact due to a northward orientation of the interplanetary magnetic ﬁeld. As shown in Figure 1, such a CME has a very wide angular extent (in the 2012 July event, the CME extended in about a 135° arc from the Sun), which could strike Earth in three out of eight occurrences. There is also some indication that a solar storm could trigger other Great Filter events. Knipp et al. (2016) outlines a solar storm in 1967 May that nearly triggered a nuclear war, as American radar operators initially mistook a solar storm for Soviet jamming. It might also be possible that a Carrington-class event could unleash or exascerbate an infectious disease due to reduced hospital care at a critical time, resulting in a pandemic.

## China DA

#### China challenging US dominance in space – private sector maintains the US’s preeminence

Harding 21 Harding, Luke. "The Space Race Is Back On – But Who Will Win?". The Guardian, 2021, <https://www.theguardian.com/science/2021/jul/16/the-space-race-is-back-on-but-who-will-win>. Luke Harding is a Guardian foreign correspondent. His book [Shadow State](https://guardianbookshop.com/shadow-state-9781783352050.html) is published by Guardian Faber.

Liu Boming took in the dizzy view. Around him lay the inky vastness of space. Below was the Earth. “Wow,” he said, laughing. “It’s too beautiful out here.” Over the next seven hours Liu and his colleague Tang Hongbo carried out China’s second spacewalk, helped along by a giant robotic arm. Mission accomplished, the two taikonauts – China’s astronauts – clambered back into their home for the next three months: Beijing’s new space station. The core module of the station, named Tiangong, meaning “heavenly palace”, was launched in April. “There will be more spacewalks. The station will keep growing,” Liu said. Meanwhile, on Mars, a Chinese rover was exploring. Video shows the [vehicle trundling over a rocky surface](https://www.theguardian.com/world/video/2021/jun/27/china-releases-footage-from-its-mars-rover-video). There is even sound: an eerie mechanical groaning. Since landing in May the Zhurong probe has been busy seeking clues as to whether Mars once supported life. There is no answer yet: so far it has travelled just over 410 metres. China is only the second country to land and operate a rover on the red planet, after the US. The frantic tempo of the China National [Space](https://www.theguardian.com/science/space) Administration’s (CNSA) recent programme is reminiscent of the cold war, when Moscow and Washington were superpower rivals scrambling to put the first man in space and land on the moon. Half a century on, space has opened up. It is less ideological and a lot more crowded. About 72 countries have space programmes, including India, Brazil, Japan, Canada, South Korea and the UAE. The European Space Agency is active too, while the UK boasts the most private space startups after the US. Space today is also highly commercial. On Sunday [Richard Branson](https://www.theguardian.com/business/richard-branson) flew to the edge of space and back again in his Virgin Galactic passenger rocket. On Tuesday, Branson’s fellow billionaire Jeff Bezos is due to travel in his own reusable craft, New Shepard, built by the Amazon founder’s company Blue Origin and launched from west Texas. Non-state actors play an increasingly important role in space exploration. Elon Musk’s SpaceX vehicles have made numerous flights to the International Space Station (ISS), and [since last year they have transported people as well as cargo](https://www.spacex.com/human-spaceflight/iss/index.html). Later this year Musk is due to send his own all-civilian crew into orbit – though he isn’t going himself. Even so, space still reflects tensions on Earth. “Astropolitics follows terrapolitics,” says [Mark Hilborne](https://twitter.com/space_security?lang=en), a lecturer in defence studies at King’s College London. Up there anything goes, he adds. “Space governance is a bit fuzzy. Laws are few and very old. They are not written for asteroid mining or for a time when companies dominate.” The biggest challenge to US space supremacy comes not from [Russia](https://www.theguardian.com/world/russia) – heir to the Soviet Union’s pioneering space programme, which launched the Sputnik satellite and got the first human into space in the form of Yuri Gagarin – but from China. In 2011 Congress prohibited US scientists from cooperating with Beijing. Its fear: scientific espionage. Taikonauts are banned from visiting the ISS, which has hosted astronauts from 19 countries over the past 20 years. The station’s future beyond 2028 is uncertain. Its operations may yet be extended in the face of increasing Chinese competition. In its annual threat assessment this April, the office of the US Director of National Intelligence (DNI) described China as a “near-peer competitor” pushing for global power. It warns: “Beijing is working to match or exceed US capabilities in space to gain the military, economic, and prestige benefits that Washington has accrued from space leadership.” The Biden administration suspects Chinese satellites are being used for non-civilian purposes. The People’s Liberation Army integrates reconnaissance and navigation data in military command and control systems, the DNI says. “Satellites are inherently dual use. It’s not like the difference between an F15 fighter jet and a 737 passenger plane,” Hilborne says. Once China completes the Tiangong space station next year, it is likely to invite foreign astronauts to take part in missions. One goal: to build new soft-power alliances. Beijing says interest from other countries is enormous. The low Earth orbit station is part of an ambitious development strategy in the heavens rather than on land – a sort of belt and rocket initiative. According to Alanna Krolikowski, an assistant professor at the Missouri University of Science and Technology, a “bifurcation” of space exploration is under way. In one emerging camp are states led by China and Russia, many of them authoritarian; in the other are democracies and “like-minded” countries aligned with the US. Russia has traditionally worked closely with the Americans, even when terrestrial relations were bad. Now it is moving closer to Beijing. In March, China and Russia [announced plans to co-build an international lunar research station](https://www.theguardian.com/science/2021/mar/10/china-and-russia-unveil-joint-plan-for-lunar-space-station). The agreement comes at a time when Vladimir Putin’s government has been increasingly isolated and subject to western sanctions. In June, Putin and his Chinese counterpart Xi Jinping renewed a friendship treaty. Moscow is cosying up to Beijing out of necessity, at a time of rising US-China bipolarity. These rival geopolitical factions are fighting over a familiar mountainous surface: the moon. In 2019 a Chinese rover landed on its far side – a first. China is now planning a mission to the moon’s south pole, to establish a robotic research station and an eventual lunar base, which would be intermittently crewed. Nasa, meanwhile, has said it intends to put a woman and a person of colour on the moon by 2024. SpaceX has been hired [to develop a lander](https://www.theguardian.com/science/2021/apr/17/nasa-spacex-moon-spacecraft-elon-musk). The return to the moon – after the last astronaut, commander Eugene Cernan, said goodbye in December 1972 – would be a staging post for the ultimate “giant leap”, Nasa says: sending astronauts to Mars. Krolikowski is sceptical that China will quickly overtake the US to become the world’s leading spacefaring country. “A lot of what China is doing is a reprisal of what the cold war space programmes did in the 1960s and 1970s,” she said. Beijing’s recent feats of exploration have as much to do with national pride as scientific discovery, she says. But there is no doubting Beijing’s desire to catch up, she adds. “The Chinese government has established, or has plans for, programmes or missions in every major area, whether it’s [Mars](https://www.theguardian.com/science/mars) missions, building mega constellations of telecommunications satellites, or exploring asteroids. There is no single area of space activity they are not involved in.” “We see a tightening of the Russia-China relationship,” Krolikowski says. “In the 1950s the Soviet Union provided a wide range of technical assistance to Beijing. Since the 1990s, however, the Russian space establishment has experienced long stretches of underfunding and stagnation. China now presents it with new opportunities.” Russia is poised to benefit from cost sharing, while China gets deep-rooted Russian technical expertise. At least, that’s the theory. “I’m sceptical this joint space project will materialise anytime soon,” says Alexander​ Gabuev, a senior fellow at the Carnegie Moscow Centre. Gabuev says both countries are “techno-nationalist”. Previous agreements to develop helicopters and wide-bodied aircraft saw nothing actually made, he says. The Kremlin has been a key partner in managing and resupplying the ISS. US astronauts used Russian Soyuz rockets to reach the station, taking off from a cosmodrome in Kazakhstan, after the Space Shuttle programme was phased out. But this epoch seems to be coming to an end as private companies such as [SpaceX](https://www.theguardian.com/science/spacex) take over. “I expect US-Russian relations to get worse,” Gabuev says, adding that Americans “no longer need” Russia’s help. Moscow’s state corporation for space activities, Roscosmos, has faced accusations of being more interested in politics than space research. Last month the newspaper Novaya Gazeta reported that Roscosmos’s executive director of manned space programmes, former cosmonaut Sergei Krikalev, had been fired. His apparent crime: questioning an official decision to shoot a film on the Russian section of the ISS. The film, Challenge, is about a female surgeon operating on a cosmonaut in space, and has been backed and financed by Roscosmos . It stars Yulia Peresild, who is due to head to space in October with director Klim Shipenko. The launch seems timed to beat Tom Cruise, who is due to shoot his own movie on board the ISS with director Doug Liman[.](https://www.theguardian.com/science/2021/may/13/russia-send-actor-director-iss-shoot-first-movie-space) Krikalev, who spent more than 800 days in space and was in orbit when the USSR collapsed, apparently told Roscomos’s chief, Dmitry Rogozin, that the film was pointless. Rogozin – its co-producer – has called on the west to drop sanctions in return for Russia’s cooperation on space projects. Putin, Rogozin’s boss, appears to not be very interested in other planets, though, and is more concerned with [nature and the climate crisis](https://www.reuters.com/article/us-russia-putin-idUSKCN1LC1X0) these days. “Space is one of the areas that has traditionally transcended politics. The Mir space station worked at a time of east-west tensions. There was symbolic cooperation. Whether this will continue in the future is really up for debate,” Hilborne says. “The US is very sensitive about what happens in space.” Most observers think the US will remain the world’s pre-eminent space power, thanks to its innovative and flourishing private sector. China’s Soviet-style state programme appears less nimble. Despite ambitious timetables, and billions spent by Beijing, it is unclear when – or even if – an astronaut will return to the moon. The 2030s, perhaps? Will they be American or Chinese? Or from a third country? It may well be that the first person to boldly go again doesn’t merely represent a nation or carry a flag. More likely, they will emerge from a lunar lander wearing a spacesuit with a SpaceX logo on the back – a giant leap not only for mankind, but for galactic marketing.

