# 1NC

## COPUOS CP

#### Text: The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS)’s Legal Subcommittee ought to recognize outer space as a global commons

#### The CP competes off of actor spec – they had complete control over how and who implements the aff, especially in this topic since the actor was not specified in the resolution. The actor is a key, debatable element and a change poses an opportunity cost, which is sufficient for competition.

#### COPUOS has jurisdiction and has passed policy on similar topics in the past

UNOOSA

UNOOSA (united nations outer space committee), 2021 (no date but written about the 2021 conference), "COPUOS 2021 Session," UNOOSA, <https://www.unoosa.org/oosa/en/ourwork/copuos/index.html> // HW AW

The Committee on the Peaceful Uses of Outer Space (COPUOS) was set up by the General Assembly in 1959 to govern the exploration and use of space for the benefit of all humanity: for peace, security and development. The Committee was tasked with reviewing international cooperation in peaceful uses of outer space, studying space-related activities that could be undertaken by the United Nations, encouraging space research programmes, and **studying legal problems arising from the exploration of outer space**. The Committee was **instrumental in the creation of the five treaties and five principles of outer space**. International cooperation in space exploration and the use of space technology applications to meet global development goals are discussed in the Committee every year. Owing to rapid advances in space technology, the space agenda is constantly evolving. The Committee therefore provides a unique platform at the global level to monitor and discuss these developments. The Committee has two subsidiary bodies: the [Scientific and Technical Subcommittee](https://www.unoosa.org/oosa/en/ourwork/copuos/stsc/2020/index.html), and the [Legal Subcommittee](https://www.unoosa.org/oosa/en/ourwork/copuos/lsc/2019/index.html), both established in 1961. The Committee reports to the [Fourth Committee of the General Assembly](http://www.un.org/en/ga/fourth/), which adopts an annual resolution on international cooperation in the peaceful uses of outer space.

#### COPUOS is losing legitimacy due to an inability to reach consensus and thereby pass policies – the CP restores faith, discourages weak agreements, solves space debris, sustainability, and security issues

Masson-Zwaan 19

Tanja Masson-Zwaan (deputy director of institute of air and space at Leiden University), 2019, "SYNOPSIS ON THE NEW SPACE RACE: NEW STATES IN SPACE " Cambridge, https://www.cambridge.org/core/services/aop-cambridge-core/content/view/E68383DE71B60A711EE1E4578CA303A8/S2398772319000138a.pdf/new\_states\_in\_space.pdf, // HW AW

The “old” space race started in 1957 and involved mainly the United States and the Soviet Union. These states led the development of the initial international agreements adopted in the framework of the UN Committee on the Peaceful Uses of Outer Space (COPUOS).1 Within less than two decades, between 1967 and 1984, five international treaties were adopted and entered into force.2 At the time, COPUOS had less than twenty-five member states and agreement was reached relatively easily. Gradually, the group of space actors grew, but space activity remained state-centered and involved a relatively small number of states, while private-entity involvement was mostly limited to the telecommunication sector in the United States. Today, the landscape is entirely different. Not only are more and more states interested and involved in exploring and using outer space, but private entities also have entered the scene, and the trend of privatization and commercialization of space activities is expected to gain more speed in years to come. As the number of states active—or wishing to become active—in outer space has grown, so has the membership of COPUOS, which today counts nearly ninety states.3 It has thus **become more difficult to reach consensus, which has been the working method of COPUOS from the start**. As a consequence of the growing number and diversity of stakeholders, in recent decades the **agreements among states about the use and exploration of outer space have taken the form of principles and other UN resolutions, rather than legally binding treaties**. At the same time, a growing number of new topics require states’ attention. With constant advances in technology, new capacities and activities emerge at high speed, such as ever-smaller satellites, large constellations of hundreds or even thousands of satellites, the prospect of suborbital flights, reusable launch vehicles, on-orbit servicing, and the use of resources from asteroids or the Moon. These developments were not foreseen in the early days of space exploration. Although the UN space treaties and resolutions provide the basic legal framework, some form of further elaboration is now needed to provide clear and predictable standards to govern these new activities. Issues such as the continuing congestion of outer space, the problems related to the mitigation and remediation of space debris, the long-term sustainability of space activities, space traffic management, space situational awareness, and the security of critical space infrastructure will also increasingly require the attention of the international community of states. In this changed landscape with new states, private entities, new activities, and new concerns, it is useful to look at how emerging space nations view the rules that were laid down in the past, the issues that will require regulation in the future, and whether there are any special concerns that influence their positions.4 The main principles of international space law are embodied in the Outer Space Treaty of 1967 (OST). The treaty has been widely adopted and states have consistently acted in accordance with its principles.5 In addition, states have not publicly contested those principles, proposed amendments, or withdrawn from the treaty. Thus, at least parts of the treaty could be considered to have reached the status of customary international law, meaning that they are binding on all states, including nonparties. The following sections highlight principles that are not likely to be contentious for new space states and then identify current principles and future issues that may raise more concerns.

## Restaurant PTX DA

#### Restaurant package coming now, but floor time is key and in short supply

Mcpherson 1-15-22

Lindsey Mcpherson, (Senior reporter [@rollcall](https://twitter.com/rollcall) covering House and Senate legislative maneuvering. ), jan 15 2022, "Restaurants could get another $40 billion financial lifeline," press reader, https://www.pressreader.com/usa/rome-news-tribune/20220115/282372632976658, // HW AW

WASHINGTON — A bipar­tisan Sen­ate group is nego­ti­at­ing a bill to provide about $40 bil­lion in fresh fund­ing for pan­demic-battered res­taur­ants, Sen­ate Small Busi­ness Chair­man Ben­jamin L. Cardin said Wed­nes­day. While the details aren’t final, the Mary­land Demo­crat told report­ers that sen­at­ors are con­sid­er­ing an aid pack­age for strug­gling busi­nesses that could more than double the amount of pan­demic aid funneled to res­taur­ants, bars and oth­ers in the food ser­vice industry. “It’s pretty urgent to get done,” Cardin told report­ers. “**The prob­lem is floor time** and how do you get to it, and also mak­ing sure we have adequate bipar­tisan sup­port.” “It’s pretty urgent to get done,” Cardin told report­ers. “The prob­lem is floor time and how do you get to it, and also mak­ing sure we have adequate bipar­tisan sup­port.” The res­taur­ant industry has been clam­or­ing for more fed­eral aid since burn­ing through $28.6 bil­lion Con­gress provided as part of a pan­demic relief pack­age last year. Only about a third of the res­taur­ants that applied for aid last year received a grant under the Res­taur­ant Revital­iz­a­tion Fund, leav­ing nearly 200,000 res­taur­ants and bars strug­gling to stay afloat without aid. More than 90,000 res­taur­ants and bars nation­wide have closed since the begin­ning of the pan­demic and **more than 86% of own­ers say they may close if they don’t receive a grant,** accord­ing to a recent sur­vey from the Inde­pend­ent Res­taur­ant Coali­tion. Law­makers of both parties intro­duced vari­ous bills last year offer­ing up to $120 bil­lion for res­taur­ant aid, But none gained enough trac­tion to win a floor vote in either cham­ber. Cardin intro­duced a bill last sum­mer that would have provided $48 bil­lion in addi­tional Relief. Cardin declined to give many details about the dis­cus­sions but said $40 bil­lion is the ball­park fig­ure law­makers have dis­cussed for new res­taur­ant aid. He said the new pack­age would include aid to other busi­nesses, includ­ing live enter­tain­ment ven­ues and gyms. “We are look­ing bey­ond just res­taur­ants,” he said, while declin­ing to offer a price tag for the entire pack­age. The Com­munity Gyms Coali­tion poin­ted out in a state­ment Wed­nes­day that gyms and fit­ness stu­dios haven’t got­ten any fed­eral relief, unlike res­taur­ants and live enter­tain­ment ven­ues. “Small gyms are con­tinu­ing to suf­fer dis­pro­por­tion­ately from the pan­demic,” the coali­tion said. “We are count­ing on both Con­gress and the Biden admin­is­tra­tion to move quickly to save tens of thou­sands of gyms and fit­ness stu­dios across the coun­try.” “Mis­sis­sippi Sen. Roger Wicker, Cardin’s chief Repub­lican part­ner in the new effort, declined to com­ment Wed­nes­day. “There’s one issue and one issue only I’m talk­ing about this week, and that’s sav­ing the Sen­ate from attack on 200 years of tra­di­tion,” he said, refer­ring to the upcom­ing fight over the Sen­ate’s fili­buster rule relat­ing to vot­ing rights legis­la­tion. Cardin wouldn’t say what legis­lat­ive vehicle would be used, whether a stand-alone bill or as part of a lar­ger spend­ing pack­age. Law­makers are con­sid­er­ing attach­ing pan­demic-related aid such as more money for test­ing, vac­cine dis­tri­bu­tion and school ret­ro­fits in an omni­bus fiscal 2022 appro­pri­ations bill. **“We are mak­ing a lot of pro­gress,” Cardin said. “The ques­tion is, how will it come to the floor?”**

#### The plan is a political firestorm---regulating private space is unpopular---lawmakers want to encourage private space industries to encourage innovation and avoid government liability.

