# Aff

#### I affirm the resolution “The appropriation of outer space by private entities is unjust”

#### My value is life

#### Death is the worse possible thing since it erases our very existence

Paterson 03, Craig [Department of Philosophy, Providence College, Rhode Island] 2003, “A Life Not Worth Living?”, Studies in Christian Ethics Contrary to those accounts, I would argue that it is **death** per se that **is** really **the objective evil** for us, not because it deprives us of a prospective future of overall good judged better than the alter- native of non-being. It cannot be about harm to a former person who has ceased to exist, for no person actually suffers from the sub-sequent non-participation. Rather, death in itself is an evil to us because **it ontologically destroys the** current existent **subject** — it is the ultimate in metaphysical lightning strikes.80 The evil of death is truly an ontological evil borne by the person who already exists, independently of calculations about better or worse possible lives. Such an evil need not be consciously experienced in order to be an evil for the kind of being a human person is. Death is an evil because of the change in kind it brings about, a change that is destructive of the type of entity that we essentially are. **Anything**, whether caused naturally or caused by human intervention (intentional or unintentional) **that** drastically **interferes in the process of maintaining** the person in **existence is an objective evil** for the person. What is crucially at stake here, and is dialectically supportive of the self-evidency of the basic good of human life, is that death is a radical interference with the current life process of the kind of being that we are. In consequence, **death** itself **can be** credibly **thought of as a ‘primitive evil’ for all persons**, regardless of the extent to which they are currently or prospectively capable of participating in a full array of the goods of life.81  In conclusion, concerning willed human actions, it is justifiable to state that any intentional **rejection of human life** itself **cannot** therefore **be warranted since it is** an expression of an **ultimate disvalue** for the subject, namely, the destruction of the present person; a radical ontological good that we cannot begin to weigh objectively against the travails of life in a rational manner. To deal with the sources of disvalue (pain, suffering, etc.) we should not seek to irrationally destroy the person, the very source and condition of all human possibility.82

#### My value criterion is maximizing lives

#### Requires the prevention of extinction which is a pre-req to all other frameworks.

GPP 17 Global Priorities Project, [Future of Humanity Institute at the University of Oxford, Ministry for Foreign Affairs of Finland] 2017, “Existential Risk: Diplomacy and Governance,” Global Priorities Project, <https://www.fhi.ox.ac.uk/wp-content/uploads/Existential-Risks-2017-01-23.pdf>

1.2. THE ETHICS OF EXISTENTIAL RISK In his book Reasons and Persons, Oxford philosopher Derek Parfit advanced an influential argument about the importance of avoiding extinction: I believe that if we destroy mankind, as we now can, this outcome will be much worse than most people think. Compare three outcomes: (1) Peace. (2) A nuclear war that kills 99% of the world’s existing population. (3) A nuclear war that kills 100%. (2) would be worse than (1), and (3) would be worse than (2). Which is the greater of these two differences? Most people believe that the greater difference is between (1) and (2). I believe that the difference between (2) and (3) is very much greater. ... The Earth will remain habitable for at least another billion years. **Civilization began only a few thousand years ago. If we do not destroy mankind, these** few thousand **years may be only a tiny fraction of the whole of** civilized **human history**. The difference between (2) and (3) may thus be the difference between this tiny fraction and all of the rest of this history. If we compare this possible history to a day, what has occurred so far is only a fraction of a second.65 In this argument, it seems that Parfit is assuming that the survivors of a nuclear war that kills 99% of the population would eventually be able to recover civilisation without long-term effect. As we have seen, this may not be a safe assumption – but for the purposes of this thought experiment, the point stands. **What makes** existential catastrophes especially bad is that they would “destroy the future,” as another Oxford philosopher, Nick Bostrom, puts it.66 **This future could potentially be extremely long and full of flourishing, and would therefore have** extremely large value. In standard risk analysis, when working out how to respond to risk, we work out the expected value of risk reduction, by weighing the probability that an action will prevent an adverse event against the severity of the event. **Because the value of preventing existential catastrophe is so vast, even a tiny probability of prevention has huge** expected **value**.67 Of course, there is persisting reasonable disagreement about ethics and there are a number of ways one might resist this conclusion.68 Therefore, it would be unjustified to be overconfident in Parfit and Bostrom’s argument. In some areas, government policy does give significant weight to future generations. For example, in assessing the risks of nuclear waste storage, governments have considered timeframes of thousands, hundreds of thousands, and even a million years.69 Justifications for this policy usually appeal to principles of intergenerational equity according to which future generations ought to get as much protection as current generations.70 Similarly, widely accepted norms of sustainable development require development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs.71 However, when it comes to existential risk, it would seem that we fail to live up to principles of intergenerational equity. Existential catastrophe would not only give future generations less than the current generations; it would give them nothing. Indeed, reducing existential risk plausibly has a quite low cost for us in comparison with the huge expected value it has for future generations. In spite of this, relatively little is done to reduce existential risk. Unless we give up on norms of intergenerational equity, they give us a strong case for significantly increasing our efforts to reduce existential risks. 1.3. WHY EXISTENTIAL RISKS MAY BE SYSTEMATICALLY UNDERINVESTED IN, AND THE ROLE OF THE INTERNATIONAL COMMUNITY In spite of the importance of existential risk reduction, it probably receives less attention than is warranted. As a result, concerted international cooperation is required if we are to receive adequate protection from existential risks. 1.3.1. Why existential risks are likely to be underinvested in There are several reasons why existential risk reduction is likely to be underinvested in. Firstly, it is a global public good. Economic theory predicts that such goods tend to be underprovided. The benefits of existential risk reduction are widely and indivisibly dispersed around the globe from the countries responsible for taking action. Consequently, a country which reduces existential risk gains only a small portion of the benefits but bears the full brunt of the costs. Countries thus have strong incentives to free ride, receiving the benefits of risk reduction without contributing. As a result, too few do what is in the common interest. Secondly, as already suggested above, existential risk reduction is an intergenerational public good: most of the benefits are enjoyed by future generations who have no say in the political process. For these goods, the problem is temporal free riding: the current generation enjoys the benefits of inaction while future generations bear the costs. Thirdly, many existential risks, such as machine superintelligence, engineered pandemics, and solar geoengineering, pose an unprecedented and uncertain future threat. Consequently, it is hard to develop a satisfactory governance regime for them: there are few existing governance instruments which can be applied to these risks, and it is unclear what shape new instruments should take. In this way, our position with regard to these emerging risks is comparable to the one we faced when nuclear weapons first became available. Cognitive biases also lead people to underestimate existential risks. **Since there have not been any catastrophes of this magnitude, these risks are not salient to** politicians and **the public**.72 This is an example of the misapplication of the availability heuristic, a mental shortcut which assumes that something is important only if it can be readily recalled. **Another cognitive bias affecting perceptions of existential risk is scope neglect**. In a seminal 1992 study, three groups were asked how much they would be willing to pay to save 2,000, 20,000 or 200,000 birds from drowning in uncovered oil ponds. The groups answered $80, $78, and $88, respectively.73 In this case, the size of the benefits had little effect on the scale of the preferred response. **People become numbed to the effect of saving lives when the numbers get too large**.74 Scope neglect is a particularly acute problem for existential risk because the numbers at stake are so large. Due to scope neglect, **decision-makers are prone to treat existential risks in a similar way to problems which are less severe by many orders of magnitude.** A wide range of other cognitive biases are likely to affect the evaluation of existential risks.75

## Contention One: Russia

#### Tensions between US and Russia high – potential invasion of Ukraine and spillover

DeYoung et al. 2/5 DeYoung, Karen. "Russia Could Seize Kyiv In Days And Cause 50,000 Civilian Casualties In Ukraine, U.S. Assessments Find". The Washington Post, 2022, https://www.washingtonpost.com/world/2022/02/05/ukraine-russia-nato-putin-germany/.