#### US space dominance prevents war with China – deters anti-satellite use and Taiwan intervention

Chow and Kelley 21 Chow, Brian, and Brandon Kelley. "China’S Anti-Satellite Weapons Could Conquer Taiwan—Or Start A War". The National Interest, 2021, <https://nationalinterest.org/feature/china%E2%80%99s-anti-satellite-weapons-could-conquer-taiwan%E2%80%94or-start-war-192135.Brian> Chow is an independent policy analyst (Ph.D. physics, MBA with Distinction, Ph.D. finance) with over 160 publications in space and other national security policies and Brandon Kelley

On July 1, 2021—the one-hundredth birthday of the Chinese Communist Party—[President Xi Jinping](https://asia.nikkei.com/Politics/Full-text-of-Xi-Jinping-s-speech-on-the-CCP-s-100th-anniversary) declared that China will “[advance peaceful national reunification](https://nationalinterest.org/blog/reboot/could-taiwan%E2%80%99s-terrain-stop-chinese-invasion-its-tracks-191919)” with Taiwan. It would be easy to dismiss such statements as mere political rhetoric: certainly, Taiwan would never willingly accede to Chinese demands to rejoin the fold. But China’s rapidly advancing anti-satellite (ASAT) capabilities could open up another avenue: deterring United States intervention on Taiwan’s behalf in order to coerce reunification without firing a shot. If current trends hold, then China’s [Strategic Support Force](https://ndupress.ndu.edu/Portals/68/Documents/stratperspective/china/china-perspectives_13.pdf) will be capable by the late 2020s of holding key U.S. space assets at risk. [Chinese military doctrine](https://nationalinterest.org/blog/reboot/nowhere-earth-will-be-safe-us-china-war-172523), statements by senior officials, and past behavior all suggest that China may well believe threatening such assets to be an effective means of deterring U.S. intervention. If so, then the United States would face a type of “Sophie’s Choice”: decline to intervene, potentially leading allies to follow suit and Taiwan to succumb without a fight, thereby enabling Xi to achieve his goal of “peacefully” snuffing out Taiwanese independence; or start a war that would at best be long and bloody and might well even cross the nuclear threshold. This emerging crisis has been three decades in the making. In 1991, China watched from afar as the United States used space-enabled capabilities to obliterate the Iraqi military from a distance in the first Gulf War. The People’s Liberation Army quickly set to work developing capabilities targeted at a perceived Achilles’ heel of this new [American way of war](https://nationalinterest.org/feature/secrets-and-lies-role-truth-great-power-information-warfare-170579): reliance on vulnerable space systems. This project came to fruition with a direct ascent [ASAT weapons test](https://fas.org/sgp/crs/row/RS22652.pdf) in 2007, but the test was limited in two key respects. First, it only reached low Earth orbit. Second, it generated thousands of pieces of long-lasting space junk, provoking immense [international ire](https://spacenews.com/u-s-official-china-turned-to-debris-free-asat-tests-following-2007-outcry/). This backlash appears to have taken China by surprise, driving it to seek new, more usable ASAT types with minimal debris production. Now, one such ASAT is nearing operational status: spacecraft capable of rendezvous and proximity operations (RPOs). Such spacecraft are [inevitable](https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-12_Issue-2/Chow.pdf#page=22) and cannot realistically be limited. The United States, European Union, China, and others are developing them to provide a range of satellite services essential to the [new space economy](https://www.morganstanley.com/ideas/space-economy-themes-2021), such as in situ repairs and refueling of satellites and active removal of space debris. But RPO capabilities are dual-use: if a satellite can grapple space objects for servicing, then it might well be capable of grappling an adversary’s satellite to move it out of its servicing orbit. Perhaps it could degrade or disable it by bending or disconnecting its solar panels and antennas all while producing minimal debris. This is [a serious threat](https://nationalinterest.org/feature/can-america-lose-china-189020), primarily because no international rules presently exist to limit close approaches in space. Left unaddressed, this lacuna in international law and space policy could enable a prospective attacker to pre-position, during peacetime, as many spacecraft as they wish as close as they wish to as many high-value targets as they wish. The result would be an ever-present possibility of sudden, bolt-from-the-blue attacks on vital space assets—and worse, on many of them at once. China has conducted at least [half a dozen tests of RPO](https://swfound.org/media/207179/swf_chinese_rpo_fact_sheet_apr2021.pdf#page=3) capabilities in space since 2008, two of which went on for years. Influential space experts have noted that these tests have plausible peaceful purposes and are in many cases similar to those conducted by the United States. This, however, does not make it any less important to establish effective legal, policy, and technical counters to their offensive use. Even if it were certain that these capabilities are intended purely for peaceful applications—and it is not at all clear that that is the case—China (or any other country) could at any time decide to repurpose these capabilities for ASAT use. There is still time to get out ahead of this threat, but likely not for much longer. China’s RPO capabilities have, thus far, lagged about five years behind those of the United States. There are reasons to believe this gap may close, but even assuming that it holds, we should expect to see China demonstrate an operational dual-use rendezvous spacecraft by around 2025. (The first instance of a U.S. commercial satellite docking with another satellite to change its orbit occurred in [February 2020](https://news.northropgrumman.com/news/releases/northrop-grumman-successfully-completes-historic-first-docking-of-mission-extension-vehicle-with-intelsat-901-satellite).) At the same time, China is expanding its capacity for rapid spacecraft manufacturing. The [Global Times](https://www.globaltimes.cn/page/202101/1213345.shtml) reported in January that China’s first intelligent mass production line is set to produce 240 small satellites per year. In April, [Andrew Jones](https://spacenews.com/china-is-developing-plans-for-a-13000-satellite-communications-megaconstellation/#:~:text=China%20is%20developing%20plans%20for%20a%2013%2C000%2Dsatellite%20megaconstellation,-by%20Andrew%20Jones&text=HELSINKI%20%E2%80%94%20China%20is%20to%20oversee,the%20country's%20major%20space%20actors.) at SpaceNews reported that China is developing plans to quickly produce and loft a thirteen thousand-satellite national internet megaconstellation. It is not unreasonable to assume that China could manufacture two hundred small rendezvous ASAT spacecraft by 2029, possibly more. If this happens, and Beijing was to decide in 2029 to launch these two hundred small RPO spacecraft and position them in close proximity to strategically vital assets, then China would be able to simultaneously threaten disablement of the entire constellations of U.S. satellites for missile early warning (about a dozen satellites with spares included); communications in a nuclear-disrupted environment (about a dozen); and positioning, navigation, and timing (about three dozen); along with several dozen key communications, imagery, and meteorology satellites. Losing these assets would severely degrade U.S. deterrence and warfighting capabilities, yet once close pre-positioning has occurred such losses become almost impossible to prevent. For this reason, such pre-positioning could conceivably deter the United States from coming to Taiwan’s aid due to the prospect that intervention would spur China to disable these critical space systems. Without their support, the war would be much bloodier and costlier—a daunting proposition for any president. Should the United States fail to intervene, the consequences would be disastrous for both Washington and its allies in East Asia, and potentially the credibility of U.S. defense commitments around the globe. Worse yet, however, might be what could happen if China believes that such a threat will succeed but proves to be wrong. History is rife with examples of major wars arising from miscalculations such as this, and there are many pathways by which such a situation could easily escalate out of control to a full-scale conventional conflict or even to nuclear use. This Catch-22 of so-called “peaceful reunification” on the one hand and catastrophic miscalculation on the other is entirely preventable. To do so, however, the United States must act now. To deter such pre-positioning and provide a clear framework for how to handle it if it does occur, the United States should immediately begin coordinating with its allies to establish shared understandings for the rules and operations of [warning](http://npolicy.org/article_file/Space_and_Missile_Wars.pdf#page=136)/[self-defense](https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-14_Issue-4/Chow.pdf#page=5) zones in orbit. Additionally, the United States should develop and deploy [bodyguard spacecraft](https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-14_Issue-4/Chow.pdf#page=6) to monitor and enforce such rules. The United States cannot afford to wait; once the potential threat arrives, it will already be too late.

