## 1AC

### Disclosure

#### Interpretation: Debaters must disclose all constructive positions on open source with highlighting on the 2021-22 NDCA LD wiki after the round in which they read them.

#### Violation – screenshots in the doc prove they didn’t osource r4

Graphical user interface, application

Description automatically generated

#### 1] Debate resource inequities—you’ll say people will steal cards, but that’s good—it’s the only way to truly level the playing field for students such as novices in under-privileged programs – it equals the playing field.

Overing 18 – Bob Overing, LD Scholar (“Holiday Disclosure Post #6 – 10 Things Edition” JANUARY 12, 2018. http://www.premierdebate.com/disclosure-post-6/)

**Open source improves on usual disclosure practices** in the obvious way – **you can read their evidence for better prep**aration – and in a number of smaller ways too. **It solves the analytics problem** I discussed above, **so round-altering uncarded arguments are available** (though this doesn’t really apply to Harvard-Westlake), **and it gives access to evidence from paywalled articles**. **Every season I coach debaters who lack access to major databases; for schools without robust online library offerings or teams without college coaches, this matters a lot**.

#### 2] Evidence ethics – open source is the only way to verify pre-round that cards aren’t miscut or highlighted or bracketed unethically. That’s a voter – maintaining ethical ev practices is key to being good academics and we should be able to verify you didn’t cheat

#### 3] Tournament procedures mandate osource which o/w jurisdiction- the judge doesn’t have an obligation to do anything else but uphold tournament procedures- its written into their contract- violating rules o/w because it’s a pre-requisite to you debating in the first place- answers appeals to oh its only one round

Graphical user interface, text, application

Description automatically generated

#### No RVI on 1ac theory --they would have 7 minutes to answer a minute-long shell and the debate would end right there

#### DTD—abuse already occurred and skewed my strat, set better norms

#### Competing interps on 1AC Theory- A] 7 minutes is more than enough time to robustly justify their counter interp B] rzn is arbitrary

#### o/w 1NC theory- epistemic skew

### Framing

#### The meta-ethic is procedural moral realism.

#### This entails that moral facts stem from procedures while substantive realism holds that moral truths exist independently of that in the empirical world. Prefer procedural realism –

#### [1] Collapses – the only way to verify whether something is a moral fact is by using procedures to warrant it.

#### [2] Uncertainty – our experiences are inaccessible to others which allows people to say they don’t experience the same, however a priori principles are universally applied to all agents.

#### [3] Is/Ought Gap – we can only perceive what is, not what ought to be. It’s impossible to derive an ought statement from descriptive facts about the world, necessitating a priori premises.

#### [4] Regress – I can keep asking “why should I follow this” which results in skep since obligations are predicated on ignorantly accepting rules. Only reason solves since asking “why reason?” requires reason which is self-justified.

#### That means we must universally will maxims— any non-universalizable norm justifies someone’s ability to impede on your ends.

#### Thus, the standard is consistency with the categorical imperative.

#### Prefer:

#### 1] Only universalizable reason can effectively explain the perspectives of agents – that’s the best method for combatting oppression.

Farr 02 Arnold Farr (prof of phil @ UKentucky, focusing on German idealism, philosophy of race, postmodernism, psychoanalysis, and liberation philosophy). “Can a Philosophy of Race Afford to Abandon the Kantian Categorical Imperative?” JOURNAL of SOCIAL PHILOSOPHY, Vol. 33 No. 1, Spring 2002, 17–32.

**One** of the most popular **criticism**s **of Kant’s moral philosophy is that it is too formalistic.**13 That is, the universal nature of the categorical imperative leaves it devoid of content. Such a principle is useless since moral decisions are made by concrete individuals in a concrete, historical, and social situation. This type of criticism lies behind Lewis Gordon’s rejection of any attempt to ground an antiracist position on Kantian principles. The rejection of universal principles for the sake of emphasizing the historical embeddedness of the human agent is widespread in recent philosophy and social theory. I will argue here on Kantian grounds that **although a distinction between the universal and the concrete is** a **valid** distinction, **the unity of the two is required for** an understanding of human **agency.** The attack on Kantian formalism began with Hegel’s criticism of the Kantian philosophy.14 The list of contemporary theorists who follow Hegel’s line of criticism is far too long to deal with in the scope of this paper. Although these theorists may approach the problem of Kantian formalism from a variety of angles, the spirit of their criticism is basically the same: The universality of the categorical imperative is an abstraction from one’s empirical conditions. **Kant is** often **accused of making the moral agent an abstract, empty**, noumenal **subject. Nothing could be further from the truth. The Kantian subject is** an embodied, empirical, concrete subject. However, this concrete subject has a dual nature. Kant claims in the Critique of Pure Reason as well as in the Grounding that human beings have an intelligible and empirical character.15 It is impossible to understand and do justice to Kant’s moral theory without taking seriously the relation between these two characters. The very concept of morality is impossible without the tension between the two. By “empirical character” Kant simply means that we have a sensual nature. We are physical creatures with physical drives or desires. **The** very **fact that I cannot simply satisfy my desires without considering the rightness** or wrongness **of my actions suggests that my empirical character must be held in check** by something, or else I behave like a Freudian id. My empiri- cal character must be held in check **by my intelligible character**, which is the legislative activity of practical reason. It is through our intelligible character that **we formulate principles that keep our** empirical **impulses in check.** The categorical imperative is the supreme principle of morality that is constructed by the moral agent in his/her moment of self-transcendence. What I have called self-transcendence may be best explained in the following passage by Onora O’Neill: In restricting our maxims to those that meet the test of the categorical imperative we refuse to base our lives on maxims that necessarily make our own case an exception. The reason why a universilizability criterion is morally signiﬁcant is that it makes our own case no special exception (G, IV, 404). In accepting the Categorical Imperative we accept the moral reality of other selves, and hence the possibility (not, note, the reality) of a moral community. **The Formula of Universal Law enjoins no more than that we act only on maxims that are open to others also.**16 O’Neill’s description of the universalizability criterion includes the notion of self-transcendence that I am working to explicate here to the extent that like self-transcendence, universalizable moral principles require that the individ- ual think beyond his or her own particular desires. The individual is not allowed to exclude others **as** rational **moral agents** who have the right to act as he acts in a given situation. For example, if I decide to use another person merely as a means for my own end I must recognize the other person’s right to do the same to me. I cannot consistently will that I use another as a means only and will that I not be used in the same manner by another. **Hence,** the **universalizability** criterion **is a principle of consistency and** a principle of **inclusion.** That is, in choosing my maxims **I** attempt to **include the perspective of other moral agents.**