Loren Grush 15, science reporter for The Verge, the technology and culture brand from Vox Media, where she specializes in news about Space and Space law, 2015, “Private space companies avoid FAA oversight again, with Congress' blessing,” https://www.theverge.com/2015/11/16/9744298/private-space-government-regulation-spacex-asteroid-mining

The Senate passed the bill [H.R. 2262](https://www.congress.gov/bill/114th-congress/house-bill/2262), also known as the US Commercial Space Launch Competitiveness Act, last week, and both the House and the Senate have expressed support for it. House Majority Leader Kevin McCarthy has [scheduled the bill for final approval this afternoon](http://www.majorityleader.gov/floor/#daily). After it passes, it goes to the president for his official signature. PRIVATE SPACE TRAVEL IS STILL CONSIDERED YOUNG Many prominent commercial space companies — including SpaceX, Blue Origin, and Virgin Galactic — [have applauded H.R. 2262](https://science.house.gov/sites/republicans.science.house.gov/files/documents/FINAL%20WTS_SPACE%20Act%20of%202015.pdf). The legislation means that private space travel is still considered young, and lawmakers have given the industry more time to experiment and gather data."It allows the industry to grow, to test, and to develop without this overshadow of the regulatory hammer coming down on them," Eric Stallmer, president of the Commercial Spaceflight Federation, a non-profit aimed at promoting commercial spaceflight development, told *The Verge*. It also means that people participating in private spaceflight do so at their own risks, and there are no government regulations in place specifically to keep them safe. Space travel isn’t that safe, of course; nearly 1 in 10 rockets fail, though most vehicles that go into space these days don’t have crew members on board. The FAA is concerned about the spacecraft that will carry people, though, which is why the agency doesn’t seem supportive of the learning period extension. In February of 2014, George Nield, head of the FAA Office of Commercial Space Transportation, [testified before the House Subcommittee on Space](http://docs.house.gov/meetings/SY/SY16/20140204/101703/HHRG-113-SY16-Wstate-NieldG-20140204.pdf) that he thinks it's time for the period to expire. Nield said he understands that many in the industry fear overregulation by the FAA, but that his office is more concerned with ensuring crew safety than issuing "burdensome" standards. "We want to enable safe and successful commercial operations," he testified. REGULATORY LEARNING PERIOD The advent of private spaceflight began in the 1960s, but the industry has only started growing rapidly this decade. To address this expansion, Congress passed the Commercial Space Launch Amendments Act in 2004. It granted the private sector a "learning period" free of regulation. The learning period was set to expire in December 2012 but was granted two short extensions. H.R. 2262 will extend the period for a further eight years, through September 30th, 2023. THE FAA STILL HAS SOME AUTHORITY TO REGULATE THE COMMERCIAL SECTOR During the learning period, the FAA still has some authority to regulate the commercial sector. The agency is responsible for issuing licenses for rocket launches and for vehicles re-entering Earth's atmosphere. The agency’s main concern is to ensure that launch vehicles aren’t immediate threats to the uninvolved public and property. Under this legislation, the FAA is restricted from issuing licenses specifically pertaining to the safety of a spacecraft's crew or passengers. Right now, people who participate in commercial spaceflight do so through "informed consent" — meaning they know that they're partaking in an endeavor that could [easily kill them](http://www.popsci.com/article/technology/virgin-galactic-crash-may-lead-new-regulations-private-spaceflight). Before these participants can fly, they must sign a document that says spaceflight is inherently dangerous and they understand the risks associated with it. The end of the learning period would allow the FAA to issue standards related to crew safety — but it also means the agency could issue standards for anything else in relation to commercial spaceflight. For example, the agency could dictate specifically how engines or vehicles should be designed and built, similar to how the FAA oversees the commercial aviation industry. *NTSB investigators stand next to the crash site of SpaceShipTwo. (NTSB)* The FAA hasn't expressed interest in doing this, but Nield noted in his 2014 testimony that the agency wants to regulate spaceflight activities that take place in orbit; for instance, the FAA wants to issue standards for collision avoidance. The agency also hinted it might try to regulate commercial crew safety following last year's Virgin Galactic crash, in which a pilot was killed during a test flight of the company's SpaceShipTwo vehicle. The initial regulatory learning period allowed the FAA to issue regulations in direct response to a serious commercial space travel accident, and the SpaceShipTwo crash was the first commercial flight to result in a fatality. [The FAA told *Bloomberg*](http://www.bloomberg.com/news/articles/2014-11-07/should-space-travel-be-like-climbing-everest-or-airlines-) that the agency may want additional regulations following an accident investigation, without saying what those might entail. H.R. 2262 still maintains the FAA's ability to issue regulations in the event of a fatal accident, however those regulations must specifically address the accident itself and wouldn't apply to the entire industry. Stallmer, of the Commercial Spaceflight Federation, argued that there will be a time when more regulations are needed — after this learning period is over, without saying when that would be. He hopes that any new standards will stem from extensive dialogue between the government and commercial sectors, as companies continue to learn more about the business of rocket science. "And as the industry grows, we’ll have the knowledge we need so we can eventually have efficient and common sense regulations," said Stallmer. SPACE STATION AND ASTEROID MINING *The International Space Station (NASA)* H.R. 2262 also issues a number of other key provisions, [which can be found here](http://www.gpo.gov/fdsys/pkg/BILLS-114hr2262eas/pdf/BILLS-114hr2262eas.pdf). For one, the bill officially extends operations of the International Space Station through 2024. President Obama had already approved this ISS extension, but Congress must sign off on it in order for it to be final. "A new president could come and say, 'To hell with this space station,'" said Stallmer. "This puts into law that the space station will continue to be a national laboratory." And then there’s the asteroid mining. Under one provision of H.R. 2262 called the Space Resource Exploration and Utilization Act of 2015, commercial companies get the rights to any resources that they collect from celestial bodies. The provision is important for companies like the asteroid mining company Planetary Resources, which recently partnered with Virgin Galactic. "Now, if you go out somewhere in space and you pick [something] up, it’s yours," said Chris Lewicki, the president and chief engineer of Planetary Resources. "IF YOU GO OUT SOMEWHERE IN SPACE AND YOU PICK [SOMETHING] UP, IT’S YOURS." The bill mostly refines what was originally laid out in the Outer Space Treaty, a document signed by 104 companies in 1967 that eventually became the basis for international space law. The treaty forbids anyone from claiming asteroids or planets as new government territories, but it does grant non-government entities the rights "explore and use" outer space. That means companies can go collect any space materials they can find and bring back home with them. Now, H.R. 2262 guarantees that they will own those materials.