Russia is close to completing preparations for what appears to be a large-scale invasion of Ukraine that could leave up to 50,000 civilians killed or wounded, decapitate the government in Kyiv within two days, and launch a humanitarian crisis with up to 5 million refugees fleeing the resulting chaos, according to updated U.S. military and intelligence assessments briefed to lawmakers and European partners over the past several days. The rising concerns come as the Russian military continues to dispatch combat units to the Ukrainian border in both its own territory and Belarus. As of Friday, seven people familiar with the assessments said, there were 83 Russian battalion tactical groups, with about 750 troops each, arrayed for a possible assault. That is up from 60 two weeks ago, and comprises about 70 percent of what Russian President Vladimir Putin needs to have in place if he wants to maximize the operation. Those more than 62,000 troops are backed by tens of thousands of additional personnel to provide logistics, air power and medical support. U.S. officials have said the Russian presence along Ukraine’s borders totals more than 100,000; one Western security official put the number at 130,000. Russia has long bristled over Ukrainian independence. Ukraine was part of the now-defunct Soviet Union, and parts of its territory for centuries were ruled by Russia. Ukraine also aspires to NATO membership, which Putin adamantly rejects. Key military enablers, including bridge-building units, have continued to arrive on the border, and more battalion tactical groups are now in transit, with only a few in far-flung locations, such as the Arctic, remaining at their home bases. As a result, U.S. officials initially skeptical last fall that a large-scale invasion would be launched appear now to have shifted their thinking as the buildup continues, a congressional aide said. The assessments, the people familiar with them confirmed, also judged that the window for a diplomatic resolution of the crisis appears to be closing. Even as a steady stream of European leaders have been in contact with Putin, further meetings have been scheduled, and the Kremlin has repeatedly denied any invasion plans, the number and configuration of troop movements have continued to push the West’s consensus in the opposite direction. “Our worry would be that you don’t park battle groups … on the border of another country twice and do nothing,” one European official said, referring to an earlier buildup last year. “I think that’s the real fear that I have. [Putin’s] now put them all out there. If he does nothing again … what does that say to the wider international community about the might of Russia?” The European official and others familiar with the assessments spoke on the condition of anonymity about intelligence matters. The new assessments surfaced as Putin was reinforcing his own diplomatic support network. After a meeting Friday with Chinese President Xi Jinping at the opening of the Winter Olympics in Beijing, the two leaders issued a lengthy communique affirming their mutual grievances about the U.S.-led international order, from NATO expansion to security alliances in the Asia-Pacific region. As the United States and its allies have threatened stiff sanctions that could cripple Russia’s oil and gas exports, among other things, Moscow and Beijing agreed to new energy cooperation via a Russian gas pipeline into China. While not underplaying the significance of the Putin-Xi meeting, and the level of alignment between the two, U.S. officials said that the failure to mention Ukraine in the communique was an indication of China’s general uneasiness about military interventions and instability. A Russian invasion of Ukraine could “embarrass Beijing,” because “it suggests that China is willing to tolerate or tacitly support Russia’s efforts to coerce Ukraine,” Daniel Kritenbrink, the top U.S. diplomat for East Asia, told reporters Friday. Russian Foreign Ministry Spokesperson Maria Zakharova said that undercutting the Beijing games was one of the reasons the United States and its partners were now spreading what she said was false information. “As soon as there are talks about a country which is not part of this ‘Western circle’ hosting the Olympic Games … situations surrounding everything become tense immediately — human rights, national interests, regional conflicts and many more,” Zakharova said in a radio interview, according to Russia’s Interfax news agency. Recent U.S. allegations that Russia was considering staging and videotaping a “false flag” attack purportedly by Ukrainian forces against Russian territory or Russian-speaking people in Ukraine as a pretext for invasion drew fierce denials from Moscow. On Friday, the Russian Embassy in Washington released a transcript of an exchange between Ambassador Anatoly Antonov and Newsweek in which the diplomat said the United States was making up its own pretexts for war to be used as an “alibi” for a possible Western-backed military operation in Ukraine’s contested Donbas region, where Moscow-backed separatists have been locked in a conflict with Ukrainian government forces for eight years. “This lie is part of the information war against Russia,” Antonov said of the false flag allegation. “Washington has been provoking the whole world for several months with statements that Ukraine is about to become a victim of ‘Russian aggression.’ ” Also on Friday, the Russian Foreign Ministry attacked Western leaders such as British Prime Minister Boris Johnson for issuing such statements, saying that they “provoke acrid laughter and jokes,” and are “impossible” to take seriously, the Russian news agency Tass reported. Some Ukrainian officials, including President Volodymyr Zelensky, have taken issue with Washington’s description of Russian deployments and the likelihood of an “imminent” attack, fearing it will cause panic and hurt Ukraine’s economy. U.S. officials are increasingly concerned that a Russian invasion, at the scale they now believe is indicated, would have widespread global repercussions even if Russian troops do not move beyond Ukraine. What could become the largest military land offensive in Europe since World War II would probably pose broad challenges to the U.S.-led postwar international order of the last 75 years. As they have watched the assembling of Russian forces north of Ukraine in Belarus, as well as along the Russian border itself, the people familiar with the information said, U.S. officials believe the Kremlin may be positioning them to launch an assault of Kyiv itself by sending troops south to the Ukrainian city of Zhytomyr and moving east toward the capital, while a larger force advances westward from Russian territory. Such a move would allow the Russians to avoid the site of the Chernobyl nuclear disaster, which lies in Ukraine near the Belarus border. Satellite imagery has indicated that some Russian ground units already in the region are moving closer to the Ukrainian border. The Russian Defense Ministry said Saturday that Su-255M aircraft, the most advanced version of the jets designed to attack ground targets and low-speed airborne targets, have been deployed to Belarus to take part in ongoing “exercises.” Russia also has 20 to 30 combat ships in the Black Sea, and could launch amphibious assaults along the coast. Putin is still not believed to have made a final decision to invade or how far to go, the people familiar with the intelligence said. He could still opt for a smaller invasion along the Black Sea Coast — heading north from the Russian-annexed Ukrainian territory of Crimea — or into the Donbas. Western officials are divided on whether he would attempt a full-scale or partial invasion. One Western security official said that a full invasion intended to hold territory indefinitely would probably be challenging for Moscow. All signs are that the people of Ukraine would not accept a Russian-installed puppet government and would form a strong resistance movement, both popular and military. The size of the buildup makes it clear it’s more than a bluff, but some European officials are still not sure, a Western security official said. But the official cautioned that Putin is putting so much political and economic pressure on Ukraine, including by cutting gas transit through its territory, that the government could fall even without a full invasion. While many believe an assault could be launched any day, optimal conditions are believed to come between mid-February and the end of March, when Ukraine’s flat, open terrain and the rivers crisscrossing it are frozen and armored vehicles can maneuver easily. One possibility is that Putin may delay until after the Olympics conclude Feb. 20, in order not to upset China by overshadowing the games and threaten Chinese financial assistance in response to U.S. sanctions. While Ukraine is not part of NATO, and direct military action is not contemplated as a U.S. and allied response to an invasion, a Russian assault is sure to trigger alarm on NATO’s eastern flank, including in Poland and the Baltic states of Lithuania, Latvia and Estonia. The Pentagon announced Thursday that it would deploy about 3,000 additional U.S. troops to Europe in response to the crisis, including 1,700 to Poland. An initial wave of 300 troops from Fort Bragg arrived Saturday in Wiesbaden, Germany, to activate a new headquarters to oversee the Pentagon response to Russia’s buildup. They named it Combined Joint Task Force Dragon. The deployments mark a fraction of the 85,000 U.S. troops already in Europe, either on multiyear assignments or shorter rotational deployments. About 1,000 troops already in Germany are being sent to Romania. The new moves are meant to reassure allies and show that an expanded Russian invasion into a NATO ally would trigger a response, and the administration has not ruled out sending other troops already stationed in Europe farther east. In the event of an invasion, the United States may be forced to rapidly consider what to do about American citizens and U.S. troops who are still in Ukraine. U.S. officials said that about 7,500 American citizens there have registered with the U.S. Embassy in Kyiv, and there are probably several thousand others who have not done so. For weeks, Americans have been asked to consider leaving, and it remains unclear whether the United States would be able to run any kind of evacuation operation while a Russian invasion also is underway. But unlike Afghanistan, which necessitated an air evacuation last year, Ukraine has western land borders with four NATO countries: Poland, Slovakia, Hungary and Romania. The United States also still has about 300 U.S. troops in Ukraine, mostly military advisers from the Florida National Guard. Pentagon officials have said they could quickly be withdrawn.

#### US-Russia War – Two Warrants

#### Scenario One – Co-op

#### **Private space sector decks US-Russia cooperation**

CSIS 18 [(Center for Strategic and International Studies), “Why Human Space Exploration Matters,” August 21, 2018 https://www.csis.org/blogs/post-soviet-post/space-cooperation]

U.S.-Russian space cooperation continues to be a stated mutual goal. In April 2018, President Putin said of space, “Thank God, this field of activity is not being influenced by problems in politics. Therefore, I hope that everything will develop, since it is in the interests of everyone…This is a sphere that unites people. I hope it will continue to be this way.” During his statement at a recent event at CSIS, NASA Administrator Jim Bridenstine said, “[space] is our best opportunity to dialogue when everything else falls apart. We’ve got American astronauts and Russian cosmonauts dependent on each other on the International Space Station, which enables us to ultimately maintain that dialogue.” The U.S. and Russia both benefit from the ISS partnership. Russia provides transportation to the ISS for U.S. astronauts, from which Russia receives an average of $81 million per seat on the Soyuz (and recognition of its status as a space power). The U.S. also benefits from Russia’s technical contributions to the ISS while Russia benefits The U.S. and Russia signed a joint statement in 2017 in support of the idea of collaborating on deep space exploration, including the construction of the Lunar Orbital Platform-Gateway, a research-focused space station orbiting the moon. Through agreements on civilian space exploration, such as the Lunar Orbital Platform-Gateway or future Mars projects, that have clear benefits to both sides, some degree of cooperation will remain in both countries’ interest. The high price tag for pursuing space exploration alone and opportunities for sharing and receiving technical expertise encourages international partnerships like the ISS. However, at least three factors, apart from the overall deterioration of U.S.-Russia relations, threaten this cooperation. First, growth of the private sector space industry may alter the economic arrangement between the U.S. and Russia, and ultimately lower the benefits of cooperation to both countries. The development of advanced technologies by private companies will give NASA new options to choose from and reduce the need to depend on (and negotiate with) Russia. If NASA and its Russian counterpart, Roskosmos, have no need to talk with one another, they probably won’t in the face of tense political relations. The U.S. intends to use Boeing and SpaceX capsules for human spaceflight beginning in 2020, and a Congressional plan in 2016 set a phase out date of Russian RD-180 rocket engines by 2022.