#### US-China war goes nuclear – leads to power vacuum, econ collapse and extinction

Sharman 17 (Jon Sharman, “US would go into any war with China with 'unparalleled violence', warn experts’” 2017. The Independent. February 5, 2017. http://www.independent.co.uk/news/world/americas/us-china-war-be-end-of-life-earth-nuclear-weapons-apocalypse-steve-bannon-donald-trump-white-house-a7561821.html.)

While the prospect remains relatively remote, experts have told The Independent they believe such a conflict would be catastrophic, throwing the entire globe into turmoil and potentially ending "life as we know it on Earth". The United States would likely win because sending China's untested forces against the might of America's military would be like pitching farmers against Achilles and his warriors, said one, but even a conventional military victory would be a strategic disaster. It would set off a global economic crisis and create a potential power vacuum inside defeated China "the like of which we can't imagine". Mr Bannon said war would erupt in the South China Sea in "five to 10 years". He said: "They’re taking their sandbars and making basically stationary aircraft carriers and putting missiles on those. They come here to the United States in front of our face—and you understand how important face is—and say it’s an ancient territorial sea." The US and China have been engaged in a back-and-forth dispute over military build-up and territorial claims in the region for some years. In December the US said it would base its deadliest fighter jets in Australia, and days later China seized an unmanned US Navy drone. It followed a diplomatic spat around then-President-elect Trump's congratulatory phone call with Taiwan's Prime Minister Tsai Ing-wen, which broke with decades of US policy. Mr Trump has been forthright about China's influence, blaming it for the loss of American jobs. The war of words recently heated up when a Chinese military official was quoted as saying talk of war with the US under Mr Trump "are not just slogans, they are becoming a practical reality". Trevor McCrisken, associate professor of politics and international studies at the University of Warwick, said that if war broke out "we would be looking, I would imagine, at World War Three". He said: "I really do think that would be the end of life as we know it on Earth. "From a global strategic risk level I would say the last thing you want is war between the United States and any of the major powers because of the risks of escalation, obviously the potential for nuclear weapons to be used. The likelihood of nuclear exchange between the two principals involved is high."

## OST CP

#### CP: The Outer Space Treaty of 1967 should be amended to allow private property rights in space

MacWhorter 16 Kevin MacWhorter, Sustainable Mining: Incentivizing Asteroid Mining in the Name of Environmentalism, 40 Wm. & Mary Envtl. L. & Pol'y Rev. 645 (2016), <https://scholarship.law.wm.edu/wmelpr/vol40/iss2/11> Kevin MacWhorter focuses his practice on land use, zoning and complex development projects. Kevin has extensive experience obtaining land use entitlements in several Northern Virginia jurisdictions. He represents developers, owners and investors in residential and commercial property in securing land use and zoning entitlements in both urban and suburban environments. He counsels clients in their interactions with local, state and federal governments and works to build consensus among property owners, government officials and community groups.