#### Restaurants failing means collapse of the economy – it takes other sectors down with it

CAEDC 21

Cumberland Area Economic Development Corporation, (a company which decides which parts of the economy are most important. They have a bunch of articles about what different sectors mean to the economy), 4-1-2021, "The Importance of Restaurants to Local Community," https://cumberlandbusiness.com/news/the-importance-of-restaurants-to-local-community/, // HW AW

The Importance of Restaurants to Local Community In an increasingly complicated economic reality, restaurants are a stronghold of local communities. The restaurant industry fosters regional job growth, supports [local agriculture](https://cumberlandbusiness.com/news/the-importance-of-agribusiness/) and keeps your hard-earned money in your community. When you choose to shop or dine at a local business or restaurant, you generate almost four times more economic benefits for your local community. Choose a local restaurant and make memories while supporting your hometown’s economic development. Local restaurants are an impactful gathering place for communities, where relationships form and memories are made. They preserve agriculture and recipes from generation to generation and are the lifeblood of regional food culture. When you choose to dine at a local restaurant, you invest your money right back into the hands of your community and preserve local recipes and agriculture. The benefits of a restaurant don’t end there, either. Local eateries have a big impact on all of the following factors. Local Taxes **Approximately 10% of America’s economy is affected by the restaurant industry alone, which is a massive financial power**. When you choose to support local restaurants, you’re putting those funds toward strengthening your hometown. Eating at local restaurants allows them to stay open and thrive in your area. As a result, the restaurants’ tax revenue will benefit your local economy. Local Jobs Restaurants are an industry that is continually hiring and creating new jobs. **The restaurant industry employs as much as 10% of the American workforce,** so spending your money at a local restaurant goes straight into feeding members of your community. The restaurant industry is also currently creating new middle-class jobs at three times the growth of any other industry. Local restaurants are **community cornerstones where many young people get their first jobs and where adults begin fulfilling careers**. Agriculture As food becomes more mass-produced and imported from other countries, local varieties of produce begin dying out and the American agriculture sector takes a hit. Local restaurants promote regional produce production and help farms near you. Eating at a local restaurant gives you the opportunity to taste the most delicious ingredients your area has to offer. Local restaurants may even switch out their menus regularly to highlight seasonal produce.

#### Economic decline causes global nuclear war

Stein Tønnesson 15, Research Professor, Peace Research Institute Oslo; Leader of East Asia Peace program, Uppsala University, 2015, “Deterrence, interdependence and Sino–US peace,” International Area Studies Review, Vol. 18, No. 3, p. 297-311

Several recent works on China and Sino–US relations have made substantial contributions to the current understanding of how and under what circumstances a combination of nuclear deterrence and economic interdependence may reduce the risk of war between major powers. At least four conclusions can be drawn from the review above: first, those who say that interdependence may both inhibit and drive conflict are right. Interdependence raises the cost of conflict for all sides but asymmetrical or unbalanced dependencies and negative trade expectations may generate tensions leading to trade wars among inter-dependent states that in turn increase the risk of military conflict (Copeland, 2015: 1, 14, 437; Roach, 2014). The risk may increase if one of the interdependent countries is governed by an inward-looking socio-economic coalition (Solingen, 2015); second, the risk of war between China and the US should not just be analysed bilaterally but include their allies and partners. Third party countries could drag China or the US into confrontation; third, in this context it is of some comfort that the three main economic powers in Northeast Asia (China, Japan and South Korea) are all deeply integrated economically through production networks within a global system of trade and finance (Ravenhill, 2014; Yoshimatsu, 2014: 576); and fourth, decisions for war and peace are taken by very few people, who act on the basis of their future expectations. International relations theory must be supplemented by foreign policy analysis in order to assess the value attributed by national decision-makers to economic development and their assessments of risks and opportunities. If leaders on either side of the Atlantic begin to seriously fear or anticipate their own nation’s decline then they may blame this on external dependence, appeal to anti-foreign sentiments, contemplate the use of force to gain respect or credibility, adopt protectionist policies, and ultimately refuse to be deterred by either nuclear arms or prospects of socioeconomic calamities. Such a dangerous shift could happen abruptly, i.e. under the instigation of actions by a third party – or against a third party. Yet as long as there is both nuclear deterrence and interdependence, the tensions in East Asia are unlikely to escalate to war. As Chan (2013) says, all states in the region are aware that they cannot count on support from either China or the US if they make provocative moves. The greatest risk is not that a territorial dispute leads to war under present circumstances but that changes in the world economy alter those circumstances in ways that render inter-state peace more precarious. If China and the US fail to rebalance their financial and trading relations (Roach, 2014) then a trade war could result, interrupting transnational production networks, provoking social distress, and exacerbating nationalist emotions. This could have unforeseen consequences in the field of security, with nuclear deterrence remaining the only factor to protect the world from Armageddon, and unreliably so. Deterrence could lose its credibility: one of the two great powers might gamble that the other yield in a cyber-war or conventional limited war, or third party countries might engage in conflict with each other, with a view to obliging Washington or Beijing to intervene.

## Laser Cannons CP

#### CP –

#### Outer Space ought to be made into a global commons except for the orbital space surrounding the ISS for purposes of single-use debris-limiting laser cannons

#### the US and Japan ought to divert funds to build a laser cannon for the International Space Station and require gossamer sails on all future satellites

#### Debris is already here, the problem is cleaning it up, and only the profit motive from private entities can do it

Powell 15

Corey S Powell (science journalist and editor in chief at discover magazine, wrote 3 books with Bill Nye!!), May 20 2015, "Space Junk is a Problem. Is a Laser Cannon the Solution?," https://www.discovermagazine.com/the-sciences/space-junk-is-a-problem-is-a-laser-cannon-the-solution#.VV4ENGRViko, // HW AW, bracketed cause I don’t like reading big numbers