#### US-Russia Space co-op prevents militarization of space

Posner 21 Posner, Lillian. "The U.S. And Russia Are Parting Ways In Space And That's Risky". The National Interest, 2021, <https://nationalinterest.org/feature/us-and-russia-are-parting-ways-space-and-thats-risky-184506>. Lillian Posner is a former assistant managing editor at The National Interest. She earned her Master's degree in Eurasian, Russian, & East European Studies from the Walsh School of Foreign Service at Georgetown University.

American space partisans could be forgiven for yawning at the recent announcement that the Russian and Chinese space agencies will build a [joint lunar research base](https://spacenews.com/china-russia-enter-mou-on-international-lunar-research-station/). The statement included no timeline, and everyone knows that paper plans for space projects are a dime a dozen. While the Russians and Chinese talk, NASA is busy testing rockets and selecting astronauts for its Artemis Program, which is supposed to return Americans to the Moon within the next five years. Yet [U.S. space policy](https://nationalinterest.org/feature/us-spaceflight-turns-60-why-stakes-are-higher-ever-184352) is about more than budgets and big engineering problems. It also contains a strong tradition of international cooperation, especially across geopolitical boundaries. Whether or not it comes to fruition, the Sino-Russian plan is the latest sign this tradition is in trouble. A series of new programs, agreements, and organizations indicate the United States is adopting a more unilateral space policy. In the long run, this risks fracturing the multilateral space regime. U.S.-Russia cooperation created and sustained the pillars of this regime. [The Outer Space Treaty of 1967](https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html), which, among other things, prohibits deployments of nuclear weapons in space and the construction of military facilities on the Moon, would have been a dead letter without Cold War détente. Today it is the foundation of international space law. The current International Space Station (ISS) is effectively a joint U.S.-Russia facility and American astronauts have often launched there aboard the Russian Soyuz spacecraft. This pattern of cooperation has survived severe crises in the broader relationship. Many of these agreements are now winding down. The success of NASA’s commercial crew partnership with SpaceX and Boeing means that American astronauts will increasingly fly to low Earth orbit on American spacecraft, rather than the Russian Soyuz. U.S. funding for the ISS will likely run out by 2030 and the Russians have announced that they are considering withdrawing from the ISS in 2025 to develop their own [space station](https://www.bbc.com/news/world-europe-56812294). NASA invited Russian cooperation on the new Artemis Program, but only to play a small role. It is not hard to understand why Dmitry Rogozin, the director of the Russian space program, rejected the proposal as “too U.S.-centric” and sought out a more equal partnership with China. In a clear departure from post-Cold War practice, America’s return to the Moon is now multilateral only insofar as close U.S. allies have signed on as junior partners. The Artemis Program also features a strong normative component called the “Artemis Accords,” a non-treaty agreement asserting, among other things, signatories’ right to own mineral wealth extracted from the Moon and declare “safety zones” around their space operations to prevent harmful interference by other space actors. But each rests on America’s specific interpretation of articles two and twelve of the Outer Space Treaty of 1967, which respectively ban the national appropriation of natural space objects and require all off-world facilities to be open to all visitors. Of the nine signatories, only the United States has the potential to conduct such operations. The exclusive nature of the agreement is not lost on China and Russia, which have refused to sign. Prospects for space cooperation with China are also bleak. China now has the world’s second-most capable civilian space program, but a 2011 law called the Wolf Amendment bans NASA from interacting with them absent case-by-case authorization from Congress. This was meant to prevent the transfer of sensitive technologies to China and demonstrate opposition to China’s human rights abuses in Hong Kong and Xinjiang, but it is doubtful this has meaningfully slowed their space development. Since 2011, China has launched a space station, deployed new heavy-lift rockets, and sent robotic missions to the Moon and Mars. The reality is that the United States does not need space cooperation. The current balance of space power is heavily skewed in its favor. [At $40 billion](https://spacenews.com/op-ed-global-government-space-budgets-continues-multiyear-rebound/), the combined U.S. civil and military space budget is nearly as large as the rest of the world combined. Of the 3,372 operational artificial satellites now in Earth orbit, [56 percent](https://www.ucsusa.org/resources/satellite-database) are controlled by the U.S. government or American entities. The capabilities of SpaceX alone rival those of almost every other national space program. The extent of this lead makes it tempting to opt for space unilateralism or cooperation only with a narrow set of technologically dependent allies. The Artemis Program, the 2019 formation of the Space Force, and continuing restrictions on cooperation with China all embody this unilateral style. The Sino-Russian Moon agreement hints at what the long-term costs may be. America’s “unipolar moment” has lingered on in the international distribution of space capabilities, but it will not last forever. India will become the fourth country to achieve manned spaceflight in this decade. China is likely to attempt a manned Moon landing in the 2030s. How the next space age plays out depends critically on how the United States now chooses to wield its disproportionate influence. Its current path is to submit to the mindless dictates of great-power competition, risking a harmful bifurcation of international space policy. It’s not difficult to imagine a new space race characterized by rival legal regimes, arms buildups, and orbital accidents. The United States and its allies may not keep the upper hand. Some Americans may look back at the 2020s and wonder why their country did not use its moment of space power dominance to sustain and expand the multilateral space policy regime. That regime is flawed, no doubt. It includes no explicit recognition of space property rights. It does too little to regulate space weapon systems. But this is an argument for improving the existing framework, not bypassing it. The Artemis Accords contain useful ideas for international space policy. However, these will not become widely recognized norms by American decree. The United States should not be afraid to negotiate with Russia and China over the terms of a revision to the Outer Space Treaty. Russia recently celebrated the sixtieth anniversary of Yuri Gagarin’s first manned spaceflight on April 12. Moscow used it as an opportunity used to [reemphasize](https://thediplomat.com/2021/04/fresh-calls-for-space-security-governance-measures-unlikely-to-yield-results/) its proposed draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT), which would ban conventional weapons in space. Several American commentators have [decried](https://2017-2021.state.gov/whither-arms-control-in-outer-space-space-threats-space-hypocrisy-and-the-hope-of-space-norms/index.html) this opportunity for cooperation as a [nefarious trap](https://foreignpolicy.com/2021/03/31/russia-china-space-war-treaty-demilitarization-satellites/) intended to bind the United States while doing nothing to address Chinese and Russian ground-based anti-space capabilities. The proposed Sino-Russian Moonbase has likewise been identified as part of a [larger plot](https://www.washingtonpost.com/opinions/2021/03/12/china-russias-proposed-lunar-research-station-is-an-ominous-sign-west/) to create an axis of unfriendly powers bent on undermining the West, despite Moscow’s repeated professions of appreciation for American space contributions and an open invitation to participate. The automatic rejection of policies because they were suggested by Russia or China is childish, to say the least. Moreover, the assumption that America always makes good on its international commitments and Russia and China never do is likewise unsound. The answer is not to throw cooperation to the wind, but to strive to make the language as explicit as possible. The United States need not accept Russia and China’s proposed treaties in their current form or take their professions of compliance at face value. But even an imperfect ban on the placement of conventional weapons in orbit would set a positive precedent and further U.S. interests, not least because such weapons might threaten nuclear stability on Earth. American efforts to expand the Artemis Accords suggest the outline of a deal: the United States would agree to engage in good faith with the PPWT, while China and Russia would do the same with the Artemis Accords. Neither side would get everything they want, but the results would help to reinforce the international space regime. New space norms will only emerge through honest give and take. Sticking with a zero-sum mindset will only ensure that the existing space framework continues to erode. Amid the mudslinging at the recent U.S.-China summit in Alaska, the Chinese side repeated its desire to expand space cooperation with the United States. A full repeal of the Wolf Amendment is impossible in the current climate, but NASA should cooperate with China to the greatest extent possible under current constraints. NASA recently received [Congressional approval](https://spacenews.com/nasa-exchanged-data-with-china-on-mars-orbiters/) to engage with China in order to learn about their Mars orbiter, which launched successfully last year. The American space policy community should keep the door open for the day when the political climate allows for broader space cooperation with China. The U.S. lead in international space capabilities is perhaps larger than in any other realm. During and after the Cold War it leveraged that lead to cooperation with Russia in building today’s multilateral space regime. Today, its pursuit of policies like the Artemis Program and the Space Force lays bare its desire for unilateral space dominance and undermines a decades-long relationship that has kept space cordial and safe. In the short term, the United States has little to lose by not cooperating with Russia and China, but NASA and the Pentagon should be wary of path dependence. If America plays fast and loose in space, then it can expect other space-farers to do the same.

