# 1NC

## 1

#### Interpretation: the affirmative must ONLY defend that the appropriation of outer space by private entities is unjust

#### Violation –

#### They defend the Moon treaty which is Extra Topical:

NTI No Date, [“Moon Agreement”, <https://www.nti.org/education-center/treaties-and-regimes/agreement-governing-activities-states-moon-and-other-celestial-bodies-moon-agreement/>] brett

The Moon Agreement supplements the Outer Space Treaty and confirmed the demilitarization of the Moon and other celestial bodies as provided for in that treaty. The Agreement also prohibits the use or threat of use of force, or any other hostile action or threat of hostile action on the Moon, which is reserved exclusively for peaceful activities. It prohibits the use of the Moon in order to commit any hostile act or to engage in any such threat in relation to the Earth, the Moon, spacecraft, the personnel of spacecraft, or man-made space objects. States Parties shall not place in orbit around or other trajectory to or around the Moon objects carrying nuclear weapons or any other kinds of weapons of mass destruction or place or use such weapons on or in the Moon. The agreement forbids the establishment of military bases, installations and fortifications on the Moon and, the testing of any type of weapons, and the conduct of military maneuvers on the Moon. But the use of military personnel for scientific research or for any other peaceful purposes is not prohibited. The use of any equipment or facility necessary for peaceful exploration and use of the Moon is not prohibited. States Parties are committed to inform the UN Secretary-General as well as the public and the international scientific community, to the greatest extent feasible and practicable, of their activities concerned with the exploration and use of the Moon. Information on the time, purposes, locations, orbital parameters, and duration is to be given in respect of each mission to the Moon as soon as possible after launching, while information on the results of each mission, including scientific results, shall be furnished upon completion of the mission. In the case of a mission lasting more than 60 days, information on conduct of the mission, including any scientific results, is to be given periodically, at 30-day intervals. For missions lasting more than six months, only significant additions to such information need be reported thereafter. As reflected in the provisions of this Agreement the Moon and its natural resources are the common heritage of mankind. The Moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means. Neither the surface nor the subsurface of the Moon, nor any part thereof or its natural resources, can become the property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity, or of any natural person. The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the Moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the Moon or any areas thereof.

#### Vote neg for limits -- they justify tons of advantages abt moon militarization, space war, as well as banning stuff like Trumps space force which plans to build a moon military base. That destroys prep bc they justify new advantages we didn’t prep for, making neg prep burden too high.

#### CI bc reasonability is arbitrary and invites judge intervention

#### DTD to deter future abuse

#### No RVIs: 1] illogical, you shouldn’t win for being topical, 2] good theory debaters will read abusive positions to bait theory and dump on an RVI, 3] trades off with substance since we can’t kick out of T

#### Neg theory first because AFF abuse made it impossible to engage so any neg abuse was to get back in the game.

## 2

#### 1AC Williams and Tosar is uniqueness for us – Asteroid mining is coming now but they ban it---

#### Asteroid mining’s key to space col---extinction

Feinman ‘14 [Matthew; Juris Doctor Candidate, Class of 2015, at the University of Pittsburgh School of Law. Spring 2014. 14 Pitt. J. Tech. L. & Pol'y no. 2 202 (2013-2014), “Mining the Final Frontier: Keeping Earth's Asteroid Mining Ventures from Becoming the Next Gold Rush” pp. 208-210 DOI: 10.5195/tlp.2014.140] brett

C. Asteroid Resources Can Be Used to Propel Us into the Future

"Humans must colonize planets in other solar systems ... or face extinction."49 -Stephen Hawking

The Earth is plagued with famine, 0 war," disease,52 the fear of nuclear annihilation,53 and those are only some of the "local" threats we face. Other thresats include, tiny meteorites that are consistently pelting the atmosphere every day. Almost all of these meteorites bum up in the atmosphere, but there are occurrences of meteorites reaching the Earth's surface. For example, on February 15, 2013, over Chelyabinsk, Russia, one meteorite passed through the atmosphere and did not bum up.55 Luckily, the meteor exploded before hitting the ground. 56 It is estimated that the meteor had the strength of at least 500 kilotons,57 25 times stronger than the atomic bomb dropped on Nagasaki, Japan, in 1945.

These threats and dangers are very real, and the human race needs alternatives. Stephen Hawking has been quoted as saying that ". . . once we spread out into space and establish independent colonies, our future should be safe."59 To this end, there are a number of companies currently developing technology to live off world.

The Eros Project's mission is to colonize a near-Earth asteroid.60 The Eros Project is the brainchild of Orbital Development, a company dedicated to the advancement of space travel.61 During this project, Orbital Development plans to create a city on one end, a tunnel leading to the other end, and a shipyard at the end of the tunnel. 2 The Lifeboat Foundation, a 501(c)(3),63 on the other hand, is a group devoted to defending Earth and protecting its people, while also developing means to leave this planet should the need arise.64 Lifeboat recognizes the inherent dangers of living on Earth,6 5 and is preparing to move the citizens of the world off the planet if and when the worst should happen.66

Each of these companies has something in common-all need the means and materials to make their missions a reality. It is not cheap to go to space as launching a Space Shuttle can cost the U.S. between $1 and $1.3 billion per launch.67 Add to that the cost of the materials needed to build a colony and the prices will only increase.6 8 Mars One, a nonprofit foundation with plans to have four colonists land on Mars in 2023, estimates that the initial launch will cost $6 billion.69

The technology created by companies like Planetary Resources and DSI could help with these colonization endeavors. Launches from Earth could be cheaper if the shuttles were able to refuel at a DSI Propellant Refinery. 0 Planetary Resources' ARKYD-300 could scout ahead for possible colonization sites on both asteroids and planets." Imagine a scenario where a DSI Harvestor mines the minerals needed to create a colony, and then the shuttle takes those materials, along with a DSI Microgravity Foundry, to build the colony itself. 2

#### Asteroid mining overcomes all technical barriers to colonizing space.

---creates initial habitats in Low Earth Orbit that mine asteroids for the materials to settle the Moon, Mars, etc. Only mining produces sufficient resources.

Matt Williams, 17. Writer for Universe Today. Citing A. J. Berliner, UC Berkeley; C. P. McKay. Space Sciences Division, NASA Ames Research Center; Valeriy Yakovlev, an astrophysicist and hydrogeologist from Laboratory of Water Quality in Kharkov, Ukraine. 3/10/17, “The future of space colonization – terraforming or space habitats?” [https://phys.org/news/2017-03-future-space-colonization-terraforming-habitats.html](https://phys.org/news/2017-03-future-space-colonization-terraforming-habitats.html%20) \*edited for gendered language brett \*\*\*NEOs=Asteroids

In light of this, Yakolev presents what he considers to be the most likely prospects for humanity's exit to space between now and 2030. This will include the creation of the first space biospheres with artificial gravity, which will lead to key developments in terms of materials technology, life support-systems, and the robotic systems and infrastructure needed to install and service habitats in Low Earth Orbit (LEO).

These habitats could be serviced thanks to the creation of robotic spacecraft that could harvest resources from nearby bodies – such as the Moon and Near-Earth Objects (NEOs). This concept would not only remove the need for planetary protections – i.e. worries about contaminating Mars' biosphere (assuming the presence of bacterial life), it would also allow human beings to become accustomed to space more gradually.

As Yakovlev told Universe Today via email, the advantages to space habitats can be broken down into four points:

"1. This is a universal way of mastering the infinite spaces of the Cosmos, both in the Solar System and outside it. We do not need surfaces for installing houses, but resources that robots will deliver from planets and satellites. 2. The possibility of creating a habitat as close as possible to the earth's cradle allows one to escape from the inevitable physical degradation under a different gravity. It is easier to create a protective magnetic field.

"3. The transfer between worlds and sources of resources will not be a dangerous expedition, but a normal life. Is it good for sailors without their families? 4. The probability of death or degradation of [hu]mankind as a result of the global catastrophe is significantly reduced, as the colonization of the planets includes reconnaissance, delivery of goods, shuttle transport of people – and this is much longer than the construction of the biosphere in the Moon's orbit. Dr. Stephen William Hawking is right, a person does not have much time."

And with space habitats in place, some very crucial research could begin, including medical and biologic research which would involve the first children born in space. It would also facilitate the development of reliable space shuttles and resource extraction technologies, which will come in handy for the settlement of other bodies – like the Moon, Mars, and even exoplanets.

Ultimately, Yakolev thinks that space biospheres could also be accomplished within a reasonable timeframe – i.e. between 2030 and 2050 – which is simply not possible with terraforming. Citing the growing presence and power of the commercial space sector, Yakolev also believed a lot of the infrastructure that is necessary is already in place (or under development).

"After we overcome the inertia of thinking +20 years, the experimental biosphere (like the settlement in Antarctica with watches), in 50 years the first generation of children born in the Cosmos will grow and the Earth will decrease, because it will enter the legends as a whole… As a result, terraforming will be canceled. And the subsequent conference will open the way for real exploration of the Cosmos. I'm proud to be on the same planet as Elon Reeve Musk. His missiles will be useful to lift designs for the first biosphere from the lunar factories. This is a close and direct way to conquer the Cosmos."

With NASA scientists and entrepreneurs like Elon Musk and Bas Landorp looking to colonize Mars in the near future, and other commercial aerospace companies developing LEO, the size and shape of humanity's future in space is difficult to predict. Perhaps we will jointly decide on a path that takes us to the Moon, Mars, and beyond. Perhaps we will see our best efforts directed into near-Earth space.

Or perhaps we will see ourselves going off in multiple directions at once. Whereas some groups will advocate creating space habitats in LEO (and later, elsewhere in the Solar System) that rely on artificial gravity and robotic spaceships mining asteroids for materials, others will focus on establishing outposts on planetary bodies, with the goal of turning them into "new Earths".

Between them, we can expect that humans will begin developing a degree of "space expertise" in this century, which will certainly come in handy when we start pushing the boundaries of exploration and colonization even further.

#### Space col mathematically outweighs

Bostrom, 3 [Nick; Professor, University of Oxford; Director, Future of Humanity Institute, University of Oxford; Director, Governance of AI program. Former lecturer at Yale. PhD, Philosophy, LSE; Studied Astrophysics & General Relativity (Dept. of Physics) and completed MSc-thesis in Computational neuroscience (Dept. of Math), King’s College, London; MA, Philosophy and Physics, University of Stockholm; BA, Philosophy, Mathematics, Mathematical Logic, Artificial Intelligence, University of Goteborg. “Astronomical Waste: The Opportunity Cost of Delayed Technological Development” <https://nickbostrom.com/astronomical/waste.html>] brett

ABSTRACT. With very advanced technology, a very large population of people living happy lives could be sustained in the accessible region of the universe. For every year that development of such technologies and colonization of the universe is delayed, there is therefore an opportunity cost: a potential good, lives worth living, is not being realized. Given some plausible assumptions, this cost is extremely large. However, the lesson for utilitarians is not that we ought to maximize the pace of technological development, but rather that we ought to maximize its safety, i.e. the probability that colonization will eventually occur.

I. THE RATE OF LOSS OF POTENTIAL LIVES

As I write these words, suns are illuminating and heating empty rooms, unused energy is being flushed down black holes, and our great common endowment of negentropy is being irreversibly degraded into entropy on a cosmic scale. These are resources that an advanced civilization could have used to create value-structures, such as sentient beings living worthwhile lives.

The rate of this loss boggles the mind. One recent paper speculates, using loose theoretical considerations based on the rate of increase of entropy, that the loss of potential human lives in our own galactic supercluster is at least ~10^46 per century of delayed colonization.[1] This estimate assumes that all the lost entropy could have been used for productive purposes, although no currently known technological mechanisms are even remotely capable of doing that. Since the estimate is meant to be a lower bound, this radically unconservative assumption is undesirable.

We can, however, get a lower bound more straightforwardly by simply counting the number or stars in our galactic supercluster and multiplying this number with the amount of computing power that the resources of each star could be used to generate using technologies for whose feasibility a strong case has already been made. We can then divide this total with the estimated amount of computing power needed to simulate one human life.

As a rough approximation, let us say the Virgo Supercluster contains 10^13 stars. One estimate of the computing power extractable from a star and with an associated planet-sized computational structure, using advanced molecular nanotechnology[2], is 10^42 operations per second.[3] A typical estimate of the human brain’s processing power is roughly 10^17 operations per second or less.[4] Not much more seems to be needed to simulate the relevant parts of the environment in sufficient detail to enable the simulated minds to have experiences indistinguishable from typical current human experiences.[5] Given these estimates, it follows that the potential for approximately 10^38 human lives is lost every century that colonization of our local supercluster is delayed; or equivalently, about 10^29 potential human lives per second.

While this estimate is conservative in that it assumes only computational mechanisms whose implementation has been at least outlined in the literature, it is useful to have an even more conservative estimate that does not assume a non-biological instantiation of the potential persons. Suppose that about 10^10 biological humans could be sustained around an average star. Then the Virgo Supercluster could contain 10^23 biological humans. This corresponds to a loss of potential equal to about 10^14 potential human lives per second of delayed colonization.