There’s a general rule in media reporting called Betteridge’s Law: Whenever a headline poses a question--especially a sensational one--the answer is “no.” I’m going to break the law this time. **An orbiting laser cannon is not only an intriguing technology but, yes, it’s one of the most promising ways to clean up the ever-thickening cloud of dangerous debris surrounding the Earth**. And just to be clear, space junk is a danger. There are about 25,000 human-made objects larger than your fist flying around in orbit, and about half a million pieces bigger than a dime. If you include millimeter-scale shrapnel, the number of rogue bits reaches deep into the millions. Typical speeds in low-Earth orbit are about 30,000 kilometers per hour (18,000 miles per hour), ten times the velocity of a rifle bullet. You see the problem: A little impact can pack a big wallop. So far, there have not been any space-junk catastrophes remotely resembling the sensationalized events in the movie Gravity, but the reality is still disconcerting. In 2009, a $50 million Iridium communications satellite was destroyed by a collision with a defunct Russian satellite. Three years later, the [Fermi space observatory](https://www.nasa.gov/mission_pages/GLAST/news/bullet-dodge.html) had a near miss with another Soviet-era satellite. NASA had to clad the International Space Station in shielding to protect it from repeated small impacts, and the agency sometimes moves the whole station to dodge larger pieces of junk. Orbiting debris adds cost and risk to the space business.The proposed space-station laser cannon (upper left) would work in conjunction with a telescope called EUSO to track and destroy space debris. (Credit: RIKEN) The amount of junk in orbit is increasing rapidly, meaning that those costs and risks are increasing, too. Once junk gets up there, it takes a long time to come back down: years to centuries in low orbits, and essentially forever in geosynchronous orbit (40,000 kilometers up, where many communications satellites are located). Most disconcerting, collisions in orbit create more junk, which leads to more collisions. Potentially this could lead to a runaway process called [Kessler Syndrome](http://en.wikipedia.org/wiki/Kessler_syndrome). **This is where the laser cannon comes in**. Toshikazu Ebisuzaki and a team of researchers at the RIKEN lab in Japan have [formulated a plan](http://www.riken.jp/en/pr/press/2015/20150421_2/) to clear out near-Earth space by zapping pieces of space junk with a high-power blast of focused radiation. The laser doesn’t need to be able to destroy the whole piece of debris. All it has to do is vaporize enough of the object to slow its orbit and send it spiraling into Earth’s atmosphere, **where it will burn up harmlessly before reaching the ground. It’s an ingenious solution**. Ebisuzaki’s concept was inspired by a science project called the Extreme Universe Space Observatory, currently under development for the International Space Station. [EUSO](http://jemeuso.riken.jp/en/), which will be installed on the station in 2017, is a fascinating instrument in its own right; it will study extremely high-cosmic rays by watching the light they create when they collide with air molecules. But EUSO’s sensitive, wide-field optics also make it well suited to spotting and tracking small bits of space debris, which are hard to locate from the ground. Finding targets is the crucial first step toward getting rid of them. The next step, of course, is the laser. RIKEN’s concept (which is not yet funded) would start with a 10-watt laser prototype, mounted on the International Space Station, capable of firing 100 laser pulses a second. That would pave the way for a larger system powerful enough to blast away any pieces of space junk within a 100-kilometer range, and eventually lead to a dedicated garbage-cleanup satellite equipped with a [five-hundred-thousand]500,000-watt laser that can fire [fifty-thousand]50,000 times per second. Such a satellite could remove 100,000 pieces of junk a year, the Japanese researchers claim, **fast enough to bring the whole orbital debris problem under control.** The fast-growing population of space debris. "LEO" refers to low-Earth orbit. (Credit: Surrey Space Centre) There are significant technical hurdles to overcome, including the data-processing capacity needed to spot the bits of debris and the considerable energy supply needed to keep such a powerful laser operating for years. Building a giant laser-cannon satellite would not be cheap, either. But this is exactly the kind of ambitious thinking needed to tackle the space-junk mess. Several additional cleanup technologies are also under development. A separate Japanese-led team has proposed trapping and eliminating space debris with a huge [electromagnetic tether](http://www.academia.edu/1265073/Space_Demonstration_of_Bare_Electrodynamic_Tape-Tether_Technology_on_the_Sounding_Rocket_S520-25http:/). A European project called [e.DeOrbit](http://www.esa.int/Our_Activities/Space_Engineering_Technology/Clean_Space/How_to_catch_a_satellite) would snare big pieces of space junk using a net or harpoon and dispatch them Earthward. Other concepts under study would use puffs of [pressurized gas](http://www.nasa.gov/directorates/spacetech/niac/gregory_space_debris_elimination.html), large [magnetized nets](http://www.spacesafetymagazine.com/space-debris/debris-removal/electrodynamic-debris-eliminator-receives-funding/), or a [slingshot-style satellite](http://aero.tamu.edu/news/removing-space-debris-tamu-sweeper-sling-sat). The laser cannon has some obvious advantages over all of these options, however. It could tackle the small fry, not just the big pieces, and it could deal with far more targets than would be possible for any spacecraft that is going after them one by one. If all of these ideas sound a little wacky, there's a good reason: Getting rid of space junk is a really, really hard problem. There is a lot of space to scour for debris. The individual pieces are mostly small and nearly invisible, and they each follow a unique orbit. Hard problems call for creative (and sometimes wacky) solutions. Further complicating things, nobody has devoted much money to cleanup, and any mission that can remove space junk could potentially remove active satellites as well--a delicate political issue. **If the RIKEN laser cannon never happens, it will more likely be due to budget** and political **obstacles than to technical ones**. In the long run, the best way to deal with space junk is never to create it in the first place. One of the most important principles here is what is called [design for demise](http://www.esa.int/Our_Activities/Space_Engineering_Technology/Clean_Space/Space_debris_mitigation)--that is, engineering satellites so that they will automatically de-orbit and remove themselves from the trash pile within, say, 25 years of the end of their mission. A simple way to do this is to equip a satellite with a small sail that would pop open when it is no longer needed. The so-called [gossamer sail](https://theconversation.com/cleaning-up-space-debris-with-sailing-satellites-20384) would act like a space parachute, using the pressure of sunlight and the extremely thin traces of atmosphere in orbit to create drag. The drag would then pull the satellite down to a fiery demise. Simulated view of Earth from the Planetary Society's new LightSail, launched on May 20. Space sails could be used to clear away satellite debris--or to take humanity on great ventures of exploration. (Credit: Josh Spradling/Planetary Society) A gossamer sail is very similar in function to a solar sail--like the prototype [LightSail](http://sail.planetary.org/) launched today by the Planetary Society. That creates a neat kind of symmetry to the story. Powerful space lasers may be useful for clearing debris, but they could also be used to launch high-speed spacecraft. Solar sails could be used to de-orbit satellites, but they could also provide new ways to navigate to new worlds. In short, the kinds of technological solutions needed to clear a path through our local garbage dump could be the exact same ones needed to blaze a path to the stars.

## Innovation DA

#### Private space firms are key to promote competition and drive innovation

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On 11 July UK billionaire businessman Richard Branson travelled to the edge of space in a spaceplane developed by his company, Virgin Galactic. On Tuesday this week, the billionaire founder of Amazon, Jeff Bezos, will take a similar trip to space aboard the New Shepherd rocket built by his Blue Origin company. Elon Musk’s SpaceX will soon begin sending paying civilians into Earth orbit with the company’s Falcon 9 rocket. The ability of such billionaires to afford private spaceflight trips or invest in heavy-lift rockets, while paying a smaller fraction of income in tax than the average American, reflects inequality in America. This inequality has been made especially stark during the COVID-19 pandemic with billionaires’ wealth increasing while many others experienced financial hardships. Increasing wealth and reaching for space has not purchased popularity for these billionaires. Ahead of Bezos’ upcoming suborbital flight, a petition to “not allow Bezos to return to Earth” gained more than 160,000 signatures. Richard Branson has been criticized for using his wealth to go to space rather than addressing more terrestrial problems like climate change. But after half a century of government-led exploration beyond earth, why are billionaires now at the forefront of our minds when we think about space travel, and what do they mean for how we go to space? The private sector has always had a close involvement with space Billionaire interest in space is not new. Historically, science research funding for observatories in the 19th and 20th centuries was typically provided through endowments from wealthy individuals. Institutions such as the Smithsonian and the Guggenheim family were the early donors of Robert Goddard’s ambitious projects to develop rockets and space technology. Following 1980s initiatives like MirCorp’s plan to provide privately owned space stations, the 1990s and 2000s saw commercial space efforts like Peter Diamandis’ introduction of the Ansari X Prize (1996), the US government’s Alternate Access to [the International Space] Station Program (2000-2002), and the founding of Mojave Aerospace Ventures (2004). Between 2001 and 2009 seven wealthy people went to space as paying customers on Russian Soyuz rockets including Dennis Tito, Iranian American businesswoman Anousheh Ansari and Cirque du Soleil founder Guy Laliberte. More recently, aside from Jeff Bezos and Richard Branson, other billionaires have also planned trips to space, including Jared Isaacman and Yusaku Maezawa. The wave of billionaires now seemingly interested in space exploration is a return to a past trend. Space exploration is expensive Private actors and the government think differently when it comes to what type of space programs to prioritize. The government prioritizes aspects of a space program that are in the public-interest such as national security and Earth sciences, while wealthy individuals that enter the space sector are interested in personal and financial endeavors that involve space exploration, such as making life multiplanetary for Elon Musk and space tourism for Richard Branson and Dennis Tito. The Apollo program which ultimately sent astronauts to the moon in 1969 is thought of as the height of US government leadership in space. But the massive investment which made the first moon landing possible was an anomaly that had been driven by political necessity given the climate of the Cold War. As Figures 1 and 2 show, by 1965, the US government had begun to cut NASA’s budget to the point that by the 1970s it made up only about 0.5-1 percent of the total federal budget. According to Dr. John Logsdon of George Washington University’s Space Policy Institute: “From 1970 onward, NASA has not had a budget adequate to support a robust program of human exploration.” Figure 1 – NASA’s budget from 1959 – 2025 Source: The Space Report Figure 2 – NASA’ share of US federal Budget 1959-2018 Source: The Space Report The lackluster interest in space exploration by the US government since the 1970s sits alongside with a similar lack of enthusiasm by the American public. In a 2018 survey conducted by Pew Research Center, a majority of American adults believed that that monitoring Earth’s climate system should be the highest priority and sending astronauts to Mars and the Moon the lowest (Figure 3). Figure 3 – Americans’ views on policy priorities Source: Pew Research Center, 2018 Re-emergence of commercial space At the same time, many wealthy individuals have been dissatisfied with the lack of public enthusiasm and the lack of progress in recent years due to the government’s traditional view of space operations, and failures of the Space Shuttle. Wealthy individuals like Musk believed that they could spur a robust marketplace for providing access to space which could work alongside and provide services for government space agencies by leveraging reusable technologies, lean manufacturing, and vertically integrated production to enable cheap space access. Because typical debt and equity investors are unwilling to finance the risks of space exploration and the government is unable or uninterested in large up-front investments, it is natural for private space exploration to be funded out of billionaire’s own wealth initially, with government support through development contracts. Government support and US Commercial Space Policy Without the government, the private sector cannot thrive in space. The government supports the private sector by adopting regulatory reforms or creating contracts and awards. Early attempts to invigorate the commercial space industry include the 1984 Commercial Space Launch Act, which was unsuccessful as US launch firms were unable to compete against NASA’s Space Shuttle. President Reagan’s 1986 US Space Launch Strategy reduced NASA’s ability to provide commercial launches, which led to the re-emergence of commercial space activities. The limitations provided by the 1986 policy led to the first commercial space launch by Space Services, Inc. in 1989. The US government under the Obama administration made policy reforms such as introducing fixed price contracting to support development of commercial services. An example of this was a request for over $6 billion to subsidize commercial crew vehicles to visit the International Space Station for the Commercial Crew Resupply (CRS) program. Congressional appropriators in the Senate created a “Dual-track” approach, exemplified by the 2010 NASA Authorization Act, which calls for commercial cargo development. The bill shows that policymakers were willing to compromise on certain aspects of the space program such as CRS to support private space launch companies. By 2010, commercialization was well underway with Obama’s National Space Policy that emphasized supporting a “competitive US commercial space sector.” As of 2011, NASA had paid SpaceX $181 million for 14 Commercial Resupply Missions and $298 million under the Commercial Orbital Transportation Services Demonstration Agreement. The Trump Administration increased public investment in private space actors further and established a series of Space Policy Directives that were meant to bolster the commercial sector. Government support to the private sector further comes in the form of NASA- approved loans, loan guarantees, and tax credits. Firms can also receive tax exemptions through facility constructions, discounted loans, and environmental credits. It is estimated that all of Musk’s ventures, not limited to SpaceX, received at least $4.9 billion in government support through tax breaks, factory construction, discounted loans, environmental credits, facility loans, and rebates to product buyers. Photo by SpaceX on Unsplash How billionaires support the space industry Private investment in space has created competition and reduced space launch costs. New space actors began to challenge the government-created monopoly, United Launch Alliance (ULA), for contracts, creating competition and introducing a market for small-medium class reusable launch. SpaceX’s Falcon 9’s average cost is $62 million, while ULA’s Atlas V starts at $110 million per launch. Commercial actors enable the government to have multiple competitive proposals to select from during project development. NASA would pay less money upfront for a service, while private companies can operate and have autonomy over their final product. The government can act as a buyer of commercial services, which allows NASA to be more efficient and cost-effective, as the agency can cut costs by only developing projects it has expertise and funding for. Such competition has dramatically changed space technology. New players that enter the space industry are able to embark on ambitious projects at a greater scale and faster pace. Innovative concepts such as reusable rocket stages has shifted the launch industry into integrating reusability into vehicle design and the proliferation of ridesharing missions has decreased the costs of space launch. This has lowered barriers to enter the space industry, making small satellites rideshare as low as $1 million per mission. Innovations in space launch have further changed the policy environment and streamlined launch and reentry regulations. Billionaires in space are here to stay Investment from wealthy individuals in recent decades have stimulated private markets and paved the way for many startups to enter the industry. As more new players join the commercial space industry, access to space becomes cheaper, resulting in an explosion of proposed satellite constellations and small launch vehicle concepts. Wealthy entrepreneurs have seen an opportunity to take advantage of a lack of government interest in space exploration funding. The high-risk nature of space exploration requires substantial upfront investment that only wealthy individuals can provide before any pay-off. Private investments in space promote competition and innovation. Billionaires providing upfront investments has stimulated the space market and made space more accessible – and profitable.