#### 2] Practical identities – we find our lives worth living under practical identities such as student but that presupposes agency.

**Korsgaard 92** CHRISTINE M. Korsgaard 92 [I am a Professor of Philosophy at Harvard University, where I have taught since 1991. From July 1996 through June 2002, I was Chair of the Department of Philosophy. (The current chair is Sean Kelly.) From 2004-2012, I was Director of Graduate Studies in Philosophy. (The current DGS is Mark Richard.) Before coming here, I held positions at Yale, the University of California at Santa Barbara, and the University of Chicago, as well as visiting positions at Berkeley and UCLA. I served as President of the Eastern Division of the American Philosophical Association in 2008-2009, and held a Mellon Distinguished Achievement Award from 2006-2009. I work on moral philosophy and its history, practical reason, the nature of agency, personal identity, normativity, and the ethical relations between human beings and the other animals], “The Sources of Normativity”, THE TANNER LECTURES ON HUMAN VALUES Delivered at Clare Hall, Cambridge University 16-17 Nov 1992, BE

The Solution: Those who think that the human mind is internally luminous and transparent to itself think that the term “self-consciousness” is appropriate because what we get in human consciousness is a direct encounter with the self. Those who think that the human mind has a reflective structure use the term too, but for a different reason. The reflective structure of the mind is a source of “self-consciousness” because it forces us to have a conception of ourselves. As Kant argues, this is a fact about what it is like to be reflectively conscious and it does not prove the existence of a metaphysical self. From a third person point of view, outside of the deliberative standpoint, it may look as if what happens when someone makes a choice is that the strongest of his conflicting desires wins. But that isn’t the way it is for you when you deliberate. When you deliberate, it is as if there were something over and above all of your desires, something that is you, and that chooses which desire to act on. This means that the principle or law by which you determine your actions is one that you regard as being expressive of yourself. To identify with such a principle or law is to be, in St. Paul’s famous phrase, a law to yourself.6 An agent might think of herself as a Citizen in the Kingdom of Ends. Or she might think of herself as a member of a family or an ethnic group or a nation. She might think of herself as the steward of her own interests, and then she will be an egoist. Or she might think of herself as the slave of her passions, and then she will be a wanton. And how she thinks of herself will determine whether it is the law of the Kingdom of Ends, or the law of some smaller group, or the law of the egoist, or the law of the wanton that is the law that she is to herself. The conception of one’s identity in question here is not a theoretical one, a view about what as a matter of inescapable scientific fact you are. It is better understood as a description under which you value yourself, a description under which you find your life to be worth living and your actions to be worth undertaking. So I will call this a conception of your practical identity. Practical identity is a complex matter and for the average person there will be a jumble of such conceptions. You are a human being, a woman or a man, an adherent of a certain religion, a member of an ethnic group, someone’s friend, and so on. And all of these identities give rise to reasons and obligations. Your reasons express your identity, your nature; your obligations spring from what that identity forbids

#### Impact calc – the only relevant offense under my framework is that of libertarian ownership. The universality of freedom justifies a libertarian state which outweighs on actor specificity.