What matters for present purposes is not the exact numbers but the fact that they are huge. Even with the most conservative estimate, assuming a biological implementation of all persons, the potential for one hundred trillion potential human beings is lost for every second of postponement of colonization of our supercluster.[6]

II. THE OPPORTUNITY COST OF DELAYED COLONIZATION

From a utilitarian perspective, this huge loss of potential human lives constitutes a correspondingly huge loss of potential value. I am assuming here that the human lives that could have been created would have been worthwhile ones. Since it is commonly supposed that even current human lives are typically worthwhile, this is a weak assumption. Any civilization advanced enough to colonize the local supercluster would likely also have the ability to establish at least the minimally favorable conditions required for future lives to be worth living.

The effect on total value, then, seems greater for actions that accelerate technological development than for practically any other possible action. Advancing technology (or its enabling factors, such as economic productivity) even by such a tiny amount that it leads to colonization of the local supercluster just one second earlier than would otherwise have happened amounts to bringing about more than 10^29 human lives (or 10^14 human lives if we use the most conservative lower bound) that would not otherwise have existed. Few other philanthropic causes could hope to mach that level of utilitarian payoff.

## 3

#### ACA passed the house, but bipartisan support is key to senate fight. Mckinnon et all 2-4 [John D. Mckinnon, Natalie Andrews and Yuka Hayashi, 2-4-2022, "House Passes $350 Billion Competitiveness Bill, but Senate Fight Looms," WSJ, <https://www.wsj.com/articles/house-expected-to-pass-350-billion-bill-to-help-u-s-compete-globally-11643972401> [accessed 2-5-22] lydia

The House approved a $350 billion initiative Friday to boost U.S. competitiveness with China and other rivals, but differences with the Senate and emerging partisan divides signaled struggles ahead in reaching a compromise.The Senate in June [passed its $250 billion version](https://www.wsj.com/articles/senate-approves-250-billion-bill-to-boost-tech-research-11623192584?mod=article_inline) of the measure, the U.S. Innovation and Competition Act, on a bipartisan basis. House leaders waited until the past few weeks to put together their own package, [called the America Competes Act](https://www.wsj.com/articles/white-house-democrats-revive-effort-to-boost-high-tech-research-11642773603?mod=article_inline), as Congress wrestled with other spending proposals. The House bill passed almost entirely on party lines, in a 222-210 vote. It shares common elements with the Senate bill. Both are aimed at increasing federal support for scientific research and particularly new technologies. Both bills also provide for substantial new federal incentives to help bring [advanced semiconductor manufacturing back to the U. S.](https://www.wsj.com/articles/why-fewer-chips-say-made-in-the-u-s-a-11604411810?mod=article_inline)—another bipartisan priority. [Intel](https://www.wsj.com/market-data/quotes/INTC) Corp. cheered the passage of the House version, noting its plans for $43.5 billion in [new investment in Ohio](https://www.wsj.com/articles/intel-to-invest-at-least-20-billion-in-ohio-chip-making-facility-11642750760?mod=article_inline), Arizona and New Mexico. “Funding the [semiconductor incentives] is critical to level the playing field with global competitors, protect our domestic supply chain, invest in U.S. jobs and manufacturing and put us on a path to regain U.S. innovation leadership,” said Al Thompson, vice president of U.S. government relations at Intel. But Friday’s partisan divide over the House bill—along with differences between the House and Senate approaches—concerned Biden administration officials. “Delay is the biggest enemy we have right now,” Commerce Secretary Gina Raimondo told reporters following the vote. “My message to everyone is to find common ground quickly…This should take weeks, not months.” Ms. Raimondo said that the most contentious of the numerous partisan disagreements over the House package concerned its trade-policy changes. House Democrats sought to make more use of trade-policy changes to counter overseas threats while also adding protections for U.S. workers. One measure would offer new trade-adjustment help to workers affected by pandemic-induced trade and supply-chain disruptions, while also addressing “inherent racial disparities and inequalities in our economy,” according to a House summary. Other provisions would impose new federal oversight of U.S. cross-border investments in China and remove a loophole that allows for lower-valued products to enter the U.S. from China and some other countries without import duty or customs inspection. Ms. Raimondo urged lawmakers to find common ground and not let disagreements “bog down this whole negotiation.” Other differences are between the House and Senate versions and further complicate the final negotiations. One is over how to use scientific research to counter overseas threats. The Senate for its part focuses largely on encouraging cutting-edge technologies, such as artificial intelligence and quantum computing. The House, by contrast, wants to give more flexibility to federal science officials to decide which new ideas deserve to be jump-started. The House package also focuses more on global economic challenges and less on the specific threat from China, aides say. Compared with the Senate, the House also targets more funding and related policy changes toward issues such as climate change, human rights and domestic social inequality. Its version includes $8 billion to help developing countries convert to cleaner sources of energy. Another difference is the House’s inclusion of a new, $45 billion fund to provide grants and loans to strengthen U.S. supply chains and manufacturing. The bill’s sponsors say it provides for roughly $350 billion in overall spending, but the impact on deficits would be lower because not all of that money would represent new spending. A final estimate of its cost wasn’t available on Friday. Republicans accuse House Democrats of using the competitiveness bill as a way to pass unrelated spending proposals, weeks after President Biden’s $2 trillion Build Back Better initiative crashed in the Senate. “It has become a Frankenstein monster of other things,” said Rep. Mike Gallagher (R., Wis.), citing climate-change spending. Democrats say their bill will help solve supply-chain issues that are dragging on the economy, fueling inflation and frustrating Americans. “This bill deals with the independence and self-sufficiency of America in making things here in America that we need to have in order to grow our economy, create jobs and opportunity for our people,” said Majority Leader Steny Hoyer (D., Md.). He has long supported measures to increase manufacturing in the U.S. Democrats also view countering climate change as a global-competitiveness issue. They note that the package contains dozens of bills that have already passed with bipartisan support. Senate sponsors predicted that many of the House proposals will have to be removed to ensure Senate passage. “What candidly will happen [is], we’re going to have to move the policy towards the Senate bill,” said Sen. Todd Young (R., Ind.), who has been working with Majority Leader Chuck Schumer (D., N.Y.) on the Senate bill. While praising the House for moving on its own competitiveness package, Mr. Schumer said Thursday that lawmakers will “have much more work to do to bridge our two proposals together.”

#### The plan trades off -- treaties require PC and floor time.

---even if popular, opposition ensures immense floor time due to Senate procedures.

Kelley & Pevehouse 15 [Judith G.\*, Duke Sanford School of Public Policy; AND Jon C.W.\*\*, University of Wisconsin-Madison; International Studies Quarterly (2015); “An Opportunity Cost Theory of US Treaty Behavior,” <https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/12521/isqu12185.pdf?sequence=1>] brett

An Opportunity Costs Theory

Although existing theories about veto players and political ideology explain the fate of some treaties, they leave some questions open. To complement these theories, we draw on economic theory to offer an opportunity cost theory of treaty ratification. In economics, the opportunity cost of a resource refers to the value of the nexthighest-valued alternative use of that resource. Scholars of domestic legislation have applied this concept to the time and resources of individual policymakers (Schiller 1995) but also to the fixed chamber time. For example, Koger refers to “[T]he foregone uses of the same [chamber] time for legislators as individuals as well as for the chamber collectively” (Koger 2010:22). Indeed, the Senate’s chamber time is not only fixed, but also scarce. A vast portion of its time goes to required routine business. This leaves little opportunity for discretionary activities (Walker 1977). Given that international policy matters have to draw on exactly the same remaining discretionary floor time as domestic policy, we argue that the United States sometimes delays or derails treaty ratification simply because political capital and Senate floor time are fixed and entail opportunity costs (Heitshusen 2013:4). As Koger (2010:33) argues more generally for legislation, “The expected gains from making a proposal must exceed the time and effort legislators invest in preparing it, organizing and coalition to support it, and taking the time of the chamber to debate and pass it.”

For a treaty to progress, the opportunity cost logic thus would mean that the net gains of the treaty must outweigh the opportunity costs of the advice and consent process. Thus, if the President or some Senators assign only low political value to a particular treaty or if they believe that passage of the treaty will take a lot of Senate floor time, they may decide that they would rather spend their political capital on other matters. If they think they have to fight a war of attrition to overcome opposition, this cost in terms of time and resources may tip the scales against moving the treaty forward. Under these conditions, the opportunity cost of processing the treaty may be too high for the treaty to gain attention, even if the President or more than the required two-thirds of the Senators think the treaty yields some benefits. As a result, whether or how fast a treaty makes it through the process depends on whether it has sufficient support to pass the constitutional process and on whether its value to politicians outweighs the opportunity cost of their political resources: legislative floor time and political capital.

The Fixed Political Agenda Space and Policy Priorities

Why do treaties incur these opportunity costs? Opportunity costs arise when resources are fixed and fully employed. Political agenda space is such a resource; there are only so many policy priorities a President can promote, and only so much Senate floor time to consider them. The media will pay attention to only so many issues on the Washington agenda. Both the President and the Senate must protect their legislative opportunities. They each face opportunity costs.

For the President, the transmittal process is not simple. If the United States signs an international agreement that falls under Article II of the Constitution, the President must transmit it to the Senate for advice and consent before the United States can ratify it. This process entails an analysis of the implications of the treaty including possible implementation legislation required, and the writing of a transmittal letter that serves as a report to the Senate Foreign Relations Committee (SFRC). Because of these requirements, usually there has to be some push from the White House (Halloran 2011), and this can take precious time away from domestic legislative priorities. Thus, transmittals can be costly, especially in the face of expected opposition. Indeed, in 1995 when President Clinton wanted to transmit the UN Convention on the Rights of the Child to the Senate, Jessie Helms, who chaired the SFRC, and 26 cosponsors introduced a resolution urging him to not transmit the Convention. Such opposition can be distracting or politically harmful for the President. Furthermore, because the President usually endorses the treaty in the transmittal letter, he may incur a reputational cost by transmitting treaties that stall (Krutz and Peake 2009:140). Dealing with treaties thus involves political costs, and withholding transmittal can conserve political capital.

For the Senate, floor time is of the essence. After transmittal, the SFRC must hold a meeting on the treaty, and eventually issue its own analysis and recommendation, and (if it has enough support) pass it out of committee. The treaty then has to be scheduled for debate, possible amendments, and a vote. To gain Senate advice and consent, the treaty must pass with at least a two-thirds majority. Crucial to differentiating the opportunity cost argument from a straight veto player model, the Senate rules for debate and passage enable opponents to increase the time expended on a treaty, even if they do not have the ability to vote it down on the floor. Dealing with a treaty thus ties up the SFRC time, but even more importantly, it could potentially take up scarce discretionary time on the Senate floor. Senators seek to maximize their reputational returns from the issues they spend time on, favoring issues that have broad appeal (Walker 1977:430). Before scheduling a treaty for debate and a vote, the relevant actors therefore have to consider the opportunity cost of dealing with the treaty: What else could the Senate accomplish with that time? Even if the Senate is not being productive in terms of passing legislation, what else does the Senate want to be seen focusing on at that moment? Even if there is strong support for a treaty, Senators may hold back if they anticipate serious and potentially time consuming opposition—opposition that can result in any number of procedural maneuvers that could take up costly time in the Senate. This explains why so few treaties ever take up much floor time for debate. If senators expect them to take time, they do not schedule them.

Thus, both the President and the Senate face opportunity costs of fixed resources: Presidents are concerned with “misusing” political capital and opportunities. The Senators are protective of floor time, or how they are seen to be using their time by a public foremost focused on domestic matters. At the same time, the political benefits of treaty ratification are uncertain. Treaty ratification is often invisible, because the media rarely covers such events and whatever benefits treaties may bring may never be attributed to the treaty advocates directly.

The implication of these political calculations is central to our argument: Contrary to standard assumptions of international relations, the decision to push a treaty through the advice and consent process may be less about an isolated examination of costs and benefits of the treaty itself than about the political benefit of spending time on the treaty relative to the benefit of other possible agenda activity that may produce important domestic legislation such as health-care reform, for example. In other words: Senate advice and consent and, by association, transmittal decisions depends on the associated legislative opportunity cost.

The opportunity cost can manifest itself for many types of treaties. Even nondivisive treaties require some Presidential attention and Senate floor time to move through the process (Johnson 2010), and therefore even these may fall by the wayside, which is of course even more likely to occur if they are not considered particularly vital. More important treaties might also be affected by the opportunity cost, however. Even if opponents might not command the requisite 1/3 of Senators to block the treaty, their willingness to obstruct it (even the threat to do so) may impose such high costs in terms of time that supporters are reluctant to spend time on it when they have many competing priorities. In a time-constrained Senate, minimal winning coalitions that reach supermajority status have become less important. Each piece of legislation must compete with all other legislation and having only a minimum backing can deprioritize legislation on the agenda, slowing it down (Oppenheimer 1985:410). And although the Senate can use a cloture vote to end filibustering and technically should be able to do so easily if the treaty commands two-thirds support, Senators may be reluctant to push for treaties that push these boundaries (for example, by objecting to a unanimous consent request (Heitshusen 2013:4)).