#### Militarization of space causes nuclear war – MAD doesn’t solve

Pry 20 Pry, P., 2020. "Have Russia and China already 'Militarized' Space?. [online] realcleardefense.com. Available at: <https://www.realcleardefense.com/articles/2020/07/16/have\_russia\_and\_china\_already\_militarized\_space\_115469.html> [Accessed 6 January 2022]. Dr. Peter Vincent Pry is executive director of the Task Force on National and Homeland Security. He served on the Congressional EMP Commission as chief of staff, the Congressional Strategic Posture Commission, the House Armed Services Committee, and the CIA.

Those of us who cheered President Trump’s establishment of the U.S. Space Force hoped—and I believe President Trump intended—that it would become the vehicle for quickly resurrecting President Reagan’s Strategic Defense Initiative (SDI), the so-called “Star Wars” program.   President Reagan’s SDI envisioned a space-based “shield” to intercept nuclear missiles, replacing MAD’s immoral concept of national suicide with the moral principle of defending life—call the new concept Strategic Assured  National Existence (SANE). But officials at State and Defense worry that “militarizing” space by orbiting anti-missile systems to defend the U.S. homeland will ignite an anti-satellite arms race by Russia and China to threaten America’s over 900 satellites.[[ii]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn2)  By this thinking, U.S. national security will lose far more than it would gain from space-based defenses—because the U.S. economy and military depend far more on satellites than Russia, China, and other potential adversaries. Accordingly, even though it is well within U.S. technological capabilities to deploy Brilliant Pebbles space-based missile defenses now, over the next five years for $20 billion, the Defense Department and U.S. Space Force have no such plans.[[iii]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn3)  Space-based missile defenses are currently relegated to long-term research and development.  If State and the Pentagon have their way, "Star Wars" will never become a reality and “Dr. Strangelove’s” MAD will continue forever. One big problem with this thinking is that MAD is no longer what it used to be.  Since the 1960s, the criteria for enforcing MAD, established by then Defense Secretary Robert McNamara, is a residual U.S. capability—after a Russian first strike—to deliver 400 equivalent megatons (EMTs), enough to destroy 25% of Russia’s population and 75% of its industry.[[iv]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn4)   However, due to the New START Treaty, the U.S. has reduced its number of strategic nuclear weapons to 1,500 warheads.  This is grossly insufficient, after a Russian disarming first strike, to meet the criteria for enforcing MAD.[[v]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn5) Perhaps unsurprisingly, since Moscow consistently does better than the United States in arms control negotiations, Russia can absorb a U.S. nuclear first strike and exceed MAD damage goals against the U.S., killing more than 25% of U.S. population and 75% of U.S. industry by delivering 100 EMTs.  Even though the sides have equal numbers of strategic warheads (assuming Russia is not cheating on New START), Russia can do more damage to the United States because U.S. population and industry are much more concentrated in big urban-industrial areas.[[vi]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn6)  Moreover, U.S. National Missile Defenses have fewer than 100 interceptors while U.S. civil defenses are virtually non-existent, in contrast to Russia’s many thousands of anti-missile systems and robust civil defenses. Another big problem with banking on MAD instead of SANE and space-based defenses to deter World War III is that “strategic stability” is not what it used to be, as during the bipolar Cold War between the U.S. and USSR.  Russia, China, North Korea, and soon (if not already) Iran comprise a more complex and aggressive multi-polar constellation of nuclear powers.  The possibilities for nuclear war by design or miscalculation have increased exponentially. Finally, it could be a fatal mistake for the U.S. to forego SANE’s “Star Wars” and continue relying on MAD’s “Dr. Strangelove” trusting that China, Russia, and perhaps others have not already “militarized” space with aggressive clandestine programs designed to sweep the skies of U.S. satellites, and thereby win the next war at the outset.  Indeed, given China and Russia's contempt for international norms and noncompliance with treaties, it is likely norms and treaties are no significant obstacles to their clandestine militarization of space. Therefore, State and the Pentagon should consider not only the known space threats from China and Russia, but possible hidden threats, as yet unknown, but well within their technological capabilities.  Perhaps the Pentagon and State should weigh too much for forgoing "Star Wars" and leave U.S. space assets naked to clandestine threats from Russia and China that are not only technologically possible but even likely. The Defense Department’s Defense Space Strategy recognizes that Russia and China pose "immediate and serious threats to U.S. space operations" through hunter-killer anti-satellites, directed energy weapons, and cyber and electronic warfare.  The Pentagon warns that North Korea and Iran have growing capabilities to threaten U.S. space assets.[[vii]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn7) Hunter-killer anti-satellites appear to receive the most attention from DoD and the press, as Russia and China are both experimenting with novel anti-satellites.  Russia has four known potential anti-satellites in orbit that appear to have practiced stalking a U.S. KH-11 reconnaissance satellite.[[viii]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn8) But DoD has recently acknowledged that a far bigger threat to U.S. satellites, instead of picking them off one at a time with hunter-killers, is the use of a high-altitude nuclear electromagnetic pulse (EMP) to disable U.S. satellites in large numbers, simultaneously, at the speed of light. Deputy Assistant Secretary of Defense for Space Policy, Stephen Kitay, in May 2020 warned: “The challenge of a nuclear detonation is that it creates an electromagnetic pulse and signal that could then take out indiscriminately many satellites in space and essentially fry the electronics.  That is a threat that we have to potentially be prepared for—a nuclear detonation in space.”[[ix]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn9) Space-based defenses are the best preventive for a nuclear detonation in space delivered by missile, as it could be intercepted during boost-phase before breaching the atmosphere to threaten U.S. space assets.  This mission alone—protecting U.S. space assets—should be enough to warrant rapid deployment of space-based defenses.  However, instead of letting the U.S. Space Force “ be all that it can be” by deploying space-based defenses, the Pentagon seems content to continue relying on deterrence and hardening satellites against attack.  This could be a big mistake. Russia and China have the technical capability to make a surprise EMP attack by nuclear-armed satellite orbited over the south polar region to evade U.S. BMEWS radars and National Missile Defenses, as planned by the USSR during the Cold War. During the Cold War, the USSR developed a secret weapon called the Fractional Orbital Bombardment System (FOBS) that would disguise a nuclear attack as a peaceful satellite launch, orbiting a nuclear-armed satellite over the South Pole to attack the U.S. from the south—from which direction the U.S. is blind and defenseless as there are no BMEWS radars or anti-missile defenses facing south.  The FOBS satellite could deliver an EMP attack paralyzing U.S. retaliatory forces and C3I in the first shot of a nuclear war.  Miroslav Gyurosi in The Soviet Fractional Orbital Bombardment System describes Moscow's development of the FOBS as part of "a long running campaign of strategic deception against the West through the whole Cold War period, and the protracted development of the Soviet FOBS nuclear weapon system presents an excellent case study of such."  Gyurosi: “The Fractional Orbital Bombardment System (FOBS) as it was known in the West, was a Soviet innovation intended to exploit the limitations of U.S. BMEW radar coverage.  The idea behind FOBS was that a large thermonuclear warhead would be inserted into a steeply inclined low altitude polar orbit, such that it would approach the CONUS from any direction, but primarily from the southern hemisphere, and following a programmed braking maneuver, re-enter from a direction which was not covered by U.S. BMEW radars." "The first warning the U.S. would have of such a strike in progress would be the EMP...," writes Gyurosi.[[x]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn10)  China and Russia also has the technical capability to clandestinely orbit a nuclear-armed satellite or satellites to be maintained in orbit for years to make a surprise EMP attack against the U.S. or other adversaries when needed.  China has about 300 satellites in orbit, and Russia about 150, that could conceal among this large constellation one or a few illegal nuclear-armed satellites for EMP attack.[[xi]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn11) Russian Colonel A.V. Kopylov writes in the flagship journal of the General Staff: “Nuclear war strategy has already planned nuclear explosions at an altitude of 50-100 kilometers to destroy enemy satellites’ electronic instruments with electromagnetic pulse.”[[xii]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn12) China has a wide array of Space Launch Vehicles and satellite launch centers at Jiquan, Taiyuan, Xichang, and Wenchang that could be used for EMP surprise attack options by satellite.  China’s space and military programs are integrated.  For example, the China Academy of Launch Vehicle Technology (CALT) “is China’s largest and most important organization for the research, development and production of space launch vehicles (SLVs), liquid-fueled surface-to-surface missiles, solid-fueled surface-to-surface and submarine-launched ballistic missiles” including ICBMs, IRBMs, and SRBMs.[[xiii]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn13) Russia has equally or more impressive capabilities to harness for space warfighting. Russia and China have great strategic incentives for a clandestine capability to perform EMP attack by satellite as a means of preempting or retaliating against their many nuclear-armed potential adversaries—including each other.  An EMP attack could enable China and Russia to “level the playing field” or defeat the U.S. by being the most effective means of quickly neutralizing large numbers of LEO satellites that are crucial to U.S. military operations. Decades of experience dealing with Moscow and Beijing should have taught Washington that their unwarranted criticisms of U.S. defense policy—planning for nuclear first use, cheating on arms control, and militarizing space—are usually reliable indicators of their own plans and behavior. Is it possible that Russia and China object so vehemently to U.S. “militarization of space” because they have already done so with nuclear-armed satellites, and themselves have secret plans to rapidly deploy space-based missile defenses in wartime? President Reagan's vision of a space-based missile shield would have been stabilizing during the Cold War and would be an excellent deterrent now because it could, at a minimum, greatly complicate adversary plans for a nuclear first strike.  "Star Wars" could even render nuclear missiles obsolete and inaugurate a Revolution in Military Affairs that would shift technological advantage away from offensive operations to defensive operations.  U.S. deployment of space-based defenses now, in peacetime, would establish a “new normal” replacing “Dr. Strangelove’s” threatened megadeaths of MAD with SANE’s promise of civilizational survival. U.S. forbearance on space-based defenses is dangerously wrong-headed, potentially yielding a decisive advantage to Russia and China that could make war more likely. What if Russia and/or China already have or are developing a space shield, to be deployed immediately after destroying U.S. satellites or after attacking the United States itself, to neutralize U.S. nuclear retaliatory capabilities?  30 years ago, U.S. scientists working in the Strategic Defense Initiative, assessed that—using then existing commercial off-the-shelf technology—a Brilliant Pebbles space-based interceptor could be made weighing only about 1.5-2.5 kilograms (3.3-5.5 pounds).[[xviii]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn18) After their first strike, Russia or China could theoretically loft a Brilliant Pebbles missile shield comprising 2,000 space-based interceptors (weighing collectively 5,000 kilograms) using only one heavy Space Launch Vehicle. The U.S. should be very concerned about a scenario where China or Russia uses nuclear space weapons to quickly sweep the skies of U.S. satellites, even at the risk of losing their own satellites, which could then be replaced with a surge of military satellites and space-based defenses to capture the “high frontier” and defeat the United States.