**Otteson 9** \*\*brackets in original\*\* James R. Otteson (professor of philosophy and economics at Yeshiva University) “Kantian Individualism and Political Libertarianism” The Independent Review, v. 13, n. 3, Winter 2009

In a crucial passage in Metaphysics of Morals, Kant writes that the “Universal Principle of Right” is “‘[e]very action which by itself or by its maxim enables the freedom of each individual’s will to co-exist with the freedom of everyone else in accordance with a universal law is right.’” He concludes, “Thus the universal law of right is as follows: let your external actions be such that the free application of your will can co-exist with the freedom of everyone in accordance with a universal law” (1991, 133, emphasis in original).5 This stipulation becomes for Kant the grounding 5. Other statements of this law of equal freedom appear in the Critique of Pure Reason (Kant [1781] 1965, 312; see also 1991, 191, “Universal History,” 45 and 50, and “Theory and Practice,” 73 and 80). 394 ✦ JAMES R. OTTESON THE INDEPENDENT REVIEW justification for the existence of a state, its raison d’être, and the reason we leave the state of nature is to secure this sphere of maximum freedom compatible with the same freedom of all others. Because this freedom must be complete, in the sense of being as full as possible given the existence of other persons who demand similar freedom, it entails that the state may—indeed, must—secure this condition of freedom, but undertake to do nothing else because any other state activities would compromise the very autonomy the state seeks to defend. Kant’s position thus outlines and implies a political philosophy that is broadly libertarian; that is, it endorses a state constructed with the sole aim of protecting its citizens against invasions of their liberty. For Kant, individuals create a state to protect their moral agency, and in doing so they consent to coercion only insofar as it is required to prevent themselves or others from impinging on their own or others’ agency. In his argument, individuals cannot rationally consent to a state that instructs them in morals, coerces virtuous behavior, commands them to trade or not, directs their pursuit of happiness, or forcibly requires them to provide for their own or others’ pursuits of happiness. And except in cases of punishment for wrongdoing,6 this severe limitation on the scope of the state’s authority must always be respected: “The rights of man must be held sacred, however great a sacrifice the ruling power may have to make. There can be no half measures here; it is no use devising hybrid solutions such as a pragmatically conditioned right halfway between right and utility. For all politics must bend the knee before right, although politics may hope in return to arrive, however slowly, at a stage of lasting brilliance” (Perpetual Peace, 1991, 125). The implication is that a Kantian state protects against invasions of freedom and does nothing else; in the absence of invasions or threats of invasions, it is inactive

### Offense

#### [1] Privatization is bad

#### [a] The OST prevents state-based sovereignty claims in space. But it does not clearly restrict corporations and even if it does it may imminently be changed. This means that regions could be under the exclusive control of corporations, while no government has authority.

Ward 19 Peter Ward (Peter Ward studied journalism at the University of Sheffield before moving to Dubai, where he reported on the energy sector. After three years in the Middle East, he earned his master’s degree in business journalism from the Columbia University Graduate School of Journalism. His work has appeared in GQ, Bloomberg Buisnessweek, The Economist, and Newsweek. He lives in New York City.) “The unintended consequences of privatising space,” ScienceFocus (Online version of BBC Science Focus Magazine). Nov. 6th, 2019. <https://www.sciencefocus.com/space/the-unintended-consequences-of-privatising-space/> SJMS

Imagine a colony on [the Moon](https://www.sciencefocus.com/tag/the-moon/) or [Mars](https://www.sciencefocus.com/space/mars-facts-figures-fun-questions-red-planet/) run by a corporation. That one company would control everything the colonists need to survive, from the water to the oxygen to the food. That’s a dangerous amount of power for any company, but it’s a very real scenario. So what stops a major corporation landing on the Moon and setting up a colony? One very old document. [The Outer Space Treaty](http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html) was signed in 1967 by all of the major space-faring nations, and explicitly states nobody can go to another planet or the Moon and claim that territory for their own. It’s a very important document, but it’s flawed. For one thing, the private space sector wasn’t around when the treaty was written so it’s not clear how some of the rules would be applied to private companies. And secondly, given the ambitions of many countries and corporations, there’s no way it’s going to last much longer. Anyone with a plan to land on the Moon or Mars and stay there is going to run into the Outer Space Treaty, and the smart money is on the wealthy and powerful winning out against an old loophole-ridden document. Politicians such as Ted Cruz in the United States have [already called for changes](https://spacenews.com/cruz-interested-in-updating-outer-space-treaty-to-support-commercial-space-activities/) to be made to the treaty, and given the increasing amounts of money private space companies spend on lobbying in the United States, more such attempts will follow. It’s imperative that the space community as a whole takes this issue on to ensure the needs of all, and not just the private sector, are taken into account should any alterations be made. The further we look into the future of humans in space, the more reality resembles science fiction. That’s why it’s difficult to make people take the issues which could potentially arise seriously. But now is the time to consider the problems that could arise from a commercially-led space race, and take the necessary small steps now to avoid potentially disastrous consequences in the future.

#### [b] That’s an instance of a unilateral will governing individuals while universal decision making is absent. This is an unjust state which violates people’s freedoms and violates the categorical imperative.