#### ACA prevents Chinese tech supremacy

Kreier 2-4 Freda Kreier, a science journalist who likes to write about the environment, climate and DNA. Freda completed her master's in science communication from UC Santa Cruz at the height of the COVID-19 pandemic. Before becoming a journalist, Freda studied molecular biology at Colorado College (2017). She discovered she had a passion for storytelling while working for a podcast production company in Denver. Her work to date appears in Nature, Science News, The Mercury News, Mongabay and more. She's also worked on the anthropology podcast SAPIENS and radio show Big Picture Science, 2-4-2022, "Huge boost for US science funding inches closer to reality," Nature, [https://www.nature.com/articles/d41586-022-00349-3 //](https://www.nature.com/articles/d41586-022-00349-3%20//) ella

Under pressure COMPETES is the House’s response to a Senate bill, called the US Innovation and Competition Act, that passed in June 2021 and similarly calls for more US science funding and includes provisions to protect foreign governments from benefitting from US research. Both bills will now head to a conference committee, in which lawmakers will reconcile differences between them to create a final version of the legislation As it stands, COMPETES would authorize a more than doubling of the NSF’s budget to about US$18 billion over the next five years, a goal that has long been on the wish list of US researchers. It would also authorize an increase to the budget of the Department of Energy’s (DOE) Office of Science to about $11 billion, which funds the physical sciences in areas such as fusion research. It also directly appropriates $52 billion for semiconductor manufacturing and research and development. Semiconductors are used in everything from cars to smart phones and are a foundational part of the modern world, but have been in short supply in the United States during the COVID-19 pandemic, in part because most are produced outside the country. For many researchers who spoke to Nature, however, the most exciting part of COMPETES is that it promises to alleviate some of the pressures faced by the scientific community. In 2020, only 28% of grant proposals to the NSF were funded. Rita Colwell, a microbiologist at the University of Maryland College Park who headed the NSF between 1998 and 2004, says that far more of the proposals submitted by researchers merit funding than the agency is able to provide. Colwell says that adding money to the NSF’s pool will benefit up-and-coming researchers, who often get passed over. “Right now, we have a lot of bright young people who are scrambling for funding,” Colwell says. “It’s clear to me that doubling the NSF budget is rational, reasonable and much needed.” Promises, promises Still, some are sceptical that the bulk of the funding provided in the bill will ever materialize, pointing to historical precedents. In 2007, US Congress passed similar legislation, signed into law by then-US president George W. Bush, intended to boost US science funding, also called the America COMPETES Act. But most of the promised money never made its way to science agencies. The 2007 economic recession in the United States left Congress scrambling to make cuts to federal funding. Money that had been earmarked for science agencies in the bill but not yet formally appropriated was one casualty. “We should not repeat the error of the 2007 COMPETES legislation, where funding in the name of enhancing US competitiveness was authorized, but never actually appropriated,” says Toby Smith, vice president for science policy and global affairs at the Association of American Universities in Washington, DC. “We need to do more than pay pure lip service to increasing support for US science and innovation. We need to actually do it.” Research security Not all parts of COMPETES are threatened by the ebb and flow of federal budgets. Some provisions are unattached to funding and are instead aimed at reducing the chance of US research benefitting foreign governments such as China’s. COMPETES would ban researchers who receive federal grants from also participating in “malign” talent programmes hosted outside the country. It also proposes lowering the value of foreign gifts that universities must disclose to US agencies from which they are receiving research funds. Stephen Ezell, vice president of Information Technology and Innovation Foundation, a think tank in Washington DC, says that measures such as these are warranted, to avoid technology developed in the United States from ending up in the hands of the Chinese military.

#### Chinese tech supremacy causes nuclear war.

Kroenig 18 [Matthew, Deputy Director for Strategy, Scowcroft Center for Strategy and Security; Associate Professor of Government and Foreign Service, Georgetown University, “Will disruptive technology cause nuclear war?” The Bulletin, 11/12/2018, https://thebulletin.org/2018/11/will-disruptive-technology-cause-nuclear-war/]

Recently, analysts have argued that emerging technologies with military applications may undermine nuclear stability (see here, here, and here), but the logic of these arguments is debatable and overlooks a more straightforward reason why new technology might cause nuclear conflict: by upending the existing balance of power among nuclear-armed states. This latter concern is more probable and dangerous and demands an immediate policy response.

For more than 70 years, the world has avoided major power conflict, and many attribute this era of peace to nuclear weapons. In situations of mutually assured destruction (MAD), neither side has an incentive to start a conflict because doing so will only result in its own annihilation. The key to this model of deterrence is the maintenance of secure second-strike capabilities—the ability to absorb an enemy nuclear attack and respond with a devastating counterattack.

Recently analysts have begun to worry, however, that new strategic military technologies may make it possible for a state to conduct a successful first strike on an enemy. For example, Chinese colleagues have complained to me in Track II dialogues that the United States may decide to launch a sophisticated cyberattack against Chinese nuclear command and control, essentially turning off China’s nuclear forces. Then, Washington will follow up with a massive strike with conventional cruise and hypersonic missiles to destroy China’s nuclear weapons. Finally, if any Chinese forces happen to survive, the United States can simply mop up China’s ragged retaliatory strike with advanced missile defenses. China will be disarmed and US nuclear weapons will still be sitting on the shelf, untouched.

If the United States, or any other state acquires such a first-strike capability, then the logic of MAD would be undermined. Washington may be tempted to launch a nuclear first strike. Or China may choose instead to use its nuclear weapons early in a conflict before they can be wiped out—the so-called “use ‘em or lose ‘em” problem.

According to this logic, therefore, the appropriate policy response would be to ban outright or control any new weapon systems that might threaten second-strike capabilities.

This way of thinking about new technology and stability, however, is open to question. Would any US president truly decide to launch a massive, bolt-out-of-the-blue nuclear attack because he or she thought s/he could get away with it? And why does it make sense for the country in the inferior position, in this case China, to intentionally start a nuclear war that it will almost certainly lose? More important, this conceptualization of how new technology affects stability is too narrow, focused exclusively on how new military technologies might be used against nuclear forces directly.

Rather, we should think more broadly about how new technology might affect global politics, and, for this, it is helpful to turn to scholarly international relations theory. The dominant theory of the causes of war in the academy is the “bargaining model of war.” This theory identifies rapid shifts in the balance of power as a primary cause of conflict.

International politics often presents states with conflicts that they can settle through peaceful bargaining, but when bargaining breaks down, war results. Shifts in the balance of power are problematic because they undermine effective bargaining. After all, why agree to a deal today if your bargaining position will be stronger tomorrow? And, a clear understanding of the military balance of power can contribute to peace. (Why start a war you are likely to lose?) But shifts in the balance of power muddy understandings of which states have the advantage.

You may see where this is going. New technologies threaten to create potentially destabilizing shifts in the balance of power.

For decades, stability in Europe and Asia has been supported by US military power. In recent years, however, the balance of power in Asia has begun to shift, as China has increased its military capabilities. Already, Beijing has become more assertive in the region, claiming contested territory in the South China Sea. And the results of Russia’s military modernization have been on full display in its ongoing intervention in Ukraine.

Moreover, China may have the lead over the United States in emerging technologies that could be decisive for the future of military acquisitions and warfare, including 3D printing, hypersonic missiles, quantum computing, 5G wireless connectivity, and artificial intelligence (AI). And Russian President Vladimir Putin is building new unmanned vehicles while ominously declaring, “Whoever leads in AI will rule the world.”

If China or Russia are able to incorporate new technologies into their militaries before the United States, then this could lead to the kind of rapid shift in the balance of power that often causes war.

If Beijing believes emerging technologies provide it with a newfound, local military advantage over the United States, for example, it may be more willing than previously to initiate conflict over Taiwan. And if Putin thinks new tech has strengthened his hand, he may be more tempted to launch a Ukraine-style invasion of a NATO member.

Either scenario could bring these nuclear powers into direct conflict with the United States, and once nuclear armed states are at war, there is an inherent risk of nuclear conflict through limited nuclear war strategies, nuclear brinkmanship, or simple accident or inadvertent escalation.

This framing of the problem leads to a different set of policy implications. The concern is not simply technologies that threaten to undermine nuclear second-strike capabilities directly, but, rather, any technologies that can result in a meaningful shift in the broader balance of power. And the solution is not to preserve second-strike capabilities, but to preserve prevailing power balances more broadly.

When it comes to new technology, this means that the United States should seek to maintain an innovation edge. Washington should also work with other states, including its nuclear-armed rivals, to develop a new set of arms control and nonproliferation agreements and export controls to deny these newer and potentially destabilizing technologies to potentially hostile states.

These are no easy tasks, but the consequences of Washington losing the race for technological superiority to its autocratic challengers just might mean nuclear Armageddon

# Case

## Debris

### Alt Causes---1NC

#### Alt causes swamp the aff -

#### 1] Mega-constellations of satellites produce unmanageable debris.

Boley & Byers 21 [Aaron C., Department of Physics and Astronomy @ The University of British Columbia\*, and Michael, Department of Political Science @ The University of British Columbia; Published: 20 May 2021; Scientific Reports; “Satellite mega-constellations create risks in Low Earth Orbit, the atmosphere and on Earth,” <https://www.nature.com/articles/s41598-021-89909-7>] brett

Companies are placing satellites into orbit at an unprecedented frequency to build ‘mega-constellations’ of communications satellites in Low Earth Orbit (LEO). In two years, the number of active and defunct satellites in LEO has increased by over 50%, to about 5000 (as of 30 March 2021). SpaceX alone is on track to add 11,000 more as it builds its Starlink mega-constellation and has already filed for permission for another 30,000 satellites with the Federal Communications Commission (FCC)1. Others have similar plans, including OneWeb, Amazon, Telesat, and GW, which is a Chinese state-owned company2. The current governance system for LEO, while slowly changing, is ill-equipped to handle large satellite systems. Here, we outline how applying the consumer electronic model to satellites could lead to multiple tragedies of the commons. Some of these are well known, such as impediments to astronomy and an increased risk of space debris, while others have received insufficient attention, including changes to the chemistry of Earth’s upper atmosphere and increased dangers on Earth’s surface from re-entered debris. The heavy use of certain orbital regions might also result in a de facto exclusion of other actors from them, violating the 1967 Outer Space Treaty. All of these challenges could be addressed in a coordinated manner through multilateral law-making, whether in the United Nations, the Inter-Agency Debris Committee (IADC), or an ad hoc process, rather than in an uncoordinated manner through different national laws. Regardless of the law-making forum, mega-constellations require a shift in perspectives and policies: from looking at single satellites, to evaluating systems of thousands of satellites, and doing so within an understanding of the limitations of Earth’s environment, including its orbits.

Thousands of satellites and 1500 rocket bodies provide considerable mass in LEO, which can break into debris upon collisions, explosions, or degradation in the harsh space environment. Fragmentations increase the cross-section of orbiting material, and with it, the collision probability per time. Eventually, collisions could dominate on-orbit evolution, a situation called the Kessler Syndrome3. There are already over 12,000 trackable debris pieces in LEO, with these being typically 10 cm in diameter or larger. Including sizes down to 1 cm, there are about a million inferred debris pieces, all of which threaten satellites, spacecraft and astronauts due to their orbits crisscrossing at high relative speeds. Simulations of the long-term evolution of debris suggest that LEO is already in the protracted initial stages of the Kessler Syndrome, but that this could be managed through active debris removal4. The addition of satellite mega-constellations and the general proliferation of low-cost satellites in LEO stresses the environment further5,6,7,8.

Results

The overall setting

The rapid development of the space environment through mega-constellations, predominately by the ongoing construction of Starlink, is shown by the cumulative payload distribution function (Fig. 1). From an environmental perspective, the slope change in the distribution function defines NewSpace, an era of dominance by commercial actors. Before 2015, changes in the total on-orbit objects came principally from fragmentations, with effects of the 2007 Chinese anti-satellite test and the 2009 Kosmos-2251/Iridium-33 collisions being evident on the graph.

Figure 1

[Figure 1 omitted]

Cumulative on-orbit distribution functions (all orbits). Deorbited objects are not included. The 2007 and 2009 spikes are a Chinese anti-satellite test and the Iridium 33-Kosmos 2251 collision, respectively. The recent, rapid rise of the orange curve represents NewSpace (see "Methods").

Full size image

Although the volume of space is large, individual satellites and satellite systems have specific functions, with associated altitudes and inclinations (Fig. 2). This increases congestion and requires active management for station keeping and collision avoidance9, with automatic collision-avoidance technology still under development. Improved space situational awareness is required, with data from operators as well as ground- and space-based sensors being widely and freely shared10. Improved communications between satellite operators are also necessary: in 2019, the European Space Agency moved an Earth observation satellite to avoid colliding with a Starlink satellite, after failing to reach SpaceX by e-mail. Internationally adopted ‘right of way’ rules are needed10 to prevent games of ‘chicken’, as companies seek to preserve thruster fuel and avoid service interruptions. SpaceX and NASA recently announced11 a cooperative agreement to help reduce the risk of collisions, but this is only one operator and one agency.