#### Space innovation is key to colonizing outer space- scientific discovery promotes breakthroughs that benefit society

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Every once in a while, a confluence of discoveries, events and initiatives results in a breakthrough so significant that it propels the entire world to a higher level, redefining what is possible in so many different fields. This breakthrough is taking centerstage now, as the new era of space exploration — catalyzed by increasing launch access — dawns upon us. The surge of innovation that comes with this will create new opportunities and inspire the next generation of doers. When this happens, boundaries between scientific and social impact are blurred. Innovation leading to scientific discovery can benefit society in the same way that social innovation can diversify and support scientific innovators, who can contribute to global progress. To ride this wave of progress, we must all participate and innovate in the new era of space exploration. The intersection of space exploration, innovation and impact isn’t a new phenomenon. In the past, technology developments and spin-offs from space research have consistently found their way into communities worldwide sometimes with lifesaving benefits. The International Space Station supports experiments that have led to discoveries and inventions in communication, water purification, and remote guidance for health procedures and robotic surgeries. Satellite-enabled Earth observation capabilities that monitor natural disasters, climate and crops often support early warnings for threats and mitigation strategies. Space exploration has always been relevant to everyone no matter the discipline or interest. Commercialization of space has been key in many ways to the current boost in “firsts” over the last few years. It has spurred innovation in launch vehicles and related technologies that led to firsts in vertical-takeoff-vertical landing rocket technology, reusability of rocket boosters and privately developed crewed missions to orbit. Concurrently, NASA has continued to captivate our imagination with the first flight of a helicopter in another world, a mission to return an asteroid sample to Earth and sending a probe to make the closest ever approach to the sun. While we celebrate the scientific progress, there is a vastly important question that we all need to focus on: How can we drive the surge in innovation offered by increased access to space, to benefit humankind? Access to low-Earth orbit, and eventually human exploration of space, is a portal to achieve many impactful outcomes. The numbers and completion rate of microgravity experiments conducted by scientists will be greatly increased as a range of offerings in suborbital flights provide more opportunities to advance critical research in health, agriculture, energy, and more. Lunar, planetary, and even asteroid exploration may lead to discoveries of new materials — busting the limitations now imposed on capabilities for energy, transportation, and infrastructure or creating new sensors and devices that enhance safety on Earth. Space tourism —one can hope — has the power to potentially create an awareness of our oneness that may lead to social change. But much like all scientific endeavors, we cannot ignore the importance of pre-emptively identifying and mitigating negative impacts of new ventures some of which may have already taken shape. We need to consider space debris that threatens the very access that facilitates it, safety and rescue readiness to support increased crewed missions and space tourism, national security, and effects of light pollution on astronomy. Much of these can be approached and mitigated with new concepts and ideas that have already been set in motion. One thing is for certain, space has always been the inspiration for the next generation of innovators and creative thinkers. Architects of new ideas in this era will inspire many more. Ingenuity must also come from academic and research institutions building a new space-ready generation through innovative curriculum, scholarships, and research opportunities for key fields at all levels. Most of all, engaging participation is a responsibility anyone can take by steering the conversation and gathering ideas on how we can make this era one of positive benefit for all, while making opportunities inclusive to all.