Further, such a law would attract more investment and spur technological development within the United States. Second, to comply with international obligations, the law should direct the President to treat with OST signatories to guarantee private property rights in extracted minerals from asteroids. Again, based on a first-in-time theory of possession, the private actors would come into ownership through converting real property into personal property and bringing it back to Earth. This is necessary in order to clearly define the liability of individual nations with respect to their private companies that venture to asteroids. It will also allow private companies to register their minerals, providing them with security in their possession while in outer space. It further decreases the ambiguous limbo many companies see as a barrier to a viable asteroid mining operation. The environmental benefits alone should be enough to warrant such a law. For three reasons, however, a more robust version of the ASTEROIDS Act should be passed: first, the Outer Space Act already allows limited rights to private property in space.242 The OST and its progeny provide a framework upon which the international community can easily build a regime for private property ownership in extracted material. Second, the proposal is inherently self-limiting. It avoids many of the potential consequences of other property right schemes discussed above.243 Finally, amending the OST to flatly state that private rights in minerals extracted from asteroids are enforceable benefits all mankind, because of its environmental consequences. These points are discussed below.

## Case

#### A textual interpretation of the Outer Space Treaty allows private appropriation of space

Pershing 19 Pershing, Abigail. Interpreting The Outer Space Treaty’s Nonappropriation Principle: Customary International Law From 1967 To Today. Yale Law Journal, 2019, https://openyls.law.yale.edu/bitstream/handle/20.500.13051/6733/Pershing.pdf?sequence=2&isAllowed=y, Accessed 1 Jan 2022. Abigail Pershing was a student director of the Lowenstein International Human Rights Clinic, a co-director of the Medical-Legal Partnership at the Haven Free Clinic, a volunteer with the International Refugee Assistance Project, and a Coker Fellow. She was also an editor of the Yale Law Journal, the Yale Journal of International Law, and the Yale Law & Policy Review. Before law school, Abigail served as a Peace Corps Volunteer in Senegal, West Africa. She received dual Bachelor of Arts degrees in Sociology and Public Policy from the University of Chicago in 2014.

If States decide to explore this avenue, they will have at their disposal the work of several legal theorists, who rely on appeals to both textual arguments and to the realities of the fragility of space law, to push back against the currently accepted norm that private individuals cannot own land or other property in space. These theorists have been described as a “minority of authors,”110 but their claims may lay the foundation for a second shift in customary law. When technology develops to the point that individual appropriation becomes possible, international norms may shift for a second time, relying on these theories to exclude private individuals and corporations from the ambit of the nonappropriation principle. From a textual perspective, proponents of this view often rely on the doctrine of expressio unius est exclusio alterius. 111 This canon of construction dictates that expressly including one thing implies the exclusion of the alternative. Some legal scholars have applied this canon to the Outer Space Treaty to interpret Article II’s failure to expressly ban private appropriation as an explicit indication that private appropriation is legal. Among such scholars are Alan Wasser and Douglas Jobes, who argue that “if the framers of the Outer Space Treaty had intended to mean that States may not authorize their citizens to do anything which they themselves cannot do, they would have written such language into the Treaty explicitly.”112 Once private individuals or corporations have appropriated space, States would be within their rights to recognize these claims. Thus, for example, the United States simply could state that it would recognize claims by United States nationals (and perhaps by others as well) who discover valuable deposits of minerals or other wealth . . . . Recognition of these claims (and protection of them, if necessary, from third parties) would not constitute “national appropriation” or the exercise of sovereignty over territory, but rather the exercise of United States jurisdiction over its citizens and of its power to protect them against third parties in international common areas.113 According to some of these theorists, a narrow interpretation of Article II would legally “allow other entities like private companies and non-governmental organizations to appropriate territory.”114 Another textual argument scholars have advanced to support a narrower reading of the non-appropriation principle is that the clause is exceedingly vague, and therefore State parties are free to interpret the principle however each sees fit.115 Instead of waiting years for international consensus and change, the United States on its own authority could simply “ignore the 1967 Space Treaty’s nosovereignty provision”116 and instead act in accordance with whatever provisions it deemed internally desirable. Putting a finer gloss on what is essentially the same point, Wasser and Jobes’ view is that the non-appropriation principle has proven itself to be ambiguous, and as such, “each signatory must interpret for itself what its obligations are.”117 They later imply that the United States should do what is best for itself—which may mean allowing private appropriation of in situ space property.118 Furthermore, some of these same scholars have suggested that the development of customary international law may not rest solely State actions and may be developed by non-State actors’ actions as well.119 Given the incentives private companies have to promote the right to property ownership in outer space despite Article II of the Outer Space Treaty, this prospect should be particularly disquieting for those who hope for an equitable distribution of space resources. Accompanying these textual arguments, some scholars have suggested that such a shift would not be difficult to accomplish given the fragility and malleability of customary international law as it relates to space. As Wasser and Jobes point out, the United States and the Soviet Union were able to establish the basis of the customary international law for private appropriation of extracted resources simply by asserting ownership over moon rocks they brought back from space.120 Similarly, as to the establishment of rights to ownership of physical territory in space under customary international law, all that is needed may be “an international private settlement simply landing on and taking possession of a hunk of Lunar land.”121 Although attempting to appropriate the moon would likely generate an international outcry, it is not clear that the appropriation of a distant asteroid would incite significant protest, even though it could lay the foundation for a shift in customary international law. Significantly, such a shift may occur in State practice even if the legal arguments to support this change are weaker than the arguments supporting a continuation of the prohibition of private appropriation. Should States buckle to private commercial pressures or independently recognize the economic benefits of domestic companies obtaining private property in celestial territory, States would have a newfound interest in recognizing and protecting in situ rights. The legal justifications for de jure or de facto cooperation in non-recognition would likely become subordinate to economic incentives—spurring the adoption of new legal arguments to support shifting State interests.