Cordelli 16 Chiara Cordelli [Chiara Cordelli is an associate professor in the Department of Political Science at the University of Chicago. Her main areas of research are social and political philosophy, with a particular focus on theories of distributive justice, political legitimacy, normative defenses of the state, and the public/private distinction in liberal theory. She is the author of The Privatized State (Princeton University Press, 2020), which was awarded the 2021 ECPR political theory prize for best first book in political theory. She is also the co-editor of, and a contributor to, Philanthropy in Democratic Societies (University of Chicago Press, 2016). -- [cordelli@uchicago.edu](mailto:cordelli@uchicago.edu)] “WHAT IS WRONG WITH PRIVATIZATION?”, University of Chicago, Political Science & the College, https://www.law.berkeley.edu/wp-content/uploads/2016/01/What-is-Wrong-With-Privatization\_UCB.pdf

The intrinsic wrong of privatization, I will suggest, rather consists in the creation of an institutional arrangement that, by its very constitution, denies those who are subject to it equal freedom. I understand freedom as an interpersonal relationship of reciprocal independence. To be free is not to be subordinated to another person’s unilateral will. By building on an analytical reconstruction of Kant’s Doctrine of Right, I will argue that current forms of privatization reproduce (to a different degree) within a civil condition the very same defects that Kant attributes to the state of nature, or to a pre-civil condition, thereby making a rightful condition of reciprocal independence impossible. Importantly, this is so even if private actors are publicly authorized through contract and subject to regulations, and even if they are committed to reason in accordance with the public good. The reason for this, as I will explain, derives from the fact that private agents are constitutionally incapable of acting omnilaterally, even if their actions are omnilaterally authorized by government through some delegation mechanism, e.g. a voluntary contract. Omnilateralness, I will suggest, must be understood as a function of 1) rightful judgment and 2) unity. By rightful judgment I mean the capacity to reason publicly and to make universal rules that are valid for everyone, according to a juridical ideal of right, as necessary to solve the problem of the unilateral imposition of private wills on others. By unity I mean the capacity to make rules and decisions that change the normative situation of others, as a part of a unified system of decision-making. The condition of unity is crucial, as I shall later explain, insofar as there might be multiple interpretations compatible with rightful judgment, which would still problematically leave the definition of people’s rightful entitlements indeterminate. Further, the practical realization of the juridical idea of an omnilateral will, I will contend, requires embeddedness within a shared collective practice of decision-making. In practice, rightful judgment can only obtain when certain shared background frameworks that structure practical reasoning and confer unity to that reasoning are in place. The rules of public administration and the authority structure of bureaucracy should be understood as playing this essential function of giving empirical and practical reality to the omnilateral will, as far as the execution of rules and the concrete definition of entitlements are concerned. Together, these two requirements are necessary, (whether they are also sufficient is a different question), to make an action the omnilateral action of a state, which has the moral power to change the normative situation of citizens, by fixing the content of their rights and duties in accordance with the equal freedom of all. The phenomenon of privatization thus raises the fundamental questions of why we need political institutions to begin with, and what makes an action an action of the state. Insofar as private agents make decisions that fundamentally alter the normative situation (the rights and duties) of citizens, and insofar as, by definition, private agents are not public officials embedded in that shared collective practice, their decisions, even if well intentioned and authorized through contract, cannot count as omnilateral acts of the state. They rather and necessarily remain unilateral acts of men. Hence, I will conclude, for the very same reasons that we have, following Kant, a duty to exit the state of nature so as to solve the twofold problems of the unilateral imposition of will on others and the indeterminacy of rights, we also have a duty to limit privatization and to support, on normative grounds, a case for the re-bureaucratization of certain functions. Therefore, my paper provides foundational reasons to agree with Richard Rorty’s nonfoundational defense of bureaucracy as stated in the opening epigraph, since only agents who are appropriately embedded within a bureaucratic structure, properly understood, are, in many cases, capable of acting omnilaterally. The “bosses” I am here concerned with are not primarily those who can unilaterally impose their will on us in their capacity as private employers, but rather any private actor who acts unilaterally while in the garb of the state. This essay is structured as follows. In Section I, I assess and reject what I take to be the most powerful non-instrumental arguments against privatization. In Section II, through an interpretation of Kant, I explain in what sense the state, defined as an omnilateral system of rules, is a constitutive condition of freedom, rather than merely an instrument to promote it. In Section III, through an analytical reconstruction, based on a theory of collective action, of the conditions that make a system of rules an omnilateral system of laws rather than an aggregation of unilateral acts of men, I show that privatization constitutes a regression to the state of nature, understood as a normative condition of unfreedom. I then present some reflections on the broader implications of my argument, as it posits an expansive conception of the juridical order as an appropriate object of analysis for political philosophy. Before moving to the next section, let me first clarify what I mean by privatization. In a general sense, privatization can be defined as the devolution of public responsibilities to private actors. This however entails a baseline against which the idea of public responsibilities must be specified. Here I defend a normative, rather than, as is commonly the case, a historical or economic baseline.11 I will assume that in a just society government ought to bear, on grounds of justice, the primary responsibility to secure not only a fair distribution of general resources, including income and wealth, through tax and transfers, but also an adequate provision of particular in-kind goods, including police protection, defense, criminal justice, education and healthcare.12 This does not per se entail, however, that government should provide these goods directly. Government may fund the production of in-kind goods, while delegating their provision to private actors. I thus define privatization as the implementation of public, justice-based responsibilities through private agents.