#### Not colonizing space directly links to human and extraterrestrial extinction scenarios, which outweigh

Munevar, PhD, 19 [Gonzalo Munevar, Professor Emeritus at Lawrence Technological University, PhD Philosophy @ UC Berkeley. "An obligation to colonize outer space", Futures, Vol. 110, Pg. 38-40, published June 2019, accessed 11-1-2021, https://www.sciencedirect.com/science/article/abs/pii/S0016328718302660#!] HWIC

We have an obligation to colonize outer space. This colonization may include establishing bases on the Moon, Mars, and other bodies in the solar system, perhaps leading to terraforming some of them, as well as building the sorts of space colonies championed by Gerard O’Neill.1 By doing so we may save humanity from collisions with asteroids and other cosmic catastrophes, while also bringing clean energy to Earth and giving us access to the resources of the solar system. Carrying out such tasks will, moreover, increase our scientific knowledge of heaven and Earth. A collision with a large asteroid may bring human life on Earth to an end. Space colonization would allow human life to continue. Smaller, and far more likely, collisions will cause great destruction and kill millions of people. Furthermore, a heavy human presence throughout the solar system would make it possible, even highly probable, that many such collisions may be prevented, thus saving billions of humans, and many other living beings, from a horrible death. And whether we are able to avert such a catastrophes, the sun will become a red giant in four or five billion years; but even long before then, it will make the Earth an unbearable planet. In the long run, thus, space colonization will give terrestrial life another chance. Space colonization will give us many opportunities to improve the Earth itself, for example by moving polluting industries into space, providing clean solar power from space at reasonable prices, and making available to our home planet many of the resources of the asteroids and other bodies in the solar system. Doing so will enable us to increase our knowledge of the universe, and particularly of planetary science, which would then permit a wiser approach to our own planet. The word limit narrows my scope, and thus I will concentrate on the likelihood of collisions with comets and asteroids. Gravitational disturbances of the asteroid belt, the Kuiper Belt (a little beyond Pluto) or of the Oort cloud, in the outskirts of the solar system, send many large bodies towards the sun.2 Some of them collide with the planets and moons of the solar system. Consider that there are trillions of objects larger than 1 km and billions larger than 20 km in the Oort cloud alone. Given its position, and its gravitation, the Earth becomes a target for collisions. Even in recent geologic times (within the last 100 million years) large meteors indeed have collided with the Earth, altered the weather catastrophically and brought extinction to the majority of species then living. One asteroid about 10 km in diameter, now called the Alvarez asteroid, is held responsible for the disappearance of the dinosaurs about 65 million years ago,3 although some think a comet may have been the culprit.4 And in 1994, large fragments of Comet Shoemaker-Levy 9 hit the atmosphere of Jupiter at velocities over 200,000 km per hour, exploding with a brightness as much as fifty times that of the entire planet, and ejecting searing materials thousands of kilometers above the clouds. Had Shoemaker-Levy 9 hit the Earth instead, we would have gone the way of the dinosaurs.5 Apart from the realization that our natural history has to make conceptual room for such catastrophes,6 there is a most obvious practical issue of survival involved. With a reliable tracking system in place, space technology might allow us to change the orbits of those comets or asteroids most in danger of colliding with the Earth. But how worried should we be? According to present models, meteors large enough to create Meteor Crater in Arizona would hit an urban area every 100,000 years on average. That meteor was presumably 60 m across; the crater is 1.2 km across. A body with a diameter of 250 m would cause a crater 5 km across and destroy some 10,000 square Kilometers (about the area of greater Los Angeles). And global catastrophes would take place every 300,000 years. These would be caused by meteors with a diameter of approximately 1.7 km.7 What is the evidence for these calculations? Soon after impact on Earth, craters are attacked by wind, water, life, lava and a myriad of tectonic motions. In the blink of an eye, geologically speaking, all obvious traces of them disappear from the surface of our active planet. But we find a good record on the Moon. And in Venus, where most of the surface is 600 million years old, the spacecraft Magellan counted nearly one thousand impact craters at least twice the diameter of Meteor Crater. Venus is almost the same size as Earth, and in the Earth’s vicinity, and since the impacts are geologically recent, the Venusian impact record makes it reasonable to fear catastrophic impact on Earth every half a million years or so.8 Still greater collisions, with bodies of 5 km across, would happen, on the average every 20 million years.9 Apart from the asteroid that led to the extinction of the dinosaurs and the majority of species on Earth 65 million years ago, there have been at least two more impacts by asteroids 10 km or larger in the last 300 million years.10 New worries have been caused by the discovery of “rogue planets,” i.e. planets that were expelled from their solar systems and boulder their way through interstellar space. Some will be rocky like the Earth and some will resemble Jupiter, even much larger, carrying their large moons with them. Were one of them to come into our solar system, it would disrupt the orbits of our planets, perhaps sending the Earth itself into interstellar space. A collision would pulverize both bodies. Some scientists think that there are far more rogue planets than stars in the Milky Way, whereas the lowest estimate of Jupiter-size rogue planets is that of one per every four stars.11 Whether those of us living today will experience such catastrophes, eventually our descendants will be thankful to us for creating a warning system and the technology to prevent disaster.12 There can hardly be a better reason than the preservation of life, and perhaps the survival of the species, to establish the importance of colonizing space. An expansion of human colonies throughout the solar system would make it far easier to reach, say, an asteroid in a collision path with the Earth, when it is still very far away, and thus when the angle is small and the necessary alteration of its path will be relatively minor. Such deflection can be accomplished by several means: astronauts could make a smaller asteroid collide with the larger one, or use one of the mass drivers designed by O’Neill. Nuclear explosions might work also. If we are established in outer space. To do a proper mission starting from Earth may take many years, thus making it far less likely to succeed. Robotic deep-space missile platforms, which can never achieve human flexibility, let alone human ingenuity, are unlikely solutions, as can be gathered from previous discussion on robotic missions.13

## Space Weaponization DA

They said $$ at all costs

#### Non-state actors in space are conflict dampeners – they avoid geopolitical tension and have financial incentives to keep conflict low

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In the terms of privatization and space security, space remains relatively untapped, but commercial and military benefits from space exploration/exploitation could even lead to ‘privatization of space’. Such privatization will result from growing pressure on spacefaring countries to defect from cooperation, since is less viable with good number of multiple actors who entered the space.36 However, space policy and space research are characterized by very high costs, which are rather impossible to bear by private companies, limited by economic calculation. As pointed out earlier, under-investment in technological development by private companies it is related to the fact that these actors are not focused on profits of a social nature, such as improving the quality of life of the recipient of the product.37 This makes some technology, potentially beneficial to society, not developed or introduced into use, because the profit margin is too small to make this viable for commercial players. To conclude, privatization of space security can develop in unexpected ways, but in today’s space environment private actors would rather play the role of security regulators than security providers. When investment in space technologies is less profitable than other areas of economy, private actors would focus on soft law and conflict prevention in space, and new private initiatives will appear. For example, apart from important space companies, as SpaceX or Blue Origin active in outer space, other private actors as Secure World Foundation (SWF), who focus on space sustainability, will play more important role in crafting international guidelines for space activities.38 This path the way for future solutions and projects, as cleaning the space debris, extracting resources from asteroids and planetoids, refuelling satellites, providing payload capabilities for governmental entities on market-based logic, will be based on activity non-state actors, providing soft law and regulatory solutions, where space faring states are unable to find any compromise. Therefore private companies will be in fact global (or space) regulators, as part of UNCOPUS, being involved in space activities.39 The last argument for private involvement in space security comes from an approach based on common good and resilience of space assets, emphasized by the Project Ploughshares, as an important part of space security. As of 2017 there are more than 700,000 man-made objects on the Earth’s orbit bigger than 1 cm, while 17,000 of them are bigger than 10 cm.40 Some of them are traced by SSA systems, both American and European, but these systems are public-military owned, and private operators are not granted any access to this data. Any collision of space object with space debris, even with small particles, might result in a chain reaction, called Kessler’s syndrome, and not only private but public, and military assets will be destroyed or impaired. In such conditions, a reluctant cooperation between the public and private sector, and unwillingness to share vulnerable data by public actors seem to confirm that private space activity is more than necessary. This is an apparent case when logic of mistrust between state powers must be overcome by private actors, perhaps by suggesting common preferences for debris mitigation, and space situational awareness. In the case of space debris, Space Data Association, an initiative supported by private sector, with its main aim to enhance data sharing between commercial satellite operators, could be an example of nascent public good provided by private actors for the sake of global security.