#### Original interpretation of the Outer Space Treaty found that it didn’t prohibit individual appropriation of space

**Gorove 69** Stephen Gorove, Interpreting Article II of the Outer Space Treaty, 37 Fordham L. Rev. 349 (1969). Available at: <https://ir.lawnet.fordham.edu/flr/vol37/iss3/2> Stephen Gorove (1917-2001) was a space law education pioneer who helped develop international treaties establishing jurisdictional boundaries and liability limits for space exploration and relevant issues. He served as a professor of space law and director of space studies and policy, from 1991-1998, at the University of Mississippi. He organized the first North American international space law conference, which was held at the University of Mississippi in 1969. He founded and chaired the editorial advisory board for the first space law journal, the Journal of Space Law, in 1973. He served as the first director of the NASA-sponsored National Center for Remote Sensing, Air and Space Law from 2000 until his passing.

Turning to the second question which involves the meaning of "national" appropriation, it has been suggested that only the United Nations acting on behalf of the world community as a whole, should be entitled to appropriate.3 While further developments in space law, by international custom or treaty, may eventually prohibit spatial appropriations by an individual or a chartered company or the European communities, the Treaty in its present form appears to contain no prohibition regarding individual appropriation or acquisition by a private association or an international organization, even if other than the United Nations. Thus, at present, an individual acting on his own behalf or on behalf of another individual or a private association or an international organization could lawfully appropriate any part of outer space, including the moon and other celestial bodies. Whether or not an ad hoc international organization could be created for the exclusive purpose of enabling it to appropriate outer space is a delicate question. The answer may have to depend on the good faith of the parties. A further question in relation to "national" appropriation is whether or not political subdivisions of a state, such as the states of a federal state, cities or municipalities may appropriate? Under a strict interpretation, the answers to these questions would likely be in the negative even though an occasional court decision in other areas of the law may support an affirmative position.4

### AT: Space War

#### Turn - Private actors solve space war and specifically ASAT restraint.

Cobb 21 [Wendy N. Whitman Cobb, Associate Professor of Strategy and Security Studies at the School of Advanced Air and Space Studies, “Privatizing Peace: How Commerce Can Reduce Conflict in Space,” 2021, Routledge, pp. 68-69, EA]

Finally, given the involvement of an ever-larger number of private actors in space, states also need to consider the lost opportunity costs if private actors choose to forego research, development, and deployment of new technologies because the danger in space is too high. As space becomes more commercialized, these private actors can exert pressure on states to behave peacefully in order to promote further economic development. Gartzke and Quan Li argue that this can happen through the movement of capital from conflict-prone states or areas to non-conflictual states.50 This is not necessarily applicable to space because there is no area in space which is formally protected, but commercial space actors may choose not to engage in new economic investment which can in turn affect a state’s economic performance. To date, the size of the space sector is comparatively small, so, arguably, the potential economic loss would not be that great. Where the harm comes from is state reliance on private actors for military and national security space services. As states contract out space services to a greater extent, private actors exert an even greater influence over the state by having a capability they do not.

Why might private companies want a more conflict-free space? If there is weaponized conflict in space, they could potentially benefit through new launches to send up replacement satellites; this is similar to an argument that war can actually be beneficial to an economy because companies are needed to create materiel and weapons.51 But, in a debris filled environment, sending replacements is more difficult and dangerous. Some private companies want to engage in human spaceflight; a conflictual or more dangerous orbital environment would likely prevent those activities or increase their costs to such an extent that it becomes economically infeasible. James Clay Moltz argues specifically that “the growing presence of space tourists in low-Earth orbit would greatly increase the incentives for restraint in any future [ASAT] test programs.”52 Those foregone development costs and commercial activities can have a similar cost to states simply by discouraging private actors from participating in the market.

**No ‘space war’ – Insurmountable barriers and everyone has an interest in keeping space peaceful**

**Dobos 19** [(Bohumil Doboš, scholar at the Institute of Political Studies, Faculty of Social Sciences, Charles University in Prague, Czech Republic, and a coordinator of the Geopolitical Studies Research Centre) “Geopolitics of the Outer Space, Chapter 3: Outer Space as a Military-Diplomatic Field,” Pgs. 48-49]