#### [2] Extending neoliberal polices in space violate universal law through continued injustice.

Segobaetso 18 Segobaetso, Benjamin. *Ethical Implications of the Colonization, Privatization and Commercialization of Outer Space*. SJEP

It can be argued through Kantian ethics that our record here on Earth paints a picture of neoliberal and capitalist policies with tendencies to favour the highest bidder at the exclusion of the under privileged and puts profit first at the expense of the environment. For Kantians, there are two questions that we must ask ourselves whenever we decide to act: (i) Can I rationally will that everyone act as I propose to act? If the answer is no, then we must not perform the action. (ii) Does my action respect the goals of human beings? Again, if the answer is no, then we must not perform the action. Kantian ethicists would argue that extending to space neoliberal and capitalist policies is immoral because these systems create economic disparities and life threatening environmental injustices; therefore, they are set up in a way that we could not rationally will everyone to act the way they act either here on Earth or in space. Also, Kantian ethicists would ask whether the action of extending neoliberal and capitalist policies to space would respect the goals of extra-terrestrial intelligent life if any rather than merely using them for humans’ own purposes? If the answer is no, then the participating agent must not perform the action. Kant wrote on the possible existence of extra-terrestrial intelligent species in the final pages of the last book that he published, Anthropology from a Pragmatic Point of View [Anthropologie in pragmatischer Hinsicht] (1978). In this publication, Kant hinted that the highest concept of the Alien species may be that of a terrestrial rational being [eines irdischen vernünftigen ]; however, he argued that it will be difficult to describe its characteristics because there is no knowledge available of a non-terrestrial rational being [nicht irdischen Wesen] which could be used as a reference in regards to its properties and ultimately classify that terrestrial being as rational. This dilemma will continue until extraterrestrial intelligent life is discovered because comparing two species of rational beings has to be on the basis of experience, but that experience has not been possible yet (Kant, 237-238). In applying Kant’s deontological moral theory, it must first be recognized that Kant visualized a kind of respect in which we all can recognize every rational being exists as an end in itself (1) as being not fully comprehensible by any human understanding, (2) as being an end in him- or herself, and (3) as being a potential source of moral law (Kant, 2012). In this regard, since Kant insinuated that the highest concept of the extraterrestrial intelligent species may be that of a terrestrial rational being [eines irdischen vernünftigen ]; that implies any encounter with extra-terrestrial intelligent life will compel us under the deontological moral theory to recognize that life as being not fully comprehensible by any human understanding, as being an end in itself, and as being a potential source of moral law (Kant, 2012). It must be realized that Kant’s deontology theory does not go without criticism by critical theorists who believe in dismantling all systems of oppression.

#### [3] The categorical imperative rejects states and companies desires to profit off of space for themselves.

Wurth 19Wurth, Nicolas. “SPACE ETHICS IN INTERNATIONAL SPACE LAW: ADVANCEMENT AND ENFORCEABILITY.” *University of Luxembourg* , 2019. SJEP

Hans Jonas, german philosopher, studied the concept of ethics related to Kant’s “Categorical Imperative” under the angle of modern technology allowing humans to surpass their own frontiers.10 By extending the aforementioned Categorical Imperative to modern technologies, (which includes space activities) he wrote: “Act that the effects of your action are compatible with the permanence of genuine human life. [...] Act so that the effects of your action are not destructive of the future possibility of such life [...] Do not compromise the conditions for an indefinite continuation of humanity on earth.”11 The conceptualization of ethics implies to evaluate behavior, actions and activities of space actors.12 Related to space activities, ethical behavior shall therefore be aligned with a sort of conduct that is to be followed, independently of “any natural desires.” Such an understanding does naturally challenge States’ desires to diversify their economy via the adoption of a legal framework on space activities13 or the profit-making goal of a company which has the technical ability to conduct a profitable space activity such as space-mining?

### **Plan**

Thus, the plan – Resolved: The appropriation of outer space by private entities is unjust. Definitions and enforcement in the doc and I’ll clarify in cross.

To clarify we’ll defend implementation and a revision to the Outer Space Treaty that explicitly bans appropriation of outer space by private entities

### UV

**1AR theory is drop the debater, competing interps, and the highest layer of the round – [A] the 1ARs too short to be able to rectify abuse and adequately cover substance, [B] they get to go for their shell and beat back mine in the long 2NR but the 2AR is too short to do both**

#### The advantage is Debris –

#### Privatization of space leads to unchecked debris.

Muelhaupt et al. 19 – Theodore, Marlon Sorge, Jamie Morin, and Robert Wilson, 6/18/19, Center for Orbital and Reentry Debris Studies, Center for Space Policy and Strategy, The Aerospace Corporation, 30 year Space Systems Analyst and Operator, [“Space traffic management in the new space era,” Journal of Space Safety Engineering, <https://www.sciencedirect.com/science/article/pii/S246889671930045X?via%3Dihub>] Justin