#### Space weaponization and arms racing ensure space war goes nuclear – only strong private competition can check conflict

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Abstract. The military use of space, including in support of nuclear weapons infrastructure, has greatly increased over the past 30 years. In the current era, **rising geopolitical tensions between** the United States and Russia and China **have led to assumptions** in all three major space powers **that warfighting in space now is inevitable, and possible because of rapid technological advancements**. New capabilities for disrupting and destroying satellites include radio-frequency jamming, the use of lasers, maneuverable space objects and more capable direct-ascent anti-satellite weapons. **This situation, however, threatens international security and stability among nuclear powers. There is a continuing and necessary role for diplomacy, especially the establishment of normative rules of behavior, to reduce risks of misperceptions and crisis escalation, including** up to the **use of nuclear weapons**. U**.S. policy and strategy should seek a balance between traditional military approaches to protecting its space assets and diplomatic tools to create a more secure space environment.** I. INTRODUCTION Outer space is recognized by all nations as “the province of mankind” not subject to national boundaries or appropriation via both treaty – especially the 1967 Outer Space Treaty1 – and by the practice of nation states. Since the dawn of the space age, the use of satellites has become integral to the global economy, including providing communications, weather services, mapping, precision timing and navigation services for shipping, secure crossborder banking, and Internet connectivity. Every state has both an interest in making use of space, and reason to deal with its use by other states, because **the activities in space by one actor have the potential to impact all others**, for good or for bad. In addressing international and national security, and nuclear security in particular, the space environment has played a role of great importance from almost the beginning of the nuclear age. The first satellites launched by the Soviet Union and the United States were oriented toward seeking information on what was transpiring in areas controlled by the other, and to verify bilateral arms control agreements. While in short order space systems also were integrated to the offensive uses of long-range delivery systems by providing photographic information about potential targets, strategic space systems were during the Cold War widely viewed as stabilizing the Superpower nuclear competition. The use of space for military purposes has continued into the present era, with increasing capabilities to take advantage of large segments of the electromagnetic spectrum for acquiring intelligence, communicating globally, and generally supporting ways of using nuclear weapons both for deterrence, and, should deterrence fail, use of those weapons against an adversary. Most of the nuclear weapon possessing states operate satellites for these purposes. Perhaps as importantly, space systems over the last two decades have become integral to the tactical warfighting ability of many modern states – a situation that has complicated the status of space systems as strategically stabilizing. Indeed, the growing use of space by many countries to achieve victory on the battlefield has increased both the vulnerability of militaries to attacks on their space systems and has, at the same time, increased their value as potential targets in a war. Over the past 50 years, the Soviet Union, the United States, and China have carried out experiments in or aimed at the outer space environment – mostly the area close to the atmosphere in Low Earth Orbit (LEO) – that show the capability to destroy a satellite, or to disrupt its functions. The specter of space warfare for many years has, among other negative consequences, raised concerns that a state’s nuclear retaliatory capability could be compromised. This concern also applies more generally, of course, to an ability to disrupt communications functions for other military, or civilian, purposes. In the 1980s, there was a period when the United States, and perhaps others, explored whether systems based in space could be used to destroy an adversary’s intercontinental ballistic missiles, or their payloads. The so-called Star Wars program under the Reagan Administration envisioned the deployment of a system of satellites that would seek to destroy the missiles/warheads launched at the United States. One technology explored envisioned detonating a nuclear explosive to generate a beam of x-rays that would put out of commission the adversary’s warhead. Thus far, such technologies have not succeeded in playing a role in the nuclear-weapon situation globally. However, the U.S. descendant of the Star Wars program – currently limited to conventionally equipped, ground- and sea-based missile defense interceptors with limited capability against a full-blown nuclear attack – continues to stress nuclear deterrence and stability between the United States and Russia, as well as China, which maintains a much smaller nuclear arsenal than the Cold War adversaries. However, recent missile experiments by China have demonstrated the vulnerability of the geosynchronous equatorial orbit (GEO), where many hundreds of satellites are “parked” carrying out communications and other functions, including nuclear weapons support systems and spy satellites. II. INCREASED THREATS INVOLVING OUTER SPACE Since the first satellites were launched in the 1950s by the Soviet Union and then the United States, the Russian Federation, the United States, China, India, Japan, and other states have, without much coordination, launched so many satellites into space into various orbits and at various altitudes that there is currently a strong risk of both congestion and competition. There is no global regime for regulating outer space activities. The Outer Space Treaty of 1967, to which all the launching states, and most others, are party2 mandates that outer space be used solely for peaceful purposes, and prohibits the stationing of nuclear or other weapons of mass destruction in that environment. (The Treaty does not prohibit the transit of nuclear weapons, e.g. as a payload on a submarine-launched ballistic missile, through outer space; furthermore under common law practice, defensive military activities are tolerated as compliant with “peaceful purposes.”) The Outer Space Treaty, however, makes it clear that states are responsible for their own space activities, and compliance with international law. And while there are a number of other spacerelated treaties, UN principles and voluntary agreements managed by various UN and multilateral bodies, a nation’s activities in space are largely regulated by that nation alone. There is no international legal requirement for any one state to coordinate its satellite launches or maneuvers with others. Environmental Threats: Crowding and Debris Some 1,500 operational satellites are now in orbit, owned by more than 80 states or other entities. These states and entities have varying levels both of proficiency and of knowledge of the established laws and rules affecting space. In the radio frequency band of the electromagnetic spectrum, interference is rising, especially in the GEO regime. Some of this interference is deliberate, undertaken for political purposes, despite the fact that deliberate interference is one of the few legally binding restraints in the international space arena3 . The evolution in satellite technology has led to the wider use of smaller satellites, including so-called “Cubesats,” that can be deployed in constellations, especially in LEO. The number of operational satellites is expected to rise to many thousands within the decade. LEO, in particular, is becoming incredibly crowded with satellites, making tracking of on-orbit objects extremely difficult. Furthermore, many small satellites have no ability to maneuver to avoid collisions with other satellites and space debris. The half-century of using space has resulted, from the breakup of satellites and other activities, in a considerable amount of on-orbit debris – including satellites no longer in use, parts of satellites that have broken up, launcher stages, nuts and bolts, and debris from the deliberate destruction of satellites. The United States and others track some 23,000 orbiting pieces with a diameter of greater than 10 cm. This debris is especially dangerous if a satellite or transiting vehicle collides with a piece, since the closing velocity of such a collision on-orbit is very high – some 7.5 kilometers per second (faster than a bullet) in LEO. Worse yet, even very small debris, most of which cannot be detected much less tracked, can destroy an operational satellite; it is estimated that some 500,000 to one million pieces of debris smaller than 10 centimeters exist on orbit. **It is widely agreed that new international measures to better coordinate space activities are required to ensure that the space environment is sustained**. In 2007, the United Nations Committee for the Peaceful Uses of Outer Space (COPUOS) in Vienna, Austria, agreed on a set of guidelines for the mitigation of space debris, which are slowly being implemented by many space-faring states. It may be that such measures will eventually require removal of debris from orbit, as the decay of debris from space into the atmosphere where it burns up (or falls on Earth) is a very long-term prospect, taking as much as 25 years in LEO. Sadly, the lifetime of debris in GEO, like diamonds, is practically forever. COPUOS currently is working on a set of recommended best practices to ensure the “long-term sustainability of space.” COPUOS has a 2018 deadline to finish this work; however, there is already discussion of follow-on effort that may include international guidelines for debris removal. Increasing Military Tensions in Space In the geopolitical sphere, compared with the period following the breakup of the Soviet Union, the current decade is witnessing increased tensions between the United States and Russia, and between the United States and China. The geopolitical situation in space has been further eroded by the proliferation of experimentation with and/or deployment of dual-use technologies with “counterspace,” i.e. satellite attack, capabilities. As noted above, China, Russia and the United States all have tested (or in some cases deployed) such technologies in both LEO and GEO. The United States continues to have an advantage in military space capabilities, but its edge is eroding as China and Russia dedicate more resources. Most technologies involved in sustaining systems in orbit are dual-use, but certain specific activities are raising suspicions about potential intended weapons use. The capability to maneuver satellites is particularly relevant. Russia placed a satellite called Luch/Olymp in GEO that maneuvered or drifted over a considerable range, and at several points in 2015 came extremely close to commercial satellites owned by Intelsat.4 Intelsat called the move “irresponsible,” but their request for information from Russia went unanswered. The maneuvers further prompted concern at the U.S. Defense Department about the satellite’s