#### Scenario Two: Debris

#### Privatization leads to massive increase of debris – makes cascading inevitable

Bernat 20 Pawel @ Military University of Aviation. 11/4/20. [SAFETY ENGINEERING OF ANTHROPOGENIC OBJECTS, “ORBITAL SATELLITE CONSTELLATIONS AND THE GROWING THREAT OF KESSLER SYNDROME IN THE LOWER EARTH ORBIT,” Volume 4, PDF] Justin

The second decade of the 21st century has brought a dynamic and somewhat surprising development of the space industry. Since 1972 – the Apollo 17 crew mission to the Moon, the humankind has not left the safe environment of Earth’s orbit, and for years the global space sector has been progressing in slow but steady pace run by a few largest space agencies like American NASA, European ESA, Japanese JAXA, and Chinese CNSA. The most significant achievement of the “old ways” of managing outer space exploration is the International Space Stations (ISS) that has facilitated more than 20 years of continuous crewed operations. The situation started to change at the turn of the century when new generations of private entrepreneurs began to invest in and develop space technologies like rocket boosters, spaceships, and what most important for the subject of the paper – satellites and their constellations. This new shift is known among the space industry as “Space 2.0”, and its emergence is dated around 2000-2002 when the companies like SpaceX, Blue Origin, and Virgin Galactic were established. (Pyle, 2019). The real change, however, came in 2012 when the first SpaceX commercial mission was successfully launched to the ISS (NASA, 2012). Since then, the participation of the private sector in the space industry has skyrocketed, especially in the United States. Today, SpaceX is the only entity that provides reusable rockets (first stage and fairings) that is capable of vertical launch and landing. Their current flagship rocket – Falcon 9 has carried out 23 successful missions in 2020 (SpaceX, 2020) and another four are planned for December of that year (Weitering, 2020). Moreover, thanks to Crew Dragon spaceship developed by the company, Americans have regained this year the capacity of sending astronauts from their own soil after nine years of buying the seats on Russian Soyuz capsule. SpaceX is now in the process of building a communication satellites constellation that will be addressed and analyzed in the paper. Nowadays, in the space industry, we witness a very productive cybernetic feedback look between the development of space technologies, the democratization of those technologies, and a substantial reduction of prices. The latter is even more significant if we compare the cost of launching cargo into orbit now and 20 years ago – Falcon 9 is over ten times cheaper than Space Shuttle (Jones, 2018). This, of course, directly translates into the mass and number of objects that we are able to put in the orbit viably. Once the constellations consisting of thousands of satellites were unthinkable, but in the current environment, they become a reality. Space 2.0 also has brought new threats and challenges in the sphere of national and international security. The increase in launch capacity, among other factors, has led to progressive militarization and weaponization of space and new arms race (Bernat, 2019), which has also contributed to the growing numbers of orbiting objects. The goal of the paper is to present the argumentation that the threat posed by the cascading collisions in the Earth’s orbit (Kessler syndrome) is becoming more severe due to the construction of orbital satellite constellations; the threat that presents a real danger for people during their EVAs and orbital infrastructure, which may bare immediate consequences for safety and security systems on Earth. In order to provide the theoretical context for the above claim, the following issues will be presented and discussed: (1) space debris, (2) the Kessler syndrome, (3) orbital debris models, (4) the legal issues related to space debris and mitigation actions against their proliferation, and (5) the planned and being currently developed orbital satellite constellations and how they contribute to the growing threat of the Kessler syndrome.

#### Debris takes out military satellites and spark war

Orwig 16 [(Jessica, MS in science and tech journalism from Texas A&M, BS in astronomy and physics from Ohio State) “Russia says a growing problem in space could be enough to spark a war,” Insider,’ January 26, 2016, <https://www.businessinsider.com/russia-says-space-junk-could-spark-war-2016-1>]

NASA has already warned that the large amount of space junk around our planet is growing beyond our control, but now a team of Russian scientists has cited another potentially unforeseen consequence of that debris: War. Scientists estimate that anywhere from 500,000 to 600,000 pieces of human-made space debris between 0.4 and 4 inches in size are currently orbiting the Earth and traveling at speeds over 17,000 miles per hour. If one of those pieces smashed into a military satellite it "may provoke political or even armed conflict between space-faring nations," Vitaly Adushkin, a researcher for the Institute of Geosphere Dynamics at the Russian Academy of Sciences, reported in a paper set to be published in the peer-reviewed journal Acta Astronautica, which is sponsored by the International Academy of Astronautics. Say, for example, that a satellite was destroyed or significantly damaged in orbit — something that a 4-inch hunk of space junk could easily do traveling at speeds of 17,500 miles per hour, Adushkin reported. (Even smaller pieces no bigger than size of a pea could cause enough damage to the satellite that it would no longer operate correctly, he notes.) It would be difficult for anyone to determine whether the event was accidental or deliberate. This lack of immediate proof could lead to false accusations, heated arguments and, eventually, war, according to Adushkin and his colleagues. A politically dangerous dilemma In the report, the Adushkin said that there have already been repeated "sudden failures" of military spacecraft in te last two decades that cannot be explained. "So, there are two possible explanations," he wrote. The first is "unregistered collisions with space objects." The second is "machinations" [deliberate action] of the space adversary. "This is a politically dangerous dilemma," he added. But these mysterious failures in the past aren't what concerns Adushkin most. It's a future threat of what experts call the cascade effect that has Adushkin and other scientists around the world extremely concerned. The Kessler Syndrome In 1978, American astrophysicist Donald Kessler predicted that the amount of space debris around Earth would begin to grow exponentially after the turn of the millennium. Kessler 's predictions rely on the fact that over time, space junk accumulates. We leave most of our defunct satellites in space, and when meteors and other man-made space debris slam into them, you get a cascade of debris. The cascade effect — also known as the Kessler Syndrome — refers to a critical point wherein the density of space junk grows so large that a single collision could set off a domino effect of increasingly more collisions. For Kessler, this is a problem because it would "create small debris faster than it can be removed," Kessler said last year. And this cloud of junk could eventually make missions to space too dangerous. For Adushkin, this would exacerbate the issue of identifying what, or who, could be behind broken satellites. The future So far, the US and Russian Space Surveillance Systems have catalogued 170,000 pieces of large space debris (between 4 and 8 inches wide) and are currently tracking them to prevent anymore dilemmas like the ones Adushkin and his colleagues cite in their paper. But it's not just the large objects that concern Adushkin, who reported that even small objects (less than 1/3 of an inch) could damage satellites to the point they can't function properly. Using mathematical models, Adushkin and his colleagues calculated what the situtation will be like in 200 years if we continue to leave satellites in space and make no effort to clean up the mess. They estimate we'll have: 1.5 times more fragments greater than 8 inches across 3.2 times more fragments between 4 and 8 inches across 13-20 times more smaller-sized fragments less than 4 inches across "The number of small-size, non-catalogued objects will grow exponentially in mutual collisions," the researchers reported.