Figure 2

[Figure 2 omitted]

Orbital distribution and density information for objects in Low Earth Orbit (LEO). (Left) Distribution of payloads (active and defunct satellites), binned to the nearest 1 km in altitude and 1° in orbital inclination. The centre of each circle represents the position on the diagram, and the size of the circle is proportional to the number of satellites within the given parameter space. (Right) Number density of different space resident objects (SROs) based on 1 km radial bins, averaged over the entire sky. Because SRO objects are on elliptical orbits, the contribution of a given object to an orbital shell is weighted by the time that object spends in the shell. Despite significant parameter space, satellites are clustered in their orbits due to mission requirements. The emerging Starlink cluster at 550 km and 55° inclination is already evident in both plots (Left and Right).

Full size image

When completed, Starlink will include about as many satellites as there are trackable debris pieces today, while its total mass will equal all the mass currently in LEO—over 3000 tonnes. The satellites will be placed in narrow orbital shells, creating unprecedented congestion, with 1258 already in orbit (as of 30 March 2021). OneWeb has already placed an initial 146 satellites, and Amazon, Telesat, GW and other companies, operating under different national regulatory regimes, are soon likely to follow.

Enhanced collision risk

Mega-constellations are composed of mass-produced satellites with few backup systems. This consumer electronic model allows for short upgrade cycles and rapid expansions of capabilities, but also considerable discarded equipment. SpaceX will actively de-orbit its satellites at the end of their 5–6-year operational lives. However, this process takes 6 months, so roughly 10% will be de-orbiting at any time. If other companies do likewise, thousands of de-orbiting satellites will be slowly passing through the same congested space, posing collision risks. Failures will increase these numbers, although the long-term failure rate is difficult to project. Figure 3 is similar to the righthand portion of Fig. 2 but includes the Starlink and OneWeb mega-constellations as filed (and amended) with the FCC (see “Methods”). The large density spikes show that some shells will have satellite number densities in excess of n=10−6 km−3.

Figure 3

[Figure 3 omitted]

Satellite density distribution in LEO with the Starlink and OneWeb mega-constellations as filed (and amended) with the FCC. Provided that the orbits are nearly circular, the number densities in those shells will exceed 10–6 km−3. Because the collisional cross-section in those shells is also high, they represent regions that have a high collision risk whenever debris is too small to be tracked or collision avoidance manoeuvres are impossible for other reasons.

Full size image

Deorbiting satellites will be tracked and operational satellites can manoeuvre to avoid close conjunctions. However, this depends on ongoing communication and cooperation between operators, which at present is ad hoc and voluntary. A recent letter12 to the FCC from SpaceX suggests that some companies might be less-than-fully transparent about events13 in LEO.

Despite the congestion and traffic management challenges, FCC filings by SpaceX suggest that collision avoidance manoeuvres can in fact maintain collision-free operations in orbital shells and that the probability of a collision between a non-responsive satellite and tracked debris is negligible. However, the filings do not account for untracked debris6, including untracked debris decaying through the shells used by Starlink. Using simple estimates (see “Methods”), the probability that a single piece of untracked debris will hit any satellite in the Starlink 550 km shell is about 0.003 after one year. Thus, if at any time there are 230 pieces of untracked debris decaying through the 550 km orbital shell, there is a 50% chance that there will be one or more collisions between satellites in the shell and the debris. As discussed further in “Methods”, such a situation is plausible. Depending on the balance between the de-orbit and the collision rates, if subsequent fragmentation events lead to similar amounts of debris within that orbital shell, a runaway cascade of collisions could occur.

Fragmentation events are not confined to their local orbits, either. The India 2019 ASAT test was conducted at an altitude below 300 km in an effort to minimize long-lived debris. Nevertheless, debris was placed on orbits with apogees in excess of 1000 km. As of 30 March 2021, three tracked debris pieces remain in orbit14. Such long-lived debris has high eccentricities, and thus can cross multiple orbital shells twice per orbit. A major fragmentation event from a single satellite could affect all operators in LEO.

Even if debris collisions were avoidable, meteoroids are always a threat. The cumulative meteoroid flux15 for masses m > 10–2 g is about 1.2 × 10–4 meteoroids m−2 year−1 (see “Methods”). Such masses could cause non-negligible damage to satellites16. Assuming a Starlink constellation of 12,000 satellites (i.e. the initial phase), there is about a 50% chance of 15 or more meteoroid impacts per year at m > 10–2 g. Satellites will have shielding, but events that might be rare to a single satellite could become common across the constellation.

One partial response to these congestion and collision concerns is for operators to construct mega-constellations out of a smaller number of satellites. But this does not, individually or collectively, eliminate the need for an all-of-LEO approach to evaluating the effects of the construction and maintenance of any one constellation.

#### 2] Solar storms.

Wild 15 (Jim Wild, Professor of Space Physics at Lancaster University, “With So Much Vested In Satellites, Solar Storms Could Bring Life To A Standstill,” July 30, 2015, https://theconversation.com/with-so-much-vested-in-satellites-solar-storms-could-bring-life-to-a-standstill-45204)

These can disrupt satellite operations by depositing electrical charge within the on-board electronics, triggering phantom commands or overloading and damaging sensitive components. The effects of space weather on the Earth’s upper atmosphere disrupts radio signals transmitted by navigation satellites, potentially introducing positioning errors or, in more severe cases, rendering them unusable.

These are not theoretical hazards: in recent decades, solar storms have caused outages for a number of satellites services – and a handful of satellites have been lost altogether. These were costly events – satellite operator losses have run into hundreds of millions of dollars. The wider social and economic impact was relatively limited, but even so it’s unclear how our growing amount of space infrastructure would fare against the more extreme space weather that we might face.

When Space Weather Becomes A Hurricane

The largest solar storm on record was the Carrington event in September 1859, named after the British astronomer who observed it. Of course there were no Victorian satellites to suffer the consequences, but the telegraph systems of the time were crippled as electrical currents induced in the copper wires interfered with signals, electrocuted operators and set telegraph paper alight. The geomagnetic storm it triggered was so intense that the northern lights, usually a polar phenomenon, were observed as far south as the Bahamas.

Statistical analysis of this and other severe solar storms suggests that we can expect an event of this magnitude once every few hundred years – it’s a question of “when” rather than “if”. A 2007 study estimated a Carrington event today would cause US$30 billion in losses for satellite operators and threaten vital infrastructure in space and here on the ground. It’s a risk taken sufficiently seriously that it appears on the UK National Risk Register and has led the government to draw up its preparedness programme.

#### 3] EMP attacks.

Graham 19 (William Graham, Chairman of the Congressional EMP Commission, White House Science Advisor to President Reagan, Ambassador R. James Woolsey, CIA Director and Senior Advisor to the Congressional EMP Commission, and Peter Vincent Pry, Chief of Staff of the Congressional EMP Commission, Served on the Staffs of the House Armed Services Committee and the CIA, “The EMP Executive Order — Where Were Bush and Obama?” The National Review. May 3, 2019. <https://www.nationalreview.com/2019/05/emp-executive-order-trump-administration-takes-threat-seriously/>) [language modified]

A threat that could literally mean the end of civilization is finally getting the attention it needs under Trump.

Washington and the press call almost everything an “existential threat” these days. But the threat from a natural or man-made electromagnetic pulse (EMP) really is one, as our congressional commission reported in 2017:

The critical national infrastructure in the United States faces a present and continuing existential threat from combined-arms warfare, including cyber and manmade electromagnetic pulse (EMP) attack, as well as EMP from a solar superstorm. During the Cold War, the U.S. was primarily concerned about an EMP attack generated by a high-altitude nuclear weapon as a tactic by which the Soviet Union could suppress the U.S. national command authority and the ability to respond to a nuclear attack — and thus negate the deterrence value of assured nuclear retaliation. Within the last decade, newly-armed adversaries, including North Korea, have been developing the ability and threatening to carry out an EMP attack against the United States.

The bottom line:

Such an attack would give countries that have only a small number of nuclear weapons the ability to cause widespread, long-lasting damage to critical national infrastructures, to the United States itself as a viable country, and to the survival of a majority of its population.

The EMP Commission warns that potential adversaries are developing a revolutionary new way of warfare combining cyber-attacks, sabotage, and nuclear EMP attack against national electric grids and other critical infrastructures to achieve quick and decisive victory:

Combined-Arms Cyber Warfare, as planned by Russia, China, North Korea, and Iran, may use combinations of cyber-, sabotage-, and ultimately nuclear EMP-attack to impair the United States quickly and decisively by blacking-out large portions of its electric grid and other critical infrastructures. Foreign adversaries may also consider nuclear EMP attack as the ultimate cyber “denial of service” weapon, one which can gravely damage the U.S. by striking at its technological Achilles’ heel, without having to engage the U.S. military. . . .

The synergism of such combined-arms is described in the military doctrines of all these potential adversaries as the greatest Revolution in Military Affairs (RMA) in history — one which anticipates rendering obsolete many, if not all, traditional instruments of military power.

Alarmingly, in the military doctrines of potential adversaries, nuclear EMP attack is considered a dimension of cyber warfare, because EMP is not directly injurious to people, only to electronics. High-altitude EMP attack entails exo-atmospheric detonation (30 to 500 kilometers high), so none of the blast, fire, radiation, radioactive fallout, or other effects associated with a nuclear attack on a city would occur — only the EMP.

Yet EMP, like a super-energetic radio wave that can destroy all kinds of electronics across a region as vast as North America with a single weapon, could in the long run kill far more Americans through its indirect effects than nuclear bombing of a city. Fatalities estimated from a protracted nationwide blackout lasting one year range from 67 to 90 percent of the U.S. population, due to starvation, disease, and societal collapse.

The EMP Commission tried, but could not figure out a way to keep 328 million Americans alive for a year without food and water. In 1880, just before the invention of the first electric grid in 1882, and long before the advent of our high-tech electronic civilization, the U.S. population was about 50 million, sustained by horse-drawn, coal-fired, and mechanical critical infrastructures that no longer exist.

Nuclear deterrence may not prevent an EMP attack, which can be executed anonymously using a balloon or a private jet or by doing a zoom-climb, with a short-range missile launched off a freighter (as practiced by Iran), or by satellite (as practiced by North Korea). Retaliatory threats are credible only if you know who attacked.

EMP also [destroys] ~~blinds~~, at the speed of light, satellites, radars, and other National Technical Means used for threat assessment and identifying attackers. Super-EMP weapons now possessed by Russia, China, and probably North Korea could generate 100,000 volts/meter or more, greatly exceeding the U.S. military hardening standard (50,000 volts/meter) and potentially [undermining] ~~paralyzing~~ U.S. nuclear and conventional retaliatory capabilities.

### AT: Kessler---1NC

#### Kessler syndrome is a process not an event---timeframe is decades and intervening actors check.

Burns Interviewing Kessler **’**13 Corrinne Burns, interviewing Donald Kessler, who made up the concept. [Space junk apocalypse: just like Gravity? 11-15-2013, https://www.theguardian.com/science/blog/2013/nov/15/space-junk-apocalypse-gravity]//BPS

Now? Are we in trouble? Not yet. Kessler syndrome isn't an acute phenomenon, as depicted in the movie – it's a slow, decades-long process. "It'll happen throughout the next 100 years – we have time to deal with it," Kessler says. "The time between collisions will become shorter – it's around 10 years at the moment. In 20 years' time, the time between collisions could be reduced to five years." Fortunately, communications satellites are, in the main, situated high up in geosynchronous orbit (GEO), whereas the risk of collisions lies mainly in the much lower, and more crowded, low Earth orbit (LEO). But that doesn't mean we can relax. "We've got to get a handle on it – we need to prevent the cascade process from speeding up." And the only way to do that is, he says, to begin actively removing junk from space. Charlotte Bewick agrees. She's a mission concepts engineer with the German space technology company OHB System, with special expertise in space junk – specifically, how we can capture it and bring it back to Earth. While agreeing with Kessler that the movie scenario is exaggerated, she remains concerned. "Fragments of junk can naturally re-enter the atmosphere [and so be removed from orbit]. But we're at the stage where the rate of creation of new debris fragments is higher than the rate of natural removal. The orbits most at risk harbour important space assets – satellites for weather forecasting, oil spill and bush fire detection, and polar ice monitoring." Bewick highlights the case of Envisat, a defunct 8,000kg spacecraft circling Earth in an orbit that is very popular with space agencies and, hence, pretty crowded. "If Envisat collides with a piece of debris or a micrometeorite, the fragments could render the whole orbital region unusable." So can we get the junk down, I asked Massimiliano Vasile, part of the Mechanical & Aerospace Department at the University of Strathclyde and co-ordinator of the Stardust network. He told me defunct satellites in the high GEO region have, for some time, been shifted to higher "graveyard orbits" to keep them out of the way. But that's not an option for items in low Earth orbit. For this, he tells me, researchers are looking seriously into active debris removal – in-orbit capture techniques like harpooning, netting and tethering, the use of contactless systems like ion-beams or lasers, and even onboard robotics to position the junk away from high-risk orbital regions. As for middle Earth orbit – well, ideas are welcome, he says. We're in no immediate danger from Kessler syndrome – but it's not a problem that's going away. Despite Gravity's artistic license, Donald Kessler is pleased to see the phenomenon represented on the big screen. "It is very improbable that events would play out as they did in the film," he says. "But if it raises awareness, then that's great."