The last decade has seen rapid growth and change in the space industry, and an explosion of commercial and private activity. Terms like NewSpace or democratized space are often used to describe this global trend to develop faster and cheaper access to space, distinct from more traditional government-driven activities focused on security, political, or scientific activities. The easier access to space has opened participation to many more participants than was historically possible. This new activity could profoundly worsen the space debris environment, particularly in low Earth orbit (LEO), but there are also signs of progress and the outlook is encouraging. Many NewSpace operators are actively working to mitigate their impact. Nevertheless, NewSpace represents a significant break with past experience and business as usual will not work in this changed environment. New standards, space policy, and licensing approaches are powerful levers that can shape the future of operations and the debris environment. 2. Characterizing NewSpace: a step change in the space environment In just the last few years, commercial companies have proposed, funded, and in a few cases begun deployment of very large constellations of small to medium-sized satellites. These constellations will add much more complexity to space operations. Table 1 shows some of the constellations that have been announced for launch in the next decade. Two dozen companies, when taken together, have proposed placing well over 20,000 satellites in orbit in the next 10 years. For perspective, fewer than 8100 payloads have been placed in Earth orbit in the entire history of the space age, only 4800 [1] remain in orbit and approximately 1950 [2] of those are still active. And it isn't simply numbers – the mass in orbit will increase substantially, and long-term debris generation is strongly correlated with mass. Table 1. Some announced NewSpace constellations. Operator Number of satellites Altitude (km) Country SpaceX V-band 7518 335–345 US Capella 48 350–650 US Planet Swift 6 350–650 US Black Sky 60 450 US Satellogic NuSat 300 500 Argentina Kepler 140 550 US SpaceX Starlink 1584 550 US Skybox 30 576 US Fleet 100 580 Australia Amazon Kuiper 3236 590–630 US Commsat 800 600 China Kineis 20 600 France Yalini 135 600 Canada Spire 100 651 US Planet Doves 150 675 US Orbcomm 31 750 US Iridium 72 780 US Theia 112 800 US Lucky Star 156 1000 China Telesat LEO 72 1000 Canada Hongyan 300 1100 China Xinwei 32 1100 China SpaceX Starlink 2825 1110–1325 US OneWeb 720 1200 ESA Telesat LEO 45 1248 Canada Astrome Tech 600 1400 India LeoSat 108 1400 US Globalstar 40 1412 US This table is in constant flux. It is based largely on U.S. filings with the Federal Communications Commission (FCC) and various press releases, but many of the companies here have already altered or abandoned their original plans, and new systems are no doubt in work. Although many of these large constellations may never be launched as listed, the traffic created if just half are successful would be more than double the number of payloads launched in the last 60 years and more than 6 times the number of currently active satellites. Current space safety, space surveillance, collision avoidance (COLA) and debris mitigation processes have been designed for and have evolved with the current population profile, launch rates and density of LEO space. By almost any metric used to measure activity in space, whether it is payloads in orbit, the size of constellations, the rate of launches, the economic stakes, the potential for debris creation, the number of conjunctions, NewSpace represents a fundamental change. 3. Compounding effects of better SSA, more satellites, and new operational concepts The changes in the space environment can be seen on this figurative map of low Earth orbit. Fig. 1 shows the LEO environment as a function of altitude. The number of objects found in each 10 km “bin” is plotted on the horizontal axis, while the altitude is plotted vertically. Objects in elliptical orbits are distributed between bins as partial objects proportional to the time spent in each bin. Some notable resident systems are indicated in blue text on the right to provide an altitude reference. The (dotted) red line shows the number of objects in the current catalog tracked by the U.S. Space Surveillance Network (SSN). All the COLA alerts and actions that must be taken by the residents are due to their neighbors in the nearby bins, so the currently visible risk is proportional to the red line.