#### US-Russia nuclear conflict the most likely scenario for extinction

Farquhar et al., 17 (Sebastian Farquhar, John Halstead , Owen Cotton-Barratt, Stefan Schubert, Haydn Belfield, and Andrew Snyder-Beattie, \*DPhil student in Computer Science at the University of Oxford, \*\*Head of Applied Research at Founders Pledge, \*\*\*Research Fellow at the University of Southampton with DPhil in mathematics, \*\*\*\*researcher at the Social Behaviour and Ethics Lab at Oxford, \*\*\*\*\*Research Associate and Academic Project Manager at the University of Cambridge's Centre for the Study of Existential Risk, \*\*\*\*\*\*Director of Research at the Future of Humanity Institute at University of Oxford, 2017, accessed on 12-2-2020, The Future of Humanity Institute, "Existential Risk: Diplomacy and Governance", https://www.fhi.ox.ac.uk/xrisk-diplomacy/)

The bombings of Hiroshima and Nagasaki demonstrated the unprecedented destructive power of nuclear weapons. However, even in an all-out nuclear war between the United States and Russia, despite horrific casualties, neither country’s population is likely to be completely destroyed by the direct effects of the blast, fire, and radiation.8 The aftermath could be much worse: the burning of flammable materials could send massive amounts of smoke into the atmosphere, which would absorb sunlight and cause sustained global cooling, severe ozone loss, and agricultural disruption – a nuclear winter. According to one model 9 , an all-out exchange of 4,000 weapons could lead to a drop in global temperatures of around 8°C, making it impossible to grow food for 4 to 5 years. This could leave some survivors in parts of Australia and New Zealand, but they would be in a very precarious situation and the threat of extinction from other sources would be great. An exchange on this scale is only possible between the US and Russia who have more than 90% of the world’s nuclear weapons, with stockpiles of around 4,500 warheads each, although many are not operationally deployed.11 Some models suggest that even a small regional nuclear war involving 100 nuclear weapons would produce a nuclear winter serious enough to put two billion people at risk of starvation,12 though this estimate might be pessimistic.13 Wars on this scale are unlikely to lead to outright human extinction, but this does suggest that conflicts which are around an order of magnitude larger may be likely to threaten civilisation. It should be emphasised that there is very large uncertainty about the effects of a large nuclear war on global climate. This remains an area where increased academic research work, including more detailed climate modelling and a better understanding of how survivors might be able to cope and adapt, would have high returns. It is very difficult to precisely estimate the probability of existential risk from nuclear war over the next century, and existing attempts leave very large confidence intervals. According to many experts, the most likely nuclear war at present is between India and Pakistan.14 However, given the relatively modest size of their arsenals, the risk of human extinction is plausibly greater from a conflict between the United States and Russia. Tensions between these countries have increased in recent years and it seems unreasonable to rule out the possibility of them rising further in the future.

## Contention 2: Ozone

#### Ozone hole healing – new destruction reverses progress

Stone 18 [Maddie Stone is a science journalist. “Our Best Evidence Yet That Humans Are Fixing the Ozone Hole.” January 5, 2018. https://gizmodo.com/our-best-evidence-yet-that-humans-are-fixing-the-ozone-1821808429]

The ozone hole feels like the quintessential ‘80s problem, but unlike car phones and mullets, it remains relevant in a number of ways. For starters, it’s still there, chilling over Antartica. More importantly, it’s slowly healing, and a new study offers some of the best evidence yet that sound environmental policy is responsible. It’s been nearly 30 years since the world adopted the Montreal Protocol, a landmark treaty banning the use of ozone-destroying chlorofluorocarbons (CFCs). But despite a firm scientific understanding of the link between CFCs and ozone depletion, it’s been tough to tell how much of a success the protocol was, because the ozone hole didn’t start showing signs of recovery until a few years back. Moreover, nobody had actually measured the chemistry of the hole to see if ozone-destroying compounds are declining as we’d expect due to the Montreal Protocol. A study published this week in Geophysical Research Letters addresses that knowledge gap. The authors, from NASA’s Goddard Spaceflight Center, made use of data collected by NASA’s Aura satellite, which measures a suite of trace atmospheric gases to understand changes to the ozone layer, Earth’s climate, and air pollution. “It kind of surprised me that no one had done this,” lead study author Susan Strahan told Earther. “The data is there if you’re careful about what data to use.” Strahan and her colleague Anne Douglass looked at changing ozone levels above Antarctica throughout the austral winter from 2005 to 2016, and found that ozone depletion had declined by about 20 percent. Then, they looked at levels of hydrochloric acid in the stratosphere at the end of winter, an indicator of how much ozone had been destroyed by CFCs. Sure enough, chlorine levels declined as well, at a rate of about 0.8 percent per year. That’s in line with model expectations of how much CFC levels should have declined over the same time period thanks to the Montreal Protocol’s ban. “This reaffirms our scientific understanding of what’s controlling ozone,” she said. Bill Randall, an atmospheric scientist at the University Corporation for Atmospheric Research who was not involved with the study, told Earther he thought the paper’s analysis was “very well done.” “They’re seeing net decreases in chlorine that are very consistent with the Montreal Protocol,” he said. “That’s a big take home message, that the Montreal Protocol is doing what we think it should be doing.”

#### Ozone Destruction – two warrants

#### Rockets cause soot and black carbon – massive ozone depletion and exacerbates global warming

LiveScience 10 [Live Science Staff. “New Climate Change Worry: Space Tourism Soot.” October 22, 2010. https://www.livescience.com/10202-climate-change-worry-space-tourism-soot.html]

Humans’ attempts to visit space may not be good for the folks back home, according to a new study that finds soot emitted by space tourism rockets could significantly contribute to global climate change in coming decades. The researchers assumed that a fast-growing suborbital space tourism market will develop over the next decade, and they examined the climate impact of soot and carbon dioxide emissions from 1,000 suborbital rocket flights per year, the approximate number advertised in recent materials promoting space tourism. "Rockets are the only direct source of human-produced compounds above about 14 miles (22.5 kilometers), and so it is important to understand how their exhaust affects the atmosphere," said the study's chief researcher, Martin Ross of The Aerospace Corp. in El Segundo, Calif. He and his colleagues describe their findings in a scientific paper that has been accepted for publication in Geophysical Research Letters. A layer of soot According to the study, soot particles emitted by the proposed fleet of space tourism rockets would accumulate at about 25 miles (40 km) altitude, three times higher than the altitude of airline traffic. Unlike soot from jets or coal power plants, which is injected lower in the atmosphere and falls to earth within weeks, the particles created by rockets remain in the atmosphere for years, efficiently absorbing sunlight that would otherwise reach the Earth's surface. The result is a global pattern of change, according to researcher Michael Mills of the National Center for Atmospheric Research (NCAR) in Boulder, Colo. "The response of the climate system to a relatively small input of black carbon is surprising," Mills said in a statement. "Our results show particular climate system sensitivity to the type of particles that rockets emit." Using a computer model of the Earth's atmosphere, the researchers discovered that beneath the predicted layer of soot, the Earth's surface would cool by as much as 1.2 degrees Fahrenheit (0.7 degrees Celsius). Antarctica would warm by 1.5 degrees F (0.8 degrees C). Meanwhile, equatorial regions could lose about 1 percent of their ozone, while the poles could gain 10 percent. The global effect would be an increase in the amount of solar energy absorbed by the Earth's atmosphere. That means the soot from the rockets contributes to atmospheric heating at a rate higher than the carbon dioxide from those same rockets. An earlier study by Ross, published in March 2009 in the journal Astrophysics, found that rocket emissions are particularly harmful to the ozone because they're injected directly into the stratosphere where the ozone layer resides. Considering black carbon The researchers based their predictions on business plans for suborbital space travel in the year 2020, Ross said. The current global fleet of hydrocarbon-fueled orbital rockets emits about one-tenth of the soot assumed in the study. "Climate impact assessments of suborbital and orbital rockets must consider black carbon emissions, or else they ignore the most significant part of the total climate impact from rockets," Ross said. "This includes existing assessments that may need to be brought up to date."