Despite the theorized potential for the achievement of the terrestrial dominance throughout the utilization of the ultimate high ground and the ease of destruction of space-based assets by the potential space weaponry, the utilization of space weapons is with current technology and no effective means to protect them far from fulfilling this potential (Steinberg 2012, p. 255). In current global international political and technological setting, the utility of space weapons is very limited, even if we accept that the ultimate high ground presents the potential to get a decisive tangible military advantage (which is unclear). This stands among the reasons for the lack of their utilization so far. Last but not the least, it must be pointed out that the states also develop passive defense systems designed to protect the satellites on orbit or critical capabilities they provide. These further decrease the utility of space weapons. These systems include larger maneuvering capacities, launching of decoys, preparation of spare satellites that are ready for launch in case of ASAT attack on its twin on orbit, or attempts to decrease the visibility of satellites using paint or materials less visible from radars (Moltz 2014, p. 31). Finally, we must look at the main obstacles of connection of the outer space and warfare. The first set of barriers is comprised of physical obstructions. As has been presented in the previous chapter, the outer space is very challenging domain to operate in. Environmental factors still present the largest threat to any space military capabilities if compared to any man-made threats (Rendleman 2013, p. 79). A following issue that hinders military operations in the outer space is the predictability of orbital movement. If the reconnaissance satellite's orbit is known, the terrestrial actor might attempt to hide some critical capabilities-an option that is countered by new surveillance techniques (spectrometers, etc.) (Norris 2010, p. 196)-but the hide-and-seek game is on. This same principle is, however, in place for any other space asset-any nation with basic tracking capabilities may quickly detect whether the military asset or weapon is located above its territory or on the other side of the planet and thus mitigate the possible strategic impact of space weapons not aiming at mass destruction. Another possibility is to attempt to destroy the weapon in orbit. Given the level of development for the ASAT technology, it seems that they will prevail over any possible weapon system for the time to come. Next issue, directly connected to the first one, is the utilization of weak physical protection of space objects that need to be as light as possible to reach the orbit and to be able to withstand harsh conditions of the domain. This means that their protection against ASAT weapons is very limited, and, whereas some avoidance techniques are being discussed, they are of limited use in case of ASAT attack. We can thus add to the issue of predictability also the issue of easy destructibility of space weapons and other military hardware (Dolman 2005, p. 40; Anantatmula 2013, p. 137; Steinberg 2012, p. 255). Even if the high ground was effectively achieved and other nations could not attack the space assets directly, there is still a need for communication with those assets from Earth. There are also ground facilities that support and control such weapons located on the surface. Electromagnetic communication with satellites might be jammed or hacked and the ground facilities infiltrated or destroyed thus rendering the possible space weapons useless (Klein 2006, p. 105; Rendleman 2013, p. 81). This issue might be overcome by the establishment of a base controlling these assets outside the Earth-on Moon or lunar orbit, at lunar L-points, etc.-but this perspective remains, for now, unrealistic. Furthermore, no contemporary actor will risk full space weaponization in the face of possible competition and the possibility of rendering the outer space useless. No actor is dominant enough to prevent others to challenge any possible attempts to dominate the domain by military means. To quote 2016 Stratfor analysis, "(a) war in space would be devastating to all, and preventing it, rather than finding ways to fight it, will likely remain the goal" (Larnrani 20 16). This stands true unless some space actor finds a utility in disrupting the arena for others.

#### No space war - deterrence

Kyle L. Evanoff 19, Research Associate for International Institutions and Global Governance at the Council on Foreign Relations, “Big Bangs, Red Herrings, and the Dilemmas of Space Security”, Council on Foreign Relations, 6/27/2019, https://www.cfr.org/blog/big-bangs-red-herrings-and-dilemmas-space-security