#### Tracking systems solves space dust.

**Mosher** **’19** [Dave; September 3rd; Journalist with more than a decade of experience reporting and writing stories about space, science, and technology; Business Insider, “Satellite collisions may trigger a space-junk disaster that could end human access to orbit. Here’s How,” <https://www.usafa.edu/app/uploads/Space_and_Defense_2_3.pdf>; GR]

The Kessler syndrome plays center-stage in the movie "Gravity," in which an accidental space collision endangers a crew aboard a large space station. But Gossner said that type of a runaway space-junk catastrophe is unlikely. "Right now I don't think we're close to that," he said. "I'm not saying we couldn't get there, and I'm not saying we don't need to be smart and manage the problem. But I don't see it ever becoming, anytime soon, an unmanageable problem." There is no current system to remove old satellites or sweep up bits of debris in order to prevent a Kessler event. Instead, space debris is monitored from Earth, and new rules require satellites in low-Earth orbit be deorbited after 25 years so they don't wind up adding more space junk. "Our current plan is to manage the problem and not let it get that far," Gossner said. "I don't think that we're even close to needing to actively remove stuff. There's lots of research being done on that, and maybe some day that will happen, but I think that — at this point, and in my humble opinion — an unnecessary expense." A major part of the effort to prevent a Kessler event is the Space Surveillance Network (SSN). The project, led by the US military, uses 30 different systems around the world to identify, track, and share information about objects in space. Many objects are tracked day and night via a networkof radar observatories around the globe. Optical telescopes on the ground also keep an eye out, but they aren't always run by the government. "The commercial sector is actually putting up lots and lots of telescopes," Gossner said. The government pays for their debris-tracking services. Gossner said one major debris-tracking company is called Exoanalytic. It uses about 150 small telescopes set up around the globe to detect, track, and report space debris to the SSN. Telescopes in space track debris, too. Far less is known about them because they're likely top-secret military satellites. Objects detected by the government and companies get added to a catalog of space debris and checked against the orbits of other known bits of space junk. New orbits are calculated with supercomputers to see if there's a chance of any collisions. Diana McKissock, a flight lead with the US Air Force's 18th Space Control Squadron, helps track space debris for the SSN. She said the surveillance network issues warnings to NASA, satellite companies, and other groups with spacecraft, based on two levels of emergency: basic and advanced. The SSN issues a basic emergency report to the public three days ahead of a 1-in-10,000 chance of a collision. It then provides multiple updates per day until the risk of a collision passes. To qualify for such reporting, a rogue object must come within a certain distance of another object. In low-Earth orbit, that distance must be less than 1 kilometer (0.62 mile); farther out in deep space, where the precision of orbits is less reliable, the distance is less than 5 kilometers (3.1 miles). Advanced emergency reports help satellite providers see possible collisions much more than three days ahead. "In 2017, we provided data for 308,984 events, of which only 655 were emergency-reportable," McKissock told Business Insider in an email. Of those, 579 events were in low-Earth orbit (where it's relatively crowded with satellites).

### AT Climate

#### Their “solves warming” ev is abt how satellites help us adapt to the EFFECTS of climate change rather than REDUCING EMISSIONS at the source. That fails -- here’s their impact ev to the warming scenario:

1AC Klein 14[(Naomi Klein, award-winning journalist, syndicated columnist, former Miliband Fellow at the London School of Economics, member of the board of directors of 350.org), *This Changes Everything: Capitalism vs. the Climate*, pp. 12-14]

“we’re on track to a 4-C warmer world [by century’s end] marked by extreme heat waves, declining global food stocks, loss of ecosystems and biodiversity, and life-threatening sea level rise.” And the report cautioned that, “there is also no certainty that adaptation to a 4-C world is possible.”

#### Only solving emissions at their source solves -- asteroid mining does that best:

#### Commercial mining solves adaptation better

Pelton 17—(Director Emeritus of the Space and Advanced Communications Research Institute at George Washington University, PHD in IR from Georgetown). Pelton, Joseph N. 2017. The New Gold Rush: The Riches of Space Beckon! Springer. Accessed 8/30/19.

Are We Humans Doomed to Extinction? What will we do when Earth’s resources are used up by humanity? The world is now hugely over populated, with billions and billions crammed into our overcrowded cities. By 2050, we may be 9 billion strong, and by 2100 well over 11 billion people on Planet Earth. Some at the United Nations say we might even be an amazing 12 billion crawling around this small globe. And over 80 % of us will be living in congested cities. These cities will be ever more vulnerable to terrorist attack, natural disaster, and other plights that come with overcrowding and a dearth of jobs that will be fueled by rapid automation and the rise of artifi cial intelligence across the global economy. We are already rapidly running out of water and minerals. Climate change is threatening our very existence. Political leaders and even the Pope have cautioned us against inaction. Perhaps the naysayers are right. All humanity is at tremendous risk. Is there no hope for the future? This book is about hope. We think that there is literally heavenly hope for humanity. But we are not talking here about divine intervention. We are envisioning a new space economy that recognizes that there is more water in the skies that all our oceans. Th ere is a new wealth of natural resources and clean energy in the reaches of outer space—more than most of us could ever dream possible. There are those that say why waste money on outer space when we have severe problems here at home? Going into space is not a waste of money. It is our future. It is our hope for new jobs and resources. The great challenge of our times is to reverse public thinking to see space not as a resource drain but as the doorway to opportunity. The new space frontier can literally open up a “gold rush in the skies.” In brief, we think there is new hope for humanity. We see a new a pathway to the future via new ventures in space. For too long, space programs have been seen as a money pit. In the process, we have overlooked the great abundance available to us in the skies above. It is important to recognize there is already the beginning of a new gold rush in space—a pathway to astral abundance. “New Space” is a term increasingly used to describe radical new commercial space initiatives—many of which have come from Silicon Valley and often with backing from the group of entrepreneurs known popularly as the “space billionaires.” New space is revolutionizing the space industry with lower cost space transportation and space systems that represent significant cost savings and new technological breakthroughs. “New Commercial Space” and the “New Space Economy” represent more than a new way of looking at outer space. These new pathways to the stars could prove vital to human survival. If one does not believe in spending money to probe the mysteries of the universe then perhaps we can try what might be called “calibrated greed” on for size. One only needs to go to a cubesat workshop, or to Silicon Valley or one of many conferences like the “Disrupt Space” event in Bremen, Germany, held in April 2016 to recognize that entrepreneurial New Space initiatives are changing everything [ 1 ]. In fact, the very nature and dimensions of what outer space activities are today have changed forever. It is no longer your grandfather’s concept of outer space that was once dominated by the big national space agencies. The entrepreneurs are taking over. The hopeful statements in this book and the hard economic and technical data that backs them up are more than a minority opinion. It is a topic of growing interest at the World Economic Forum, where business and political heavyweights meet in Davos, Switzerland, to discuss how to stimulate new patterns of global economic growth. It is even the growing view of a group that call themselves “space ethicists.” Here is how Christopher J. Newman, at the University of Sunderland in the United Kingdom has put it: Space ethicists have offered the view that space exploration is not only desirable; it is a duty that we, as a species, must undertake in order to secure the survival of humanity over the longer term. Expanding both the resource base and, eventually, the habitats available for humanity means that any expenditure on space exploration, far from being viewed as frivolous, can legitimately be rationalized as an ethical investment choice. (Newman) On the other hand there are space ethicists and space exobiologists who argue that humans have created ecological ruin on the planet—and now space debris is starting to pollute space. Th ese countervailing thoughts by the “no growth” camp of space ethicists say we have no right to colonize other planets or to mine the Moon and asteroids—or at least no right to do so until we can prove we can sustain life here on Earth for the longer term. However, for most who are planning for the new space economy the opinion of space philosophers doesn’t really fl oat their boat. Legislators, bankers, and aspiring space entrepreneurs are far more interested in the views of the super-rich capitalists called the space billionaires. A number of these billionaires and space executives have already put some very serious money into enterprises intent on creating a new pathway to the stars. No less than five billionaires with established space ventures—Elon Musk, Paul Allen, Jeff Bezos, Sir Richard Branson, and Robert Bigelow—have invested millions if not billions of dollars into commercializing space. They are developing new technologies and establishing space enterprises that can bring the wealth of outer space down to Earth. This is not a pipe dream, but will increasingly be the economic reality of the 2020s. These wealthy space entrepreneurs see major new economic opportunities. To them space represents the last great frontier for enterprising pioneers. Th us they see an ever-expanding space frontier that offers opportunities in low-cost space transportation, satellite solar power satellites to produce clean energy 24h a day, space mining, space manufacturing and production, and eventually space habitats and colonies as a trajectory to a better human future. Some even more visionary thinkers envision the possibility of terraforming Mars, or creating new structures in space to protect our planet from cosmic hazards and even raising Earth’s orbit to escape the rising heat levels of the Sun in millennia to come. Some, of course, will say this is sci-fi hogwash. It can’t be done. We say that this is what people would have said in 1900 about airplanes, rocket ships, cell phones and nuclear devices. The skeptics laughed at Columbus and his plan to sail across the oceans to discover new worlds. When Thomas Jefferson bought the Louisiana Purchase from France or Seward bought Alaska, there were plenty of naysayers that said such investment in the unknown was an extravagant waste of money. A healthy skepticism is useful and can play a role in economic and business success. Before one dismisses the idea of an impending major new space economy and a new gold rush, it might useful to see what has already transpired in space development in just the past five decades. The world’s first geosynchronous communications satellite had a throughput capability of about 500 kb / s. In contrast, today’s state of the art Viasat 2 —a half century later— has an impressive throughput of some 140 Gb/s. Th is means that the relative throughput is nearly 300,000 greater, while its lifetime is some ten times longer (Figs. 1.1 and 1.2 ). Each new generation of communications satellite has had more power, better antenna systems, improved pointing and stabilization, and an extended lifetime. And the capabilities represented by remote sensing satellites , meteorological satellites , and navigation and timing satellites have also expanded their capabilities and performance in an impressive manner. When satellite applications first started, the market was measured in millions of dollars. Today commercial satellite services exceed a quarter of a billion dollars. Vital services such as the Internet, aircraft traffi c control and management, international banking, search and rescue and much, much more depend on application satellites. Th ose that would doubt the importance of satellites to the global economy might wish to view on You Tube the video “If Th ere Were a Day Without Satellites?” [ 2 ]. Let’s check in on what some of those very rich and smart guys think about the new space economy and its potential. (We are sorry to say that so far there are no female space billionaires, but surely this, too, will come someday soon.) Of course this twenty-fi rst century breakthrough that we call the New Space economy will not come just from new space commerce. It will also come from the amazing new technologies here on Earth. Vital new terrestrial technologies will accompany this cosmic journey into tomorrow. Information technology, robotics, artificial intelligence and commercial space travel systems have now set us on a course to allow us humans to harvest the amazing riches in the skies—new natural resources, new energy, and even totally new ways of looking at the purpose of human existence. If we pursue this course steadfastly, it can be the beginning of a New Space renaissance. But if we don’t seek to realize our ultimate destiny in space, Homo sapiens can end up in the dustbin of history—just like literally millions of already failed species. In each and every one of the five mass extinction events that have occurred over the last 1.5 billion years on Earth, some 50–80 % of all species have gone the way of the T. Rex, the woolly mammoth, and the Dodo bird along with extinct ferns, grasses and cacti. On the other hand, the best days of the human race could be just beginning. If we are smart about how we go about discovering and using these riches in the skies and applying the best of our new technologies, it could be the start of a new beginning for humanity. Konstantin Tsiokovsky, the Russian astronautics pioneer, who fi rst conceived of practical designs for spaceships, famously said: “A planet is the cradle of mankind, but one cannot live in a cradle forever.” Well before Tsiokovsky another genius, Leonardo da Vinci, said, quite poetically: “Once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return.” The founder of the X-Prize and of Planetary Resources, Inc., Dr. Peter Diamandis, has much more brashly said much the same thing in quite diff erent words when he said: “The meek shall inherit the Earth. The rest of us will go to Mars.” The New Space Billionaires Peter Diamandis is not alone in his thinking. From the list of “visionaries” quoted earlier, Elon Musk, the founder of SpaceX; Sir Richard Branson, the founder of Virgin Galactic; and Paul Allen, the co-founder of Microsoft and the man who financed SpaceShipOne, the world’s first successful spaceplane have all said the future will include a vibrant new space economy. Th ey, and others, have said that we can, we should and we soon shall go into space and realize the bounty that it can offer to us. Th e New Space enterprise is today indeed being led by those so-called space billionaires , who have an exciting vision of the future. They and others in the commercial space economy believe that the exploitation of outer space may open up a new golden age of astral abundance. They see outer space as a new frontier that can be a great source of new materials, energy and various forms of new wealth that might even save us from excesses of the past. Th is gold rush in the skies represents a new beginning. We are not talking about expensive new space ventures funded by NASA or other space agencies in Europe, Japan, China or India. No, these eff orts which we and others call New Space are today being forged by imaginative and resourceful commercial entrepreneurs. Th ese twenty-fi rst century visionaries have the fortitude and zeal to look to the abundance above. New breakthroughs in technology and New Space enterprises may be able to create an “astral life raft” for humanity. Just as Columbus and the Vikings had the imaginative drive that led them to discover the riches of a new world, we now have a cadre of space billionaires that are now leading us into this New Space era of tomorrow. These bold leaders, such as Paul Allen and Sir Richard Branson, plus other space entrepreneurs including Jeff Bezos of Amazon and Blue Origin, and Robert Bigelow, Chairman of Budget Suites and Bigelow Aerospace, not only dream of their future in the space industry but also have billions of dollars in assets. These are the bright stars of an entirely new industry that are leading us into the age of New Space commerce. These space billionaires, each in their own way, are proponents of a new age of astral abundance. Each of them is launching new commercial space industries. They are literally transforming our vision of tomorrow. These new types of entrepreneurial aerospace companies—the New Space enterprises—give new hope and new promise of transforming our world as we know it today. The New Space Frontier What happens in space in the next few decades, plus corresponding new information technologies and advanced robotics, will change our world forever. These changes will redefi ne wealth, change our views of work and employment and upend almost everything we think we know about economics, wealth, jobs, and politics. Th ese changes are about truly disruptive technologies of the most fundamental kinds. If you thought the Internet, smart phones, and spandex were disruptive technologies, just hang on. You have not seen anything yet. In short, if you want to understand a transition more fundamental than the changes brought to the twentieth century world by computers, communications and the Internet, then read this book. There are truly riches in the skies. Near-Earth asteroids largely composed of platinum and rare earth metals have an incredible value. Helium-3 isotopes accessible in outer space could provide clean and abundant energy. There is far more water in outer space than is in our oceans. In the pages that follow we will explain the potential for a cosmic shift in our global economy, our ecology, and our commercial and legal systems. These can take place by the end of this century. And if these changes do not take place we will be in trouble. Our conventional petro-chemical energy systems will fail us economically and eventually blanket us with a hydrocarbon haze of smog that will threaten our health and our very survival. Our rare precious metals that we need for modern electronic appliances will skyrocket in price, and the struggle between “haves” and “have nots” will grow increasingly ugly. A lack of affordable and readily available water, natural resources, food, health care and medical supplies, plus systematic threats to urban security and systemic warfare are the alternatives to astral abundance. The choices between astral abundance and a downward spiral in global standards of living are stark. Within the next few decades these problems will be increasingly real. By then the world may almost be begging for new, out of- the-box thinking. International peace and security will be an indispensable prerequisite for exploitation of astral abundance, as will good government for all. No one nation can be rich and secure when everyone else is poor and insecure. In short, global space security and strategic space defense, mediated by global space agreements, are part of this new pathway to the future.