mission, which has not been revealed by Moscow. The United States also has carried out programs in GEO that could have potential weapons capabilities. For example, the PAN, an acronym for Palladium at Night, is a classified program apparently dealing with communications platforms, and perhaps providing other capabilities.5 The Geosynchronous Space Situational Awareness Program (GSSAP) is a U.S. military satellite constellation that also maneuvers in orbit, designed, according to the Pentagon, with the objective of inspecting other satellites orbiting in GEO. Such activities are known as Rendezvous and Proximity Operations (RPO), and have a number of benign applications such as satellite refueling, inspection and repair. Russia is carrying out other such experiments in LEO, as are China, the United States, Japan and Sweden. The commercial applications of maneuvering satellites are also increasing. Among the number of more directly identifiable counterspace technologies now available, the most widespread are ground-based radio-frequency jammers, which can be used to disrupt satellite communications and operations. In addition, there are efforts to develop lasers for disrupting or degrading systems based in space. Russia, China and the United States have also carried out projects involving terrestrially based missiles carrying anti-satellite payloads. The United States as early as the 1980s launched missiles from an F-15 fighter jet with this objective. A 2007 Chinese test, involving the destruction of a non-functional Chinese weather satellite in LEO, released a considerable quantity of debris. The United States subsequently launched a missile from an Aegis cruiser that was advertised to have the objective of destroying a satellite in a decaying orbit, but this did not prevent speculation that the mission also had the objective of demonstrating a similar capability to that of China. Over decades, the U.S. missile defense program has also heavily relied on the space environment, for early warning, for communications, and as a place for engaging and destroying hostile systems. Noted above is the Reagan Administration’s “Star Wars” program, pursued with the idea of creating a “shield” against intercontinental ballistic missiles. **The harder-line rhetoric that has been employed in recent years also has had an inevitable impact of raising tensions**. The United States has pivoted from an approach of “strategic restraint” to one emphasizing “warfighting.”6 In particular, the budgets for providing resiliency in space systems and counterspace capabilities have been increasing. At the same time, Russian accusations that U.S. activities have a hostile objective, and its responses to U.S. representations, have become shriller. Russia has called the anti-ballistic missile system SM-3 2A an anti-satellite weapon, while touting its own objectives for acquiring anti-satellite capabilities. In 2013, China tested a missile, the Dong Ning-2, which appears capable of reaching satellites in GEO. Chinese military space activities lack transparency, but it seems clear that such activities include the objective of being able to exercise counterspace actions. Most troubling, there has been a lack of serious dialogue among these Big Three states. Multilateral Efforts to Reduce Risks For many years, a direct approach to concerns about the potential for weaponizing space (space has been militarized since the dawn of the space age, but so far cannot be said to have been weaponized) has been debated within the United Nations, as well as at the Conference on Disarmament in Geneva. The Russian-Chinese cosponsored initiative, on the Prevention of an Arms Race in Outer Space, has been on the agenda of the Conference on Disarmament since 1985, and under that agenda item Moscow and Beijing have proposed a treaty to ban weapons in space.7 However, the Conference has been all but immobilized by wider disagreements since that time; and the United States remains firmly opposed to the proposed treaty. There have been a number of efforts to set norms of behavior in space in order to guard against misunderstanding and conflict in space. Most recently, the 2013 UN Group of Governmental Experts (GGE) on Transparency and Confidence-Building Measures in Outer Space Activities released a set of recommended initiatives for states to implement, including improved communications about objects in orbit.8 Unfortunately, little work has been done since to implement the recommendations, either at the multilateral level or by individual states. However, the United States, Russia and China have recommended that the UN Disarmament Commission, based in New York, and the deliberative body on arms control issues, take up the question of implementation of the GGE recommendations. While the initial proposal has been received favorably, a decision regarding whether to put the issue on the Commission’s formal agenda will not be made until Fall. III. POLICY QUESTIONS FOR THE UNITED STATES In view of the increased uncertainties affecting the use of outer space, particularly in the area of international security, the United States needs to address several issues with some urgency. First, what is the appropriate mix of resiliency measures to apply in the coming years? A subsidiary question in this regard is what is an appropriate role for commercial providers? And should the U.S. military switch to constellations of small satellites for some national security missions? The budgetary implications of achieving objectives, and establishing appropriate requirements, are important components of pursuing this mix. And there is the inevitable bureaucratic overlap between the Department of Defense and the Intelligence Community. Such “turf” issues require constant attention lest they adversely impact on the fulfillment of national, vice institutional, objectives. Lengthy acquisition programs put systems at risk of becoming obsolescent earlier than they would otherwise become outdated. As part of this latter issue, the United States will need to consider what reforms are needed in the acquisition process, and related organizational arrangements. The integration of Department of Defense and Intelligence Community programs and activities is inevitably a delicate matter; it will require especial focus from the White House, in particular as resiliency is now being embedded into the requirements for acquisition of new systems. A more far reaching issue is how best to strike a balance between the defensive aspects of counterspace and the offensive aspects. And integral to addressing this balance is the impact of U.S. options to respond to hostile space activities on the stability of the strategic/nuclear relationships: U.S.-Russia, U.S.-China, and a large number of other such relationships involving the nuclear-weapon-possessing states. If “arms racing” resumes, or, in the case of India and Pakistan, continues, how will the use of space, specifically for counterspace activities, impact on these races, and vice-versa? Will there be a deterioration in nuclear deterrence? Will an offensive strategy involving the targeting of an adversary’s nuclear-related satellites emerge? These are questions that beg answers in the near-term, as budgetary and policy decisions are being made. **It is also important to consider the role of diplomacy in dealing with international security for outer space.** Diplomacy, in the form of both self-restraint and in reassurance of potential adversaries regarding intentions, has been a part of the tool kit for managing competition in space from the beginning of the space age. Can effective “rules of the road” be further developed? The limited success, but slow pace, of multilateral efforts should not be seen as failure, however. Diplomacy is a difficult business, often characterized by a “one step forward, one step back” dynamic. There is some optimism to be found in the ongoing COPUOS effort, which while a slightly sideways approach, will have positive impacts on international security if successful. While the Disarmament Commission has little power, the advent of discussions there would provide a much needed multilateral forum for addressing the security issues for space given the decades-long impasse at the Conference on Disarmament. Finally, **one should not overlook the value of bilateral diplomacy, particularly among the Big Three space powers. Further work will also be needed to regulate the proliferation of technologies in the commercial sector**. This will likely involve export control, and measures for the management of “traffic” in space (STM). However, care must be given to weigh national security concerns against the needs of commercial industry to thrive in the international marketplace. There is a tendency in the national security community to try to “close the barn door after the horses have escaped” that must not be indulged in the space domain, given the reliance of the national security sector on commercial capabilities and technological innovation. IV. THE NEED FOR A “TIME OUT” To date, no state is deploying dedicated anti-satellite weapons. Testing of capabilities does not a program make. That said, the trend lines are currently negative and require both time and analysis to mitigate. It would be irresponsible for the United States, or any other country, to leap to conclusions about the “inevitability” of all-out war in space. A balanced strategy, which combines resiliency, deterrence, and diplomacy **will be required to** protect national security and **ensure international security**. While development of some anti-satellite capabilities for potential future use may be wise, a run-away space arms race is not desirable for any party. It may be that a viable modus vivendi could be a situation of “implied deterrence:” i.e., the development of dual-use technologies with inherent weapons capabilities in a transparent manner so as to provide the knowledge to others that, if pushed, antisatellite weapons could be deployed. And despite the difficulties to date, **the prospect of the multilateral establishment of norms shows some possibility of promise.** This involves the implementation of recommendations by the Group of Governmental Experts discussed above; of the COPUOS LTS (long-term sustainability) best practices work making progress by 2018; the successful efforts to codify the legal regime that are underway (e.g., those at McGill University in Montreal), and perhaps the UN Disarmament Commission addressing TCBMs in 2018. These efforts must be given a chance to ripen, however much frustration is involved in the processes. It can perhaps be helpful to think of the world as being surrounded on all sides by a large fishbowl, of indefinite dimensions in the outward direction, with the atmosphere at the intersection between “outer” space and the land and waters below. Looked at in this way, human activities in outer space have little room to be confined to a single state: the world as a whole is impacted by those activities. Accordingly, when dealing with outer space, traditional concepts of absolute roles for state sovereignty must inevitably be modified to serve the objectives of global peace, security and stability. Whether this reality will at some point lead to an appreciation that reliance on force, nuclear weapons in particular, cannot play the role in space that it does on the Earth, remains to be seen.