Analysts pointed to Mission Shakti as a vivid example of growing contestation in the outer space domain. Traditional U.S. dominance in space has eroded as a litany of foreign actors (collaborator and competitor alike) have increased their spacefaring prowess, including through the development and use of ASAT weapons and dual-use uncrewed orbiters capable of space rendezvous and proximity operations [PDF]. Pundits fear that such space technologies could alter the calculus of deterrence to inauspicious effect or, worse, become instruments in an adversary’s enactment of a “space Pearl Harbor.” These fears are valid in some senses, overblown and misleading in others. Developments in space pose significant challenges for strategic stability. Obsessive concern with the remote contingency of kinetic warfare in orbit, however, detracts from efforts to address more pressing space security issues and makes catastrophic outcomes more, not less, probable. Missiles and Lasers and Viruses, Oh My Recent years have witnessed burgeoning democratization in the outer space domain as plummeting costs—both for manufacturing satellites and placing them in orbit—and proliferating technologies have enabled new spacefaring actors to deploy assets in Earth orbit. The number of active satellites has ballooned to more than two thousand, and their integration into military operations and civil life has deepened in tandem. Recognition of the indispensability of these orbital assets to numerous areas of strategic competition, and defense planners’ emphasis on offensive capabilities as a deterrence measure, has led states to invest large sums in the development of ASAT weapons of various stripes. In their April Space Threat Assessment 2019 [PDF] report, Todd Harrison, Kaitlyn Johnson, and Thomas G. Roberts of the Center for Strategic and International Studies outline four categories of counterspace operations: kinetic physical attacks, non-kinetic physical attacks, electronic attacks, and cyberattacks. This litany of potential threats, which vary in their severity, reversibility, ease of attribution, and other aspects, makes U.S. policymakers uneasy. After over half a century of spacefaring pre-eminence, the United States has come to depend on the remote-sensing, telecommunications, and positioning, navigation, and timing capabilities that satellites provide. The resounding defeat of the Iraqi military by American and coalition forces during the Gulf War of the early 1990s underscored the substantial battlefield advantages that orbital capabilities confer, and numerous subsequent conflicts have affirmed the U.S. military’s tactical and strategic reliance on space assets. Proliferating counterspace systems heighten the potential for adversaries to disrupt American command, control, and communications networks, as well as surveillance and reconnaissance operations. In attacking these critical space systems, U.S. adversaries could compromise large segments of the national defense enterprise. Indeed, an insecure orbital environment poses significant challenges for broader strategic stability. Actors in possession of counterspace capabilities can threaten or attack vital elements of ballistic missile launch detection architectures and other systems integral to national and international security, which opens new avenues for intentional, inadvertent, or accidental dispute or conflict escalation. In this sense, novel satellite vulnerabilities add layers of technical and psychological complexity to already labyrinthine deterrence calculations. The effect compounds in light of the deep integration of satellites into information and communications networks: cyber intrusions into space systems are a tantalizing option for state and nonstate actors, and such operations carry their own elaborate deterrence considerations, not least the difficulty of attribution. The net result is a convoluted deterrence landscape, rife with uncertainty and in constant motion thanks to the rapid clip and often competitive character of technological innovation. Swords of Many Edges For staunch deterrence advocates, this uncertainty justifies expanding counterspace arsenals. In their view, preventing a space Pearl Harbor in which a U.S. adversary launches a crippling surprise attack against American orbital assets requires evincing the certainty of a devastating counterattack. One way of accomplishing this is through the unambiguous demonstration of effective counterspace capabilities. The clearer the demonstration, the better. In this sense, ASAT missile tests, which are easy to attribute and spectacular in nature, hold great allure as a means of signaling orbital strike capabilities. Such tests, however, come with significant drawbacks. The most obvious of these is that they generate large amounts of dangerous space debris, which pose serious hazards to spacecraft. Each new fragment requires monitoring and, in cases of potential collisions, risk assessment and avoidance maneuvers. Debris-generating military operations, in this sense, are a self-defeating proposition. ASAT missile tests also come with nebulous reputational costs, as the corpus of international space law, including the 1967 Outer Space Treaty, emphasizes that uses of space should be peaceful in nature. Likewise, UN Debris Mitigation Guidelines [PDF] affirm the importance of minimizing space junk, a dictum inconsistent with kinetic weapons testing. Western media heaped scorn on India for its violation of the important, if incipient, norm against debris generation, even after the country took pains to destroy a low-altitude satellite in order to minimize the lifespan of the bulk of the fragments. Another important consideration for would-be ASAT testers lies in the potential for space militarization to ignite or exacerbate international arms races. Although military activities have been a persistent feature of the Space Age, those activities have often furthered peaceful as much as warlike pursuits, as has been the case with many remote-sensing operations and the opening of the U.S. Global Positioning System to civilian use. Militarization is a process rather than a state of affairs, and one that takes various forms at that. Deterrence implications notwithstanding, the development and deployment of counterspace capabilities can drive potential adversaries to develop and deploy similar capabilities, contributing to the erosion of norms of peaceful use. Some military planners and policymakers’ assertions to the contrary, space is at present less a domain of warfighting than a domain of deep interdependence. The value of combat support functions performed from space, as important as they are to battlefield success, pales in comparison to that of other satellite-facilitated services, which are vital to myriad aspects of contemporary global society. Common space security interests include minimizing debris-generation, coordinating on satellite placement and radio-frequency spectrum use, monitoring terrestrial and space weather and the global environment, ensuring the integrity of global navigation satellite systems, tracking licit and illicit ground, air, and maritime movements, scanning for hazardous comets and asteroids, and conducting scientific observations and experiments. Many of these require states to work together to maximize benefits and minimize risks. Perceptions that one or more countries are attempting in systematic fashion to exert dominance and preclude other actors’ access to the domain and its benefits, then, carry significant dangers. They bend state behavior toward aggression and actual warfighting. Security in the Heavens and on Earth National governments, including that of the United States, should be careful not to make active contributions to such perceptions. Although low-level grey zone aggression has become commonplace for space-linked systems due to the relative ease and reversibility of many cyber and electronic attacks, space remains free of kinetic combat at present, as a recent Secure World Foundation report [PDF] emphasizes. Rather than responding to limited attacks by expanding counterspace arsenals, which carries the risk of contributing to arms race dynamics, U.S. and allied policymakers should accept some amount of limited aggression as more or less inevitable. They should place more emphasis on diplomacy—not weaponry—as a tool in mitigating these sorts of attacks. The United States should work with other spacefaring powers to reach consensus on non-binding rules of the road for space, using the International Code of Conduct for Outer Space Activities [PDF] that the European Union proposed in 2008 as a rough starting point. While new international law could be a greater boon still, formal UN discussions on the Prevention of an Arms Race in Outer Space have yielded little progress since the mid-1980s. A joint Chinese-Russian proposal for a Treaty on the Prevention of the Placement of Weapons in Outer Space, for instance, has significant shortcomings and has drawn open condemnation from the United States. Such paralysis, in tandem with the Trump administration’s and U.S. Senate Republicans’ disdain of multilateral treaties, makes a formal agreement a farfetched proposition for now. More important, U.S. policymakers should avoid making decisions on the basis of a possible, though highly improbable, space Pearl Harbor. They should recognize that latent counterspace capabilities—as exemplified in 2008’s Operation Burnt Frost, which saw the United States repurpose a ballistic missile interceptor to destroy a satellite—are more than sufficient to deter adversaries from launching a major surprise attack in almost all scenarios, especially in light of the aforementioned deep interdependence in the space domain. Adding to the deterrence effect are uncertain offensive cyber capabilities. The United States continues to launch incursions into geopolitical competitors’ critical systems, such as the Russian power grid, and has demonstrated a willingness to employ cyberattacks in the wake of offline incidents, as it did after Iran shot down a U.S. drone last week. Unlike in the nuclear arena, where anything short of the prospect of nuclear retaliation holds limited dissuasive power, space deterrence can stem from military capabilities in various domains. For this reason, an attack on a U.S. satellite could elicit any number of responses. The potential for cross-domain retaliation, combined with the high strategic value of space assets, means that any adversary risks extreme escalation in launching a major assault on American space architectures. Again, well-conceived diplomatic efforts are useful in averting such scenarios altogether.