#### Asteroid mining solves emissions from terrestrial platinum mining---independently solves warming.

MIT Review 18 Emerging Technology [Our mission is to bring about better-informed and more conscious decisions about technology through authoritative, influential, and trustworthy journalism.], 10-19-2018, "Asteroid mining might actually be better for the environment," MIT Technology Review, <https://www.technologyreview.com/2018/10/19/139664/asteroid-mining-might-actually-be-better-for-the-environment/> // ella

For a certain kind of investor, asteroid mining is a path to untold riches. Astronomers have long known that asteroids are rich in otherwise scarce resources such as platinum and water. So an obvious idea is to mine this stuff and return it to Earth—or, in the case of water, to a moon base or Earth-orbiting space station. There is no shortage of interest in these ventures. In the last decade, investors have funded half a dozen companies that have set their sights on various nearby rocks. To many observers, it’s only a matter of time before such a mission gets the green light. But profit margins are only part of the picture. A potentially more significant aspect of these missions is the impact they will have on Earth’s environment. But nobody has assessed this environmental impact in detail. Today, that changes thanks to the work of Andreas Hein and colleagues at the University of Paris-Saclay in France. These guys have calculated the greenhouse-gas emissions from asteroid-mining operations and compared them with the emissions from similar Earth-based activities. Their results provide some eyebrow-raising insights into the benefits that asteroid mining might provide. The calculations are relatively straightforward. Rocket launches release significant amounts of greenhouse gases into the atmosphere. The fuel on board the first stage of a rocket burns in Earth’s atmosphere to form carbon dioxide. For kerosene-burning rockets, one kilogram of fuel creates three kilograms of CO2. (The second and third stages operate outside the Earth’s atmosphere and so can be ignored.) Reentries are just as damaging. That’s because a significant mass of a re-entering vehicle ablates in the upper atmosphere, producing NOx such as nitrous oxide (N2O), a greenhouse gas that is about 300 times more potent than CO2. By one estimate, the space shuttle released about 20% of its mass in the form of N2O every time it returned to Earth. Hein and co use these numbers to calculate that a kilogram of platinum mined from an asteroid would release some 150 kilograms of CO2 into Earth’s atmosphere. However, economies of scale from large asteroid-mining operations could lower this to about 60 kilograms of CO2 per kilogram of platinum. That needs to be compared with the emission from Earth-based mining. Here, platinum mining generates significant greenhouse gases, mostly from the energy it takes to remove this stuff from the ground. Indeed, the numbers are huge. The mining industry estimates that producing one kilogram of platinum on Earth releases around 40,000 kilograms of carbon dioxide. “The global warming effect of Earth-based mining is several orders of magnitude larger,” say Hein and co. The figures for water are also encouraging. In this case, the authors calculate the greenhouse-gas emissions from an asteroid-mining operation that returns water to anywhere within the moon’s orbit, a so-called cis-lunar orbit. They compare this to the emissions from sending the same volume of water from Earth into orbit. The big difference is that a water-carrying vehicle from Earth can haul only a small percentage of its mass as water. But an asteroid-mining spacecraft can transport a significant multiple of its mass as water to cis-lunar orbit. “Substantial savings in greenhouse gas emissions can be achieved,” say Hein and co.

#### Independently, the dust itself is good: it shields the earth from warming and buys us time.

Choi 12 Charles Q. Choi [a contributing writer for Space.com and Live Science. He covers all things human origins and astronomy as well as physics, animals and general science topics. Charles has a Master of Arts degree from the University of Missouri-Columbia, School of Journalism and a Bachelor of Arts degree from the University of South Florida. Charles has visited every continent on Earth, drinking rancid yak butter tea in Lhasa, snorkeling with sea lions in the Galapagos and even climbing an iceberg in Antarctica], 9-28-2012, "Asteroid Dust Could Fight Climate Change on Earth," Space, [https://www.space.com/17830-asteroid-dust-geoenineering-global-warming.html //](https://www.space.com/17830-asteroid-dust-geoenineering-global-warming.html%20//) ella

To combat global warming, scientists in Scotland now suggest an out-of-this-world solution — a giant dust cloud in space, blasted off an asteroid, which would act like a sunshade for Earth. The world is warming and the climate is changing. Although many want to prevent these shifts by reducing emissions of greenhouse gases that trap heat from the sun, some controversially suggest deliberating manipulating the planet's climate with large-scale engineering projects, commonly called geoengineering. Instead of altering the climate by targeting either the oceans or the atmosphere, some researchers have suggested geoengineering projects that would affect the entire planet from space. For instance, projects that reduced the amount of solar radiation Earth receives by 1.7 percent could offset the effects of a global increase in temperature of 3.6 degrees F (2 degrees C). The United Nations' Intergovernmental Panel on Climate Change (IPCC) has noted climate models suggest average global temperatures will likely rise by 2 to 11.5 degrees F (1.1 to 6.4 degrees C) by the end of this century. "A 1.7 percent reduction is very small and will hardly be noticeable on Earth," said researcher Russell Bewick, a space scientist at the University of Strathclyde in Scotland. "People sometimes get the idea of giant screens blocking the entire sun. This is not the case ... as [the device] is constantly between the sun and the Earth, it acts merely as a very light shade or filter." Shading Earth One proposal to shade the Earth from the sun would place giant mirrors in space. The main problem with this concept is the immense cost and effort needed either to build and launch such reflectors or to construct them in outer space — the current cost to launch an object into low Earth orbit runs into thousands of dollars per pound. Another would use blankets of dust to blot out the sun, just as clouds do for Earth. These offer the virtue of simplicity compared with mirrors, but run the risk of getting dispersed over time by solar radiation and the gravitational pull of the sun, moon and planets. Now instead of having a dust cloud floating by itself in space, researchers suggest an asteroid could essentially gravitationally anchor a dust cloud in space to block sunlight and cool the Earth. "I would like to make it clear that I would never suggest geoengineering in place of reducing our carbon emissions," Bewick told LiveScience. Instead, he said, "We can buy time to find a lasting solution to combat Earth’s climate change. The dust cloud is not a permanent cure, but it could offset the effects of climate change for a given time to allow slow-acting measures like carbon capture to take effect."

### AT: War---1NC

#### Kessler induces restraint, not war.

Bowen 18 [Bleddyn, Lecturer in International Relations at the University of Leicester; ELN; 20 Februrary 2018; “The Art of Space Deterrence,” <https://www.europeanleadershipnetwork.org/commentary/the-art-of-space-deterrence/>] brett

Fourth, the ubiquity of space infrastructure and the fragility of the space environment may create a degree of existential deterrence. As space is so useful to modern economies and military forces, a large-scale disruption of space infrastructure may be so intuitively escalatory to decision-makers that there may be a natural caution against a wholesale assault on a state’s entire space capabilities because the consequences of doing so approach the mentalities of total war, or nuclear responses if a society begins tearing itself apart because of the collapse of optimised energy grids and just-in-time supply chains. In addition, the problem of space debris and the political-legal hurdles to conducting debris clean-up operations mean that even a handful of explosive events in space can render a region of Earth orbit unusable for everyone. This could caution a country like China from excessive kinetic intercept missions because its own military and economy is increasingly reliant on outer space, but perhaps not a country like North Korea which does not rely on space. The usefulness, sensitivity, and fragility of space may have some existential deterrent effect. China’s catastrophic anti-satellite weapons test in 2007 is a valuable lesson for all on the potentially devastating effect of kinetic warfare in orbit.

#### No miscalc from satellite disruptions or space dust -- empirically denied.

Mazur 12 (Jonathan Mazur, Manager Engineering at Northrop Grumman, writing in Space & Defense, from the Eisenhower Center for Space and Defense Studies. Past U.S. Actions: Redlines in Space. Space & Defense, Volume 6, Number 1, Fall 2012. https://inss.ndu.edu/Portals/97/Space\_and\_Defense\_6\_1.pdf?ver=2018-09-06-135424-147)

U.S. Reactions To Foreign Disruption Of U.S. Capabilities

In the 1970s, it was suspected that a U.S. maritime communications satellite was turned off by the Soviets when it was outside of the range of U.S. tracking stations.25 There does not appear to be any documented U.S. reaction, and I suspect there was none. In the mid-1990s, satellite hackers in Brazil began hijacking U.S. military communication satellite signals to broadcast their own information, though it took until 2009 for Brazil to crack down on the illegal activity with the support of the DoD.26 In 1998, a U.S.-German satellite known as ROSAT was rendered useless after it turned suddenly toward the sun. NASA investigators later determined the accident was possibly linked to a cyber-intrusion by Russia.

The fallout? Though there was an ongoing criminal investigation as of 2008; NASA security officials have seemed determined to publicly minimize the seriousness of the threat.27 In 2003, a signal originating from Cuba—later determined to be coming from Iranian embassy property— was jamming a U.S. communications satellite that was transmitting Voice of America programming over Iran, which was publicly referred to as an “act of war” by a U.S. official. 28 Press reporting indicates the U.S. administration was [frozen]“paralyzed” about how to cope with the jamming that continued for at least a month, even after U.S. diplomatic protests to Cuba.29 In 2005, U.S. diplomats protested to the Libyan government after two international satellites were illegally jammed disrupting American diplomatic, military, and FBI communications.30 In 2006, press reporting indicates that China hit a U.S. spy satellite with a ground-based laser. This action was acknowledged by the then director of the NRO, though the DoD remained tight lipped about the incident.31

“We’re at a point where the technology’s out there, and the capability for people to do things to our satellites is there. I’m focused on it beyond any single event.” – Air Force Space Command Commander, General Chilton, 2006 32

In 2009, a U.S. commercial Iridium communications satellite—extensively used by the DoD—was accidently destroyed by a collision with a dead Russian satellite.33 The U.S. company, Iridium, was able to minimize any loss of service by implementing a network solution within a few days.34 As of early 2011, no legal action had been taken by the company either because it is not clear who was at fault or because it might be politically problematic for the United States, which is trying to enter into bi-lateral transparency and confidence-building measures (TCBM) with Russia regarding space activities.35 Since August of 2010, North Korea has been intermittently using GPS jamming equipment, which reportedly has been interfering with U.S. and South Korean military operations and civilian use south of the North Korean border.36 Reportedly, only South Korea and the United Nations International Telecommunications Union—at the request of South Korea—have issued letters to Pyongyang demanding the cessation of disruptive communications signals in South Korea.37

It appears that the only time the U.S. military has responded with force to a disruption in U.S. space capabilities was in 2003, a few days after the start of the Iraq war.38 According to U.S. officials, Iraq was using multiple GPS jammers—which supposedly did not affect military GPS functionality. However, the U.S. military bombed the jammers anyway after a diplomatic complaint to Russia.39 The use of military force against the GPS jamming threat was possibly because the United States was already intervening in Iraq, and the bombing probably would not have occurred if the United States was not at war.