Fig. 1. Objects in LEO orbit by altitude per 10 km altitude bin. Elliptical orbit objects distributed by portion spent in each bin. Some notable existing resident systems are listed on the right. New residents, including some replacement systems, are on the left. (For interpretation of the references to color in this figure, the reader is referred to the web version of this article.) The red line of the current catalog does not represent the complete risk; it indicates the risk we can track and perhaps avoid. A rule of thumb is that the current SSN LEO catalog contains objects about 10 cm or larger. It is generally accepted that an impact in LEO with an object 1 cm or larger will cause damage likely to be fatal to a satellite's mission. Therefore, there is a large latent risk from unobserved debris. While we cannot currently track and catalog much smaller than 10 cm, experiments have been performed to detect and sample much smaller objects and statistically model the population at this size [3]. The (solid) blue line represents the model of the 1 cm and larger debris that is likely mission-ending, usually called lethal but not trackable. If LEO operators avoid collisions with all the objects in the red line, they are nonetheless inherently accepting the risk from the blue line. This risk is already present. The (dashed) orange line is an estimate of the population at 5 cm and larger and is thus an estimate of what the catalog might conservatively be a few years after the Space Fence, a new radar system being built by the Air Force, comes on line (currently planned for 2019) [4]. Commercial companies offering space surveillance services, such as LeoLabs, ExoAnalytics, Analytic Graphics Inc., Lockheed, and Boeing, might also add to the number of objects currently tracked. Space Policy Directive 3 (SPD-3) [13] specifically seeks to expand the use of commercial SSA services. Existing operators can expect a sharp increase in the number of warnings and alerts they will receive because of the increase in the cataloged population. Almost all the increase will come from newly detected debris [5]. The pace of safety operations for each satellite on orbit will significantly change because of the increase in the catalog from the Space Fence. This effect is compounded because the NewSpace constellations described in Table 1 will drastically change the profile of satellites in LEO. The green bars in Fig. 1 represent the number of objects that will be added to the catalog (red or orange lines) from only the NewSpace large LEO constellations at their operational altitudes. This does not include the rocket stages that launch them, or satellites in the process of being phased into or removed from the operational orbits. Neighbors of one of these new constellations may face a radically different operations environment than their current practices were designed to address. Satellites in these large LEO constellations typically have planned operational lifetimes of 5–10 years. Some companies have proposed to dispose of their satellites using low thrust electric propulsion systems, which would spiral satellites down over a period of months or years from operating altitudes as high as 1500 km through lower orbits where the Hubble Space Telescope, the International Space Station, and other critical LEO satellites operate [6]. Similar propulsive techniques would raise replacement satellites from lower launch injection orbits to higher operational orbits. These disposal and replenishment activities will add thousands of satellites each year transiting through lower altitudes and posing a risk to all resident satellites in those lower orbits. More importantly, failures will occur both among transiting satellites and operational constellations, potentially leaving hundreds more stranded along the transit path. Aerospace studies [7–9] have shown that failed satellites, whether they fail during operations or fail during disposal, can pose as great or even greater risk than the many thousands of operational satellites (Fig. 2). Given the rapid flux in the proposed large LEO constellations (LLC), we created a Future Constellations Model (FCM) with elements that represented the characteristics of the different systems being proposed. In our models, almost all the collisions and the resulting debris from those collisions occur because of failed systems. Most large constellation operators intend to perform active collision avoidance for active systems, whether operational or in some stage of check-out or disposal, but failed satellites are assumed to be incapable of maneuver. Fig. 2 also shows that satellites in the disposal phase can contribute to collisions similarly to satellites in the operational phase. Fig 2 Download : Download full-size image Fig. 2. Collisions during operations and disposal over 10 years for various NewSpace Future Constellation Models (FCMs). 4. A notional illustration of workload The highest risk to operational satellites comes from the lethal but non-trackable debris that is depicted in the blue line in Fig. 2. However, operators perform collision avoidance only on the objects that can be tracked and cataloged. Advances in tracking and NewSpace launches will both act to increase this workload. A key element of the problem is that an increase in the LEO population will lead to an increase in close approaches to existing satellites [5], and the potential for accidental collisions. Conjunction prediction, collision probability (Pc), and maneuver planning for most existing satellite operators is a time- and personnel-intensive operation. Orbit analysts, and propulsion, navigation, and communications systems personnel are involved in evaluating and planning maneuvers over several days and must do so even if the ultimate decision is to “fly through” a close approach. Since most existing systems have small numbers of vehicles and the number of conjunctions any given operator experiences is relatively small, COLA remains a manual process. For systems not designed with automated maneuver planning, a COLA assessment that progresses all the way to a maneuver plan can consume considerable effort, whether or not the maneuver is executed. If a large constellation is deployed next to an existing resident system, the existing system may experience many conjunctions and alerts due to its close proximity of the dense new constellation. A sufficiently large constellation will, in effect, form a “shell” where frequent opportunities for conjunctions will be created. For example, Fig. 3 depicts a fictional scenario where 1225 “New” satellites are distributed in 35 planes in circular orbits at 1000 km altitude, at 98° inclination. These are placed near a hypothetical “Old” six-satellite constellation operating in a nearly circular orbit at the same altitude and 63° inclination. Following a common operations practice, we assume that the Old satellite operators flag a conjunction at Pc> 10−7, start COLA assessment with additional tracking at Pc> 10−6, and plan a COLA maneuver when the Pc> 10−5. A conjunction with Pc > 10−4 would typically be considered a significant risk leading most operators to maneuver. Fig 3 Download : Download full-size image Fig. 3. “New” large LEO constellation at same average altitude as “Old” existing constellation. Currently, the Old system in this example would typically see a warning (Pc > 10−6) a few times a month at this altitude, and of those, a few per year might cross the maneuver threshold. For the operations center, this would be multiplied by the number of satellites in the constellation. When the New system parks nearby, the number of COLA alerts jumps substantially. But the number of alerts depends entirely on the error bubble, (covariance) used. If the typical errors of the public external tracking data and the orbit propagation methods that are widely available (General Perturbations, or GP) are used for both constellations, over a 30-day period we see 129 conjunctions that cross the threshold for COLA assessment (Pc> 10−6), and 53 that cross the maneuver planning threshold (Pc> 10−5) (Fig. 4). This is nearly 2 per day. This could be an enormous workload for a manual process. If a high accuracy catalog (Special Perturbations, or “SP”) and a high-fidelity propagator with its typical covariances is used, the number of conjunctions goes from 129 to a more manageable 10. SP data is maintained by the Air Force, but it is not widely available. It is interesting to note that nine of those 10 crossed the maneuver-planning threshold, and of those, four crossed the Pc> 10−4 where many operators would choose to execute a maneuver. Compared to GP, the SP-quality data resulted in far fewer warnings and flagged four very close conjunctions. The operations center would have been able to concentrate on fewer “false alarms”. We also computed the case where GPS-quality owner-operator data was used for both systems, in which we assumed near-real-time owner-operator position data of very high quality was provided by both operators and used in the collision analysis. In this case, NONE of the conjunctions resulted in a warning and no COLA alerts were generated. The closest approach was 99 m, with a Pc of 3.7 × 10−7 using SP. But because of the quality of the GPS-based position data, this conjunction did not raise an alert because the fully-informed operators could be confident that a collision would not occur. Fig 4 Download : Download full-size image Fig. 4. Number of COLA alerts in 30 days for various qualities of position knowledge when a fictional new system is deployed near an existing one. In the example, an operations center for the Old constellation of six satellites could go from about one COLA assessment a week to nearly one per day per satellite, if only the published satellite catalog is available. If a new constellation operates too close to an existing system, the operator workload may become unreasonable using existing processes. But high accuracy data makes this manageable, and GPS-quality owner-operator data for both systems makes the problem vanish. Since these constellations are likely to be operated by different companies or governments, sharing high-quality position data would likely require an active space traffic management organization. Existing operators will not necessarily have large constellations parked nearby, but they will nonetheless be affected by the new activity. The new large constellations’ satellites typically will have relatively short lifetimes and will need frequent replenishment. The traffic transiting up and down will be substantial, and failures could leave stranded objects at intermediate altitudes, permanently increasing the collision risk. 5. Conjunction warning overload NewSpace operators will face a different challenge due to the vast increase in numbers of satellites. While there are likely as many operational plans as there are operators, a large constellation must consider close approaches with itself. Even if there are no neighboring systems, self-conjunctions can occur between two members of the same constellation. Depending on the configuration, a given operator could see hundreds to thousands of self-conjunctions that cross typical warning thresholds each day using current practices. This could be an issue for a space traffic management (STM) agency, even if it is not an issue for the operator. Aerospace models show that for one possible NewSpace constellation, more than 500,000 self-conjunctions each year could result that cross the typical Pc > 10−6 warning threshold. If no action were taken, we would expect 2–3 collisions per year. This is clearly unacceptable. Thus, current tracking accuracy and processes might produce millions of warnings per year for NewSpace operators to prevent half a dozen actual collisions. Under current practices operators would need to sort through an enormous haystack to find the needles, and because a handful of actual collisions will occur, the warnings cannot be ignored.