#### Megaconstellations destroy the ozone

Tereza 21 [Tereza; June 07, 2021; Bachelor's in Journalism and Master's in Cultural Anthropology from Prague's Charles University, Master's in Science from the International Space University. Space.com, “Air pollution from reentering megaconstellation satellites could cause ozone hole 2.0,” <https://www.space.com/starlink-satellite-reentry-ozone-depletion-atmosphere>]

Chemicals released as defunct satellites burn in the atmosphere could damage Earth’s protective ozone layer if plans to build megaconstellations of tens of thousands of satellites, such as SpaceX's Starlink, go ahead as foreseen, scientists warn. Researchers also caution that the poorly understood atmospheric processes triggered by those chemicals could lead to an uncontrolled geoengineering experiment, the consequences of which are unknown. For years, the space community was content with the fact that the amount of material that burns in the atmosphere as a result of Earth's encounters with meteoroids far exceeds the mass of defunct satellites meeting the same fate. Even the rise of megaconstellations won't change that. The problem, however, is in the different chemical composition of natural meteoroids compared to artificial satellites, according to Aaron Boley, an associate professor of astronomy and astrophysics at the University of British Columbia, Canada. "We have 54 tonnes (60 tons) of meteoroid material coming in every day," Boley, one of the authors of a paper published May 20 in the journal Scientific Reports, told Space.com. "With the first generation of Starlink, we can expect about 2 tonnes (2.2 tons) of dead satellites reentering Earth's atmosphere daily. But meteoroids are mostly rock, which is made of oxygen, magnesium and silicon. These satellites are mostly aluminum, which the meteoroids contain only in a very small amount, about 1%." Related: SpaceX's Starlink satellite megaconstellation launches in photos Uncontrolled geoengineering The scientists realised that megaconstellations have a significant potential to change the chemistry of the upper atmosphere compared to its natural state. But not only that. The burning of aluminum is known to produce aluminum oxide, also known as alumina, which can trigger further unexplored side effects. "Alumina reflects light at certain wavelengths and if you dump enough alumina into the atmosphere, you are going to create scattering and eventually change the albedo of the planet," Boley said. Albedo is the measure of the amount of light that is reflected by a material. In fact, increasing Earth's albedo by pumping certain types of chemicals into the higher layers of the atmosphere has been proposed as a possible geoengineering solution that could slow down global warming. However, Boley said, the scientific community has rejected such experiments because not enough is known about their possible side effects. "Now it looks like we are going to run this experiment without any oversight or regulation," Boley said. "We don't know what the thresholds are, and how that will change the upper atmosphere." The Cygnus re-supply vehicle, which delivers cargo to the International Space Station, burning up in the atmosphere during its reentry. (Image credit: ESA/Alexander Gerst) Ozone hole 2.0 The aluminum from re-entering satellites also has a potential to damage the ozone layer, a problem well known to humanity, which has been successfully solved by widespread bans on the use of chlorofluorocarbons, chemicals used in the past in aerosol sprays and refrigerators. In their paper, Boley and his colleague Michael Byers cite research by their counterparts from the Aerospace Corporation, a U.S. non-profit research organization, which identified local damage to the planet's ozone layer triggered by the passage of polluting rockets through the atmosphere. "We know that alumina does deplete ozone just from rocket launches themselves because a lot of solid-fuel rockets use, or have, alumina as a byproduct," Boley said. "That creates these little temporary holes in the stratospheric ozone layer. That's one of the biggest concerns about compositional changes to the atmosphere that spaceflight can cause." The ozone layer protects life on Earth from harmful UV radiation. The depletion of ozone in the stratosphere, the second lowest layer of the atmosphere extending between altitudes of approximately 7 to 40 miles (10 to 60 kilometers), led to an increased risk of cancer and eye damage for humans on Earth. Gerhard Drolshagen, of the University of Oldenburg, Germany, who has published papers about the effects of meteoroid material on Earth, told Space.com that reentering satellites usually evaporate at altitudes between 55 and 30 miles (90 and 50 km), just above the ozone-rich stratosphere. However, he added, the particles created as a result of the satellites' burning will eventually sink to the lower layers. Boley said that as the alumina sinks into the stratosphere, it will cause chemical reactions, which, based on existing knowledge, will likely trigger ozone destruction. Drolshagen, who wasn't involved in the recent study, agreed that because "satellites are mostly made of aluminum, the amount of aluminum deposited in the atmosphere will certainly increase." Concerns about the effects of aluminium oxides on the atmosphere have been cited by U.S. telecommunications operator Viasat in its request to the US Federal Communications Commision to suspend launches of SpaceX's Starlink megaconstellation until a proper environmental review of its possible impacts is conducted. Spectacular stratospheric clouds are linked to ozone destruction. (Image credit: NASA/Lamont Poole) Learning from past mistakes In their study, Boley and his colleagues looked only at the effects of the first generation of the Starlink megaconstellation, which is expected to consist of 12,000 satellites. More than 1,700 of these have already been launched. As a result of SpaceX's activities (and to a lesser extent those of other constellation operators), the number of active and defunct satellites in low Earth orbit, the region of space below the altitude of 620 miles (1,000 km), has increased by 50% over the past two years, according to the paper. "The problem is that there are now plans to launch about 55,000 satellites," Boley said. "Starlink second generation could consist of up to 30,000 satellites, then you have Starnet, which is China's response to Starlink, Amazon's Kuiper, OneWeb. That could lead to unprecedented changes to the Earth’s upper atmosphere." Megaconstellation operators, inspired by the consumer technology model, expect fast development of new satellites and frequent replacement, thus the high amount of satellites expected to be burning in the atmosphere on a daily basis.

#### Ozone depletion causes extinction – diseases, biodiversity loss, and food shortages

Bestill 16 Michele M. Betsill 16. Professor in Residence and Chair of Political Science department at Colorado State University, Ph.D in Environmental Politics and Policy, “Impacts Of Stratospheric Ozone Depletion” http://www.climate-policy-watcher.org/hydrology/impacts-of-stratospheric-ozone-depletion.html