## Africa

### TURN: Depletion---1NC

#### Asteroid mining creates resource abundance and solves any need for resource expansionism

MacWhorter 16 [Kevin; J.D. Candidate, William & Mary Law School, "Sustainable Mining: Incentivizing Asteroid Mining in the Name of Environmentalism", William & Mary Environmental Law and Policy Review, Vol 40, Issue 2, Article 11, <https://scholarship.law.wm.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1653&context=wmelpr>] brett

A. Rare Element Mining on Earth

In the next sixty years, scientists predict that certain elements crucial to modern industry such as platinum, zinc, copper, phosphorous, lead, gold, and indium could be exhausted on Earth. 12 Many of these have no synthetic alternative, unlike chemical elements such as oil or diamonds.13 Liquid-crystal display (LCD) televisions, cellphones, and laptops are among the various consumer technologies that use precious metals.14Further, green technologies including wind turbines, solar panels, and catalytic converters require these rare elements. 15 As demand rises for both types of technologies, and as reserves of rare metals fall, prices skyrocket.16 Demand for nonrenewable resources creates conflict, and consumerism in rich countries results in harsh labor treatment for poorer countries.17

In general, the mining industry is extremely destructive to Earth’s environment.18 In fact, depending on the method employed, mining can destroy entire ecosystems by polluting water sources and contributing to deforestation.19 It is by its nature an unsustainable practice, because it involves the extraction of a finite and non-renewable resource.20 Moreover, by extracting tiny amounts of metals from relatively large quantities of ore, the mining industry contributes the largest portion of solid wastes in the world.21 The Environmental Protection Agency (EPA) describes the industry as the source of more toxic and hazardous waste than any other industrial sector [in the United States], costing billions of dollars to address the public health and environmental threats to communities. 22 Poor regulations and oxymoronic corporate definitions of sustainability, however, make it unclear as to just how much waste the industry actually produces.23

Platinum provides an excellent case study of the issue, because it is an extremely rare and expensive metal—an ore expected to exist in vast quantities in asteroids.24 Further, production of platinum has increased sharply in the past sixty years in order to keep up with growing demand for use in new technologies.25 In fact, despite their high costs, platinum group metals are so useful that [one] of [four] industrial goods on Earth require them in production. 26 Scholars do not expect demand to slow any time soon.27 Among other technologies, industries use platinum in products such as catalytic converters, jewelry production, various catalysts for chemical processing, and hydrogen fuel cells.28 While there is no consensus on how far the Earth’s reserves of platinum will take humanity, many scientists agree that platinum ore reserves will deplete in a relatively short amount of time.29

With the rate of mining at an all-time high,30 it is increasingly clear that historical patterns of mineral resources and development cannot simply be assumed to continue unaltered into the future. 31 The platinum mining industry, however, has a strong incentive to increase its rate of extraction as profits grow with the rate of demand. Without any alternative, this destructive practice will continue into the future.32

So-called platinum-group metal (PGM) ores are mined through underground or open cut techniques.33 Due to these practices, all but a very small fraction of the mined platinum ore is disposed of as solid waste.34 The environmental consequences of platinum production are thus quite significant, but like the mining industry in general, the amount of waste is typically under-reported.35

While this is due to high production levels at the moment, those levels will only increase given the estimated future demand of platinum.36 In spite of the negative consequences, mining continues unabated because it is economically important to many areas.37 The future environmental costs provide a major challenge in creating a sustainable system. Relegating at least some mining companies to near-Earth asteroids would reduce the negative effects of future mining levels on Earth. The economic benefits of mining need not be sacrificed for the sake of the environment.38

#### Reliance on earth mining makes resource shortages worse

Williams 19 [Matthew S. writer at Universe Today; Aug 1 2019, "Asteroid Mining: What Will It Involve and Is This the Future of Wealth?", Interessting Engineering, <https://interestingengineering.com/asteroid-mining-what-will-it-involve-and-is-this-the-future-of-wealth>] brett

Of course, this raises the obvious question: wouldn't it be really expensive to do all this mining? Why not simply continue to rely on Earth for sources of precious metals and resources and simply learn to use them better?

To put it simply, we are running out of resources. To be clear, learning to use our resources better and more sustainably is always a great idea. And while it is certainly true than Earth-based mining is far cheaper than going to space would be, that may not be the case indefinitely.

Aside from the fact that off-world minerals and ices would be of considerable value to Earth's economy, there is also the way that growing consumption is leading our reserves to become slowly exhausted.

In fact, according to some estimates, it is possible that our planet will run out of key elements that are needed for modern industry and food production within the next 50 to 60 years. This alone is a pretty good incentive to tap the virtually inexhaustible supply of elements located off-world.

Plus, there are a lot of benefits to expanding humanity's resource base beyond Earth. Here on Earth, mining takes a considerable toll on the natural environment. In fact, depending on the methods used, it can result in erosion, sinkholes, habitat destruction, and the destruction of native animal and plant life.

There's also the dangers of toxic runoff and the contamination of soil, groundwater, and surface water, which is a danger to humans, as well as to wildlife and the natural environment.

As for smelting, machining, and manufacturing, the environmental damage that results is well-documented. Combined with power generation, these industrial processes are one of the leading contributors to air, water, and pollution.

By shifting these burdens off-world, humanity could dramatically-reduce the impact it has on the natural environment.

#### That outweighs---Their impact card explains that Chinese expansionism is driven by a need to secure resources, which mining asteroids solves.

1AC Yeisley 11 [(USAF Lieutenant Colonel Mark O. Yeisley, assistant professor of international relations at the School of Advanced Air and Space Studies, Maxwell AFB, Alabama. MA Colorado State, PhD in international relations from Duke University) “Bipolarity, Proxy Wars, and the Rise of China,” Strategic Studies Quarterly, Winter 2011, <https://www.jstor.org/stable/26270538?seq=1#metadata_info_tab_contents>] TDI

Bipolarity, Nuclear Weapons, and Sino-US Proxy Conflict in Africa

It is likely China will achieve economic and then military parity with the United States in the next two decades. China currently possesses 240 nuclear warheads and 135 ballistic missiles capable of reaching the United States or its allies; that number of nuclear warheads is estimated to double by the mid 2020s.43 As during the Cold War, a bipolar system in which war between the United States and China is too costly will lead to policy decisions that seek conflict resolution elsewhere.44 But why would China’s rising necessarily lead to geostrategic competition with the United States, and where would this most likely occur? Unlike the Cold War, access to strategic resources rather than ideology would lie at the heart of future US-Sino competition, and the new “great game” will most likely be played in Africa.

Despite Communist Party control of its government, China is not interested in spreading its version of communism and is much more pragmatic in its objectives—securing resources to meet the needs of its citizens and improve their standard of living.45 Some estimates show that China will overtake the United States to become the world’s largest economy by 2015, and rising powers usually take the necessary steps to “ensure markets, materials, and transportation routes.”46 China is the leading global consumer of aluminum, copper, lead, nickel, zinc, tin, and iron ore, and its metal needs now represent more than 25 percent of the world’s total.47 In contrast, from 1970 to 1995, US consumption of all materials, including metals, accounted for one-third of the global total despite representing only 5 percent of the world’s population.48 China is the largest energy consumer, according to the International Energy Agency, surpassing the United States in consumption of oil, coal, and natural gas in 2009.49 As the two largest consumers of both global energy and materials, the United States and China must seek foreign policy prescriptions to fulfill future resource needs. While the United States can alleviate some of its energy needs via bio- or coal-based fuels, hydrogen, or natural gas alternatives, China currently lacks the technological know-how to do so and remains tied to a mainly nonrenewable energy resource base. Since the majority of these needs are nonrenewable, competition of necessity will be zero-sum and will be conducted via all instruments of power.50

Africa is home to a wealth of mineral and energy resources, much of which still remains largely unexploited. Seven African states possess huge endowments of oil, and four of these have equally substantial amounts of natural gas.51 Africa also enjoys large deposits of bauxite (used to make aluminum), copper, lead, nickel, zinc, and iron ore, all of which are imported and highly desired by China. Recent activity serves to prove that China seeks greater access to natural resources in Africa by avidly promoting Chinese development in a large number of African nations. South Africa, the continent’s largest economy, has recently allowed China to help develop its vast mineral wealth; it is China’s number one African source of manganese, iron, and copper.52 Chinese involvement in Africa is not wholly extractive; the continent provides a booming export market for China’s goods and a forum to augment its soft power in the region by offering alternatives to the political and economic baggage that accompanies US foreign aid.53

Of primary interest is open access to Africa’s significant deposits of oil and other energy resources. For example, China has 4,000 military personnel in Sudan to protect its interests in energy and mineral investments there; it also owns 40 percent of the Greater Nile Oil Production Company.54 Estimates indicate that within the next few decades China will obtain 40 percent of its oil and gas supplies from Africa.55 Trade and investment in Africa have also been on the rise; trade has grown more than 10 percent annually in the past decade. Between 2002 and 2004, African exports to China doubled, ranking it third behind the United States and France in trade with the continent. Chinese investment is also growing; more than 700 Chinese business operations across Africa total over $1 billion. Aid and direct economic assistance are increasing as well, and China has forgiven the debt of some 31 African nations.56

Africa is thus a vital foreign interest for the Chinese and must be for the United States; access to its mineral and petroleum wealth is crucial to the survival of each.57 Although the US and Chinese economies are tightly interconnected, the nonrenewable nature of these assets means competition will remain a zero-sum game. Nearly all African states have been independent entities for less than 50 years; consolidating robust domestic state institutions and stable governments remains problematic.58 Studies have shown that weak governments are often prime targets for civil conflicts that prove costly to control.59 Many African nations possess both strategic resources and weak regimes, making them vulnerable to internal conflict and thus valuable candidates for assistance from China or the United States to help settle their domestic grievances. With access to African resources of vital strategic interest to each side, competition could likely occur by proxy via diplomatic, economic, or military assistance to one (or both) of the parties involved.

Realist claims that focusing on third-world issues is misplaced are thus fallacious; war in a future US-China bipolar system remains as costly as it was during the Cold War. Because of the fragile nature of many African regimes, domestic grievances are more prone to result in conflict; US and Chinese strategic interests will dictate an intrusive foreign policy to be both prudent and vital. US-Sino proxy conflicts over control of African resources will likely become necessary if these great powers are to sustain their national security postures, especially in terms of strategic defense.60

### TURN: Economics---1NC

#### Space mining will boost, not destroy, economies like South Africa. Increased supply means it’ll be used for more things, which then boosts demand.

Froehlich 18 [Dr. Anne Froehlich, PhD in European Commercial Law, Senior Research Fellow at the Institute of International, European, International and European Economic Law at the University of Cologne, head of delegation of the German delegation of UNCOPUOS, “head of delegation of the German delegation of UNCOPUOS”, Book, Studies in Space Policy Volume 12 The European Space Policy Institute, Jan. 18, 2018, <https://www.springer.com/gp/book/9783319669687>] brett

South Africa has a long history in the mining industry which initiated the country’s industrial revolution and sustained the economy for over a century. South Africa has the largest reserves of gold, coal and PGMs in the world, along with a deep mineral wealth of diamonds, chrome, vanadium, titanium, manganese and much more. South African gold mines produced over 50% of the world output of gold in the early 1980s, constituting 40–50% of the country’s exports. The taxation of gold thus formed a large portion of the country’s income; in the period from 1981 to 1983, gold tax centred around 16.7% of the total governmental revenue. Mining remains the largest industry in the South African economic sector, with 419,219 employees and R241 345 million in sales in December 2009, and Fig. 5.8 below depicts the current mining contribution to the GDP of the five largest mining provinces in South Africa.46,47,48 If South Africa adopts a pro-space mining legislature and it becomes a reality, the country could benefit in a similar manner. Taxation of products collected by space mining companies under the jurisdiction of South Africa could support the country’s revenue income. Furthermore, with foreign investment and new companies being established in the Republic, more jobs will become available, and incoming capital will be spent on people and material within the country. These additional revenue income sources will strengthen the economy in the long term and reduce the current reliance on our terrestrial mineral reserves. The platinum group metals (PGMs) as mentioned before are a defining aspect of the South African mining industry and introduction of a new extraterrestrial supply will have multiple effects. The current demand for platinum is split between industrial uses such as autocatalysts and electronics and precious metal uses in jewellery and bullion coins. It is also stockpiled as a strategic resource for military and aerospace applications by countries like the USA. However, should the quantity greatly increase and the price fall as a result of external supply from space mining, many other industries will begin using platinum in their processes, and the global demand will increase. At the current demand and growth levels, the South African platinum reserves are expected to become exhausted within 250 years as seen in Fig. 5.9. 49 A significant increase in demand will greatly reduce the years to depletion and require further development of the terrestrial mining industry to meet demands and maintain its mineral dominated economic sector. The expanded use and demand of platinum as a result of space resource mining may cause significant growth in other markets and industries, but as South Africa currently possesses minimal manufacturing capabilities related to platinum use, we are not positioned to gain. This situation will ultimately depend on the ability of the space mining industry to maintain supply and deliver timeously. If not the case, the existing platinum producers can drive down the price prior to a shipment’s arrival, causing PGMs delivery to Earth to lose its economic feasibility The resources of Earth are finite and with future development and expansion into space, even more will be needed. South Africa’s economy is largely dependent on these resources and their depletion will leave us crutch-less. Space mining is an eventuality, whether in the short or long term, if we are to build super structures in orbit and populate the stars. We are in a position to not be taken by surprise; we have the opportunity to create laws and policies now that will transform us in the coming future. We can remove our historic crutches, the dependence on our resources, and expand into new industrial and manufacturing areas and bring new investment to our lands.

### AT: War---1NC

#### No escalation

Barrett 05 [(Robert Barrett, PhD Conflict & Post Doctoral Fellow, Conflict Analysis - University of Calgary & Principal and Senior Partner De Novo Group LLC) “Understanding the Challenges of African Democratization through Conflict Analysis,” IACM 18th Annual Conference, June 1, 2005] brett

Westerners eager to promote democracy must be wary of African politicians who promise democratic reform without sincere commitment to the process. Offering money to corrupt leaders in exchange for their taking small steps away from autocracy may in fact be a way of pushing countries into anocracy. As such, world financial lenders and interventionists who wield leverage and influence must take responsibility in considering the ramifications of African nations who adopt democracy in order to maintain elite political privileges. The obvious reason for this, aside from the potential costs in human life should conflict arise from hastily constructed democratic reforms, is the fact that Western donors, in the face of intrastate war would then be faced with channeling funds and resources away from democratization efforts and toward conflict intervention based on issues of human security. This is a problem, as Western nations may be increasingly wary of intervening in Africa hotspots after experiencing firsthand the unpredictable and unforgiving nature of societal warfare in both Somalia and Rwanda. On a costbenefit basis, the West continues to be somewhat reluctant to get to get involved in Africa’s dirty wars, evidenced by its political hesitation when discussing ongoing sanguinary grassroots conflicts in Africa. Even as the world apologizes for bearing witness to the Rwandan genocide without having intervened, the United States, recently using the label ‘genocide’ in the context of the Sudanese conflict (in September of 2004), has only proclaimed sanctions against Sudan, while dismissing any suggestions at actual intervention (Giry, 2005). Part of the problem is that traditional military and diplomatic approaches at separating combatants and enforcing ceasefires have yielded little in Africa. No powerful nations want to get embroiled in conflicts they cannot win – especially those conflicts in which the intervening nation has very little interest. It would be a false statement for me to say that there has never been a better time to incorporate the holistic insights of conflict analysis. The most opportune time has likely come and gone. Yet, Africa remains at a crossroads – set amidst the greatest proliferation of democratic regimes in history. It still has a chance. Yet, it is not only up to the West, but also Africans themselves, to stand against corruption, to participate in civil society and to ultimately take the initiative in uncovering and acknowledging the deep underlying issues perpetuating African conflict in order to open the door to democratic advancement and global interaction. Analysis will be the key that unlocks that door.

## 1NC---Kessler Good

#### Loss of satellites shuts down drones

Daniel Ventre 11, Engineer for CNRS and Researcher for CESDIP, Cyberwar and Information Warfare, p. 198-199

The introduction of cyberspace operations is part of a specific context; a major evolution in the operation environment and the nature of the conflicts, which make irregular wars the rule, and make regular actors the exception to the rule. But the battle against unconventional, non-state governed, irregular actors raises specific problems: there are multiple actors, unpredictable at that, who do not abide by the same rules. New orders in conflicts are imposing the implementation of an ever more important need for information, and information collection and processing. Networks now have an incredible importance. The document refers to the growing threats against American heritage: the USA is a target and the increasing amount of attacks against their networks is indeed the proof of this. There are many obstacles which need to be removed before they can achieve real superiority and freedom to act, especially as vulnerable points may originate within the very operations of the armed forces. An example of this is the vulnerability of using products (software and hardware), commercial products (off-the-shelf), and sometimes even foreign products123. This brings to mind the fact that the US Air Force uses commercial, even foreign, applications for its cyberspace operations.

Information space extends to space124, particularly via communication and observation satellites125. Satellites are the keystone to the cyberspace and communication systems, but also the security system: monitoring (Echelon network is the symbol), observation, communication. These are at the heart of the C4ISR systems, without which a concept such as network-centric warfare could not exist. There would be no drones without satellites. It is even a question of extending the Internet to extra-atmospheric space. Projects in this vein (Interplanetary Networks) were being formed in the 1990s, but ran into several technical difficulties (delays in important transmissions due to high distances and costs) [GEL 06]. NASA dedicates a few pages on its website to this project126. The development of communication systems based on the infrastructures in extra-atmospheric space will also raise questions for legal, geopolitical and geostrategic domains: questions of seizing this space, questions of regulation of human activity in this space, of sovereignty, new territoriality and independence.

#### Drone prolif is inevitable and causes global nuclear war

Dr. Michael C. Horowitz 19, Professor of Political Science at University of Pennsylvania, NDT Champion from Emory University, PhD in Government from Harvard University, Adjunct Senior Fellow at the Center for a New American Security, “When Speed Kills: Autonomous Weapon Systems, Deterrence, and Stability”, 5/2/2019, https://papers.ssrn.com/sol3/papers.cfm?abstract\_id=3348356

Thus, the reason to deploy autonomous systems would have to be their reliability and effectiveness rather than signaling. And giving up human control to algorithms in a crisis that could end with global nuclear war would require an extremely high level of perceived reliability and effectiveness. Few things are more important to militaries in crisis situations than informational awareness and control over decisions, and there might be fear that autonomous systems are prone to accidents.

This counterfactual illustrates that the development and deployment of lethal autonomous weapon systems by national militaries, if it occurs, is unlikely to have simple, easy, and linear consequences. Instead, human factors, including the psychological desire for control and organizational politics, will strongly shape how militaries think about developing and using LAWS. This will not just influence the potential for arms races in peacetime, but deterrence and wartime stability due to the organizational processes militaries implement for the deployment and use of autonomous systems on the battlefield.

This paper draws on research in strategic studies and examples from military history to assess how LAWS could influence the development and deployment of military systems, including arms races, crisis stability, and wartime stability, especially the risk of escalation. It also discusses the potential for arms control. It focuses on these questions through the lens of key characteristics of LAWS, especially the potential for increased operational speed and, simultaneously, less human control over battlefield choices. One of the primary attractions of autonomous systems, even compared to remotely piloted systems, is the potential to operate at machine speed. Another potential benefit is the possibility of machine-like accuracy in following programming, but that comes with a potential downside: the loss of control and the accompanying risk of accidents, adversarial spoofing, and miscalculation. Even if LAWS malfunction at the same rate as humans in a given scenario, the ability of operators to control the impact of those malfunctions may be lower, which could make LAWS less predictable on the battlefield. The paper then examines how these issues interact with the large uncertainty parameter associated with AI-based military capabilities at present, both in terms of the range of the possible and the opacity of their programming.

The results highlight several critical issues surrounding the development and deployment of LAWS.1 First, the desire to fight at machine speed with autonomous systems, while making a military more effective in a conflict, could increase crisis instability. As countries fear losing conflicts faster, it will generate escalation pressure, including an increased incentive for first strikes. Second, in addition to the actual risk of accidents and miscalculation from LAWS, the fear of accidents and losing control of autonomous systems could limit the willingness of militaries to deploy them, particularly since many militaries are conservative when it comes to emerging technologies and have high standards for system reliability. Third, the dual-use, or even general purpose, character of the basic science underlying many autonomous systems will make the technology hard to control, giving many countries and actors access to basic algorithms, though whether this is described as diffusion, proliferation, or an arms race will depend on political dynamics as much as anything.

Finally, multiple uncertainty parameters concerning lethal autonomous weapon systems could exacerbate security dilemmas. Uncertainty over the range of the possible concerning the programming of lethal autonomous weapon systems will increase fear of those systems in the near term, making restraint less likely for competitive reasons. Moreover, the inherent differences between remotely piloted systems and LAWS at the platform level come from software, not hardware. There is arguably an inherent opacity to lethal autonomous weapon systems. If an arms race over lethal autonomous weapon systems occurs, it will likely be because of worse-case assumptions about capability development by potential adversaries.

What is Autonomy or Artificial Intelligence?

Artificial intelligence is the use of computing power, in the form of algorithms, to conduct tasks that previously required human intelligence.2 Artificial intelligence in this context is best thought of as an umbrella technology or enabler, like the combustion engine or electricity. Military applications of artificial intelligence are potentially broad – from image recognition for surveillance to more efficient logistics to battle management.3 These include both non-kinetic applications, including in the cyber realm, as well as kinetic applications.4 One potential application of artificial intelligence is through armed autonomous systems that could be deployed on the battlefield, or what are most popularly called lethal autonomous weapon systems or lethal autonomous weapon systems. This differs from remotely-piloted systems where a human, though at a distance, still operates a given vehicle or system.

What is a lethal autonomous weapon system? While simple to describe on first glance, and easy to understand in the extreme – an armed humanoid robot with extremely broad programming making decisions about engaging in warfare – drawing the line between a lethal autonomous weapon system and other weapon systems is complex. In Directive 3000.09, published in 2012, the US Department of Defense defines an autonomous weapon as “A weapon system that, once activated, can select and engage targets without further intervention by a human operator.”5 What it means to select and engage a target is not entirely clear, however. For example, homing munitions, which have existed since World War II, select and engage targets, according to a common sense understanding of the terms.6

Exactly what functions are autonomous also matters. A system could have automatic piloting, for example, that flies or drives a platform to a target, but still have complete human control over the use of the weapon. That would be a system with a high level of automation, though not a lethal autonomous weapon system according to most perspectives. Heather Roff measures the level of autonomy in a weapon system based on three subcomponents: self-mobility, self-direction, and self-determination. This helps distinguish systems where there might be autonomy concerning the best way a missile should get to a target, but the target itself is designated by a person fromsystems where an algorithm might be making higher-level engagement decisions.7 There are already some applications of limited machine autonomy in military systems, with the most prominent example being the automatic mode present on many Close-In Weapon Systems (CIWS), such as the Phalanx, used to defend ships and incoming missiles from attack.8

This article will not resolve the definitional debate surrounding lethal autonomous weapon systems, which is still ongoing in meetings of the Group of Governmental Experts focused on lethal autonomous weapon systems in the United Nations Convention on Certain Conventional Weapons. Provisionally, this article adopts the Scharre and Horowitz definition that a lethal autonomous weapon system is “[A] weapon system that, once activated, is intended to select and engage targets where a human has not decided those specific targets are to be engaged.”9 However, moving beyond the close cases (e.g. particular types of missile guidance systems) and considering those weapon systems that clearly use machine intelligence to search for, select, and/or engage targets can help clarify what is at stake in this debate in the first place.10 After all, if most militaries most of the time would not have any need for lethal autonomous weapon systems, or those systems have significant disadvantages relative to remotely-piloted military robotics or soldiers on the battlefield, the stakes are lower. In contrast, if the integration of machine intelligence with military systems could give countries or violent non-state actors a significant advantage in how they employ force, it becomes even more crucial to engage the topic.

It is important to note that this article does not address concerns about existential risk related to artificial general intelligence – the fear that a superintelligence could decide to destroy the human race, either because it decides humans are malign or because humans program it to achieve a goal it can only accomplish by destroying humans.11 The existential risk issue associated with artificial intelligence is not necessarily closely coupled to military applications of artificial intelligence. If a super-intelligent machine learning system has the ability to take over human society in the interest of a goal – any goal – whether autonomous systems at much smaller orders of magnitude already exist in military systems will likely be unimportant. The super-intelligent system would simply create what it needed.

Why Invest in Autonomous Systems?

Militaries are already increasing their investments in remotely-piloted robotic systems. From UAVs such as the MQ-9 Reaper (United States) to uninhabited surface vehicles (USVs) such as the Guardium (Israel) to uninhabited ground vehicles (UGV) such as Platform-M (Russia), militaries around the world are investing in remotely piloted platforms, some of which can carry weapons. In these systems, human control over the use of force is not fundamentally different from the use of force with inhabited systems. In some cases, such as the MQ-9 Reaper, the sensor system a drone pilot uses to launch a weapon might even be the same sensor system a pilot in the cockpit of an inhabited fighter uses. Using remotely piloted systems gives militaries the ability to reduce the risk to their own soldiers while still projecting power in similar ways to how they used force previously.12 The first places militaries are likely to use kinetic lethal autonomous weapon systems include relatively “clear” environments such as air-to-air combat or naval combat, especially in geographic arenas where civilians are extremely unlikely to be present.13