Stratospheric ozone depletion was recognized as an environmental problem in need of international attention because it impacts both humans and the natural environment. When stratospheric ozone levels decrease, the amount of UV-B reaching Earth's surface increases (WMO, 1995). The changes in UV-B radiation are highest at high and midlatitudes in both hemispheres while the increases are fairly small in the tropics (UNEP, 1994). Increased levels of UV-B affect human health, the productivity of plant and animal species, as well as the composition of ecosystems. Impacts on Human Health Ultraviolet exposure does have some benefits for humans. For example, it initiates the production of vitamin D3, which is believed to inhibit the growth of tumor cells (UNEP, 1996). However, the balance of evidence indicates that the effects of stratospheric ozone depletion on human health are negative. The major risks include increased incidence of eye diseases, skin cancer, and infectious diseases. When UV-B levels increase, two main organ systems are exposed: the eyes and the skin. The impacts of ozone depletion are mediated through these two systems (Longstreth et al„ 1995; UNEP, 1998). Evidence suggests that increased UV-B radiation exposure may be associated with an increase in the incidence of cataracts, a clouding of the lens of the eye (Longstreth et al, 1995; UNEP, 1998). One review of research on this problem reported that a 1% increase in stratospheric ozone depletion would result in a 0.6 to 0.8% increase in the incidence of cataracts (UNEP, 1994; see also UNEP, 1998). The most widely known impact of increased UV-B radiation on human health is skin cancer. UV-B radiation damages deoxyribonucleic acid (DNA), which may cause gene mutations and the formation of cancer cells. Some studies estimate that a sustained 10% decrease in average stratospheric ozone concentrations would result in 250,000 new cases of nonmelanoma skin cancer. This is in addition to the 1.2 million cases already reported each year (Longstreth et al., 1995; UNEP, 1996). Many animal species, such as cows, goats, sheep, cats, and dogs, are also at increased risk of developing skin cancer as a result of increased exposure to UV-B radiation (UNEP, 1998). In an assessment of the effect of the Montreal Protocol and its amendments in protecting the ozone layer, Slaper and his colleagues (1996) concluded these efforts will substantially decrease the growth rate of the incidence of skin cancer over the next century. They found that under a scenario where there were no limits on the production and consumption of ozone-depleting substances, there would be a quadrupling in the incidence of skin cancer by the year 2100. Under the provisions of the Montreal Protocol (a 50% reduction in the production of CFCs by 1999), a doubling in the incidence of skin cancer could be expected in that same period. In contrast, they found the Copenhagen Amendments scenario (a complete phase-out in the production of 21 ozone-depleting substances by January 1, 1996) would result in a 10% increase in skin cancer incidence, peaking in the year 2060. This study lends support to the importance of international efforts to combat stratospheric ozone depletion. Researchers believe that skin exposure to increased levels of UV-B radiation is also linked to modifications in the human immune system. As a result, the ability of the immune system to respond to certain infectious diseases, such as tuberculosis, leprosy, and Lyme disease, is impaired (UNEP, 1998). Longstreth and her colleagues (1995) predict that higher levels of UV-B will result in increased severity and duration of diseases such as lupus rather than an increase in their incidence. Impacts on Aquatic Systems The balance of evidence indicates that increased UV-B radiation can have harmful effects on many species of aquatic organisms and the aquatic systems in which they live (SCOPE, 1993; UNEP, 1998). For example, studies in the Antarctic have linked increased UV-B levels to reduced phytoplankton productivity. Phytoplankton are the basis for the oceanic food chain. UV-B radiation affects the DNA, photosynthesis, enzyme activity, and nitrogen incorporation of phytoplankton. Reduced phytoplankton productivity will likely lead to reduced productivity further up the food chain. It has been estimated that a 16% reduction in stratospheric ozone could lead to a 5% loss of phytoplankton causing a loss of 7 million tons of fish worldwide per year (Hader et al., 1995; UNEP, 1994, 1996). Figure 1 illustrates the effects of UV-B radiation on phytoplankton. Researchers have also found that enhanced UV-B radiation disrupts the early development of several species of fish, shrimp, and crabs, ultimately affecting their motility (Hader et al., 1995). In damaging aquatic organisms, stratospheric Effects of enhanced solar UV-B irradiation on phytoplai Motility Vertical distribution In the water column Global consequences Reduced carbon dioxide sink? Effects of enhanced solar UV-B irradiation on phytoplai Motility Vertical distribution In the water column Reduced biomass production? Competition between species? Temperature increase? Food web in the ocean? Figure 1 Effects of UV-B radiation on phytoplankton (from Hader et al, 1995, p. 178). ozone depletion has serious implications for the world food supply. Globally, 30% of the animal protein consumed by humans comes from the oceans. The percentage is much higher in developing countries (UNEP, 1998). These impacts are particularly worrisome in light of the growing world population. Impacts on Terrestrial Plants and Ecosystems Scientific understanding of the impact of enhanced UV-B on terrestrial plants and ecosystems is incomplete. The majority of studies have been conducted in growth chambers and greenhouses under controlled conditions, conditions that are often quite different from those experienced in the field. Thus, researchers contend it is necessary to use caution in making generalizations about the impacts of enhanced UV-B on terrestrial plants. The results of existing studies need to be verified under field conditions (Caldwell et al., 1995). Keeping the limitations of existing research in mind, it is still possible to make some statements about the effect of enhanced UV-B on terrestrial plants. It appears that increased UV-B radiation may have both direct and indirect effects on plants. Some plant species exhibit a reduction in leaf area and/or stem growth when exposed to higher levels of UV-B. In addition, UV-B may also inhibit photosynthesis, damage plant DNA, and alter the time of flowering as well as the number of flowers in some species. The latter has implication for the availability of pollinators and thus the reproductive capacity of plants (Caldwell et al., 1995; UNEP, 1998). The effects of UV-B on plants are not always straightforward but rather depend on the species, the cultivar, and developmental stage of the plants as well as mineral nutrition in the soil, drought, and local air pollutants (Caldwell et al., 1995; UNEP, 1998). In affecting plants, enhanced UV-B radiation may ultimately lead to changes in entire ecosystems. In nonagricultural ecosystems (e.g., forests and grasslands), the balance of plants may change as some species are less able to respond to increases in UV-B radiation and their productivity declines. At the same time, the productivity of more responsive species will likely increase. The overall species composition of ecosystems will change, as will species interactions and ecosystem dynamics (Caldwell et al., 1995; UNEP, 1998).

#### Biodiversity loss causes extinction – threat multiplier that outweighs on timeframe

Torres 16 Phil Torres 4-11-2016 “Biodiversity loss: An existential risk comparable to climate change” thebulletin.org/biodiversity-loss-existential-risk-comparable-climate-change9329 (founder of the X-Risks Institute, an affiliate scholar at the Institute for Ethics and Emerging Technologies)

The sixth extinction. The repercussions of biodiversity loss are potentially as severe as those anticipated from climate change, or even a nuclear conflict. For example, according to a 2015 study published in Science Advances, the best available evidence reveals “an exceptionally rapid loss of biodiversity over the last few centuries, indicating that a sixth mass extinction is already under way.” This conclusion holds, even on the most optimistic assumptions about the background rate of species losses and the current rate of vertebrate extinctions. The group classified as “vertebrates” includes mammals, birds, reptiles, fish, and all other creatures with a backbone. The article argues that, using its conservative figures, the average loss of vertebrate species was 100 times higher in the past century relative to the background rate of extinction. (Other scientists have suggested that the current extinction rate could be as much as 10,000 times higher than normal.) As the authors write, “The evidence is incontrovertible that recent extinction rates are unprecedented in human history and highly unusual in Earth’s history.” Perhaps the term “Big Six” should enter the popular lexicon—to add the current extinction to the previous “Big Five,” the last of which wiped out the dinosaurs 66 million years ago. But the concept of biodiversity encompasses more than just the total number of species on the planet. It also refers to the size of different populations of species. With respect to this phenomenon, multiple studies have confirmed that wild populations around the world are dwindling and disappearing at an alarming rate. For example, the 2010 Global Biodiversity Outlook report found that the population of wild vertebrates living in the tropics dropped by 59 percent between 1970 and 2006. The report also found that the population of farmland birds in Europe has dropped by 50 percent since 1980; bird populations in the grasslands of North America declined by almost 40 percent between 1968 and 2003; and the population of birds in North American arid lands has fallen by almost 30 percent since the 1960s. Similarly, 42 percent of all amphibian species (a type of vertebrate that is sometimes called an “ecological indicator”) are undergoing population declines, and 23 percent of all plant species “are estimated to be threatened with extinction.” Other studies have found that some 20 percent of all reptile species, 48 percent of the world’s primates, and 50 percent of freshwater turtles are threatened. Underwater, about 10 percent of all coral reefs are now dead, and another 60 percent are in danger of dying. Consistent with these data, the 2014 Living Planet Report shows that the global population of wild vertebrates dropped by 52 percent in only four decades—from 1970 to 2010. While biologists often avoid projecting historical trends into the future because of the complexity of ecological systems, it’s tempting to extrapolate this figure to, say, the year 2050, which is four decades from 2010. As it happens, a 2006 study published in Science does precisely this: It projects past trends of marine biodiversity loss into the 21st century, concluding that, unless significant changes are made to patterns of human activity, there will be virtually no more wild-caught seafood by 2048. Catastrophic consequences for civilization. The consequences of this rapid pruning of the evolutionary tree of life extend beyond the obvious. There could be surprising effects of biodiversity loss that scientists are unable to fully anticipate in advance. For example, prior research has shown that localized ecosystems can undergo abrupt and irreversible shifts when they reach a tipping point. According to a 2012 paper published in Nature, there are reasons for thinking that we may be approaching a tipping point of this sort in the global ecosystem, beyond which the consequences could be catastrophic for civilization. As the authors write, a planetary-scale transition could precipitate “substantial losses of ecosystem services required to sustain the human population.” An ecosystem service is any ecological process that benefits humanity, such as food production and crop pollination. If the global ecosystem were to cross a tipping point and substantial ecosystem services were lost, the results could be “widespread social unrest, economic instability, and loss of human life.” According to Missouri Botanical Garden ecologist Adam Smith, one of the paper’s co-authors, this could occur in a matter of decades—far more quickly than most of the expected consequences of climate change, yet equally destructive. Biodiversity loss is a “threat multiplier” that, by pushing societies to the brink of collapse, will exacerbate existing conflicts and introduce entirely new struggles between state and non-state actors. Indeed, it could even fuel the rise of terrorism. (After all, climate change has been linked to the emergence of ISIS in Syria, and multiple high-ranking US officials, such as former US Defense Secretary Chuck Hagel and CIA director John Brennan, have affirmed that climate change and terrorism are connected.) The reality is that we are entering the sixth mass extinction in the 3.8-billion-year history of life on Earth, and the impact of this event could be felt by civilization “in as little as three human lifetimes,” as the aforementioned 2012 Nature paper notes. Furthermore, the widespread decline of biological populations could plausibly initiate a dramatic transformation of the global ecosystem on an even faster timescale: perhaps a single human lifetime. The unavoidable conclusion is that biodiversity loss constitutes an existential threat in its own right. As such, it ought to be considered alongside climate change and nuclear weapons as one of the most significant contemporary risks to human prosperity and survival.