#### Feedback loops of technology cause increasing development and debris.

Bernat 20 – Pawel, 2020, Military University of Aviation, [“ORBITAL SATELLITE CONSTELLATIONS AND THE GROWING THREAT OF KESSLER SYNDROME IN THE LOWER EARTH ORBIT,” SAFETY ENGINEERING OF ANTHROPOGENIC OBJECTS, Volume 4, PDF] Justin

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

#### Invisible tipping points trigger the Kessler Syndrome.

Thompson 21 – Clive, 11/17/21, Clive Thompson is a contributing writer for the New York Times Magazine, a columnist for Wired and Smithsonian magazines, and a regular contributor to Mother Jones. He’s the author of Coders: The Making of a New Tribe and the Remaking of the World, and Smarter Than You Think: How Technology is Changing our Minds for the Better. He’s @pomeranian99 on Twitter and Instagram, [“Get Ready for the “Kessler Syndrome” to Wreck Outer Space,” OneZero, <https://onezero.medium.com/get-ready-for-the-kessler-syndrome-to-wreck-outer-space-7f29cfe62c3e>] Justin

Back in 1978, the astrophysicist Donald Kessler made an alarming prediction: Space junk could wreck our ability to keep satellites aloft. In a fascinating paper, Kessler noted that “low earth orbit” — a region between 99 miles and 1,200 miles up — was getting pretty crowded. In 1978 there were already 3,866 objects being tracked in space. That included satellites used by scientists (say, to monitor weather) or spy agencies. It also included a lot of debris: Every time a rocket launches a satellite into orbit, it tends to leave stray bits of material. The thing is, when objects are zooming through space about 2 km/s, even something as tiny as a chip of paint can smash through glass or steel. Pieces of debris become bullets. What Kessler predicted is that sooner or later, objects in low-earth orbit would start colliding, and produce chain effects, like billiard balls colliding on a crowded pool table. If a piece of debris hit a satellite, it would produce more debris, which would to increase the risk of other collisions … and so on, and so on. At some point, you could reach a tipping point. There’d be so many chunks of debris that collisions would be inevitable, leaving low-earth orbit a junkyard where no satellites could survive. Remember the scene in Wall-E where they blast off Earth, and the planet is utterly ringed with crap? That’s what Kessler worried about. Except in our situation the pieces of junk could be quite small — billions of objects the size of grains of sand, which is actually a lot harder to deal with, because you can’t see it coming. In essence, Kessler predicted we could create an artificial asteroid belt of junk: The result would be an exponential increase in the number of objects with time, creating a belt of debris around the earth. This process of mutual collisions is thought to have been responsible for creating most of the astroids from larger planetlike bodies. Space folks began calling this the “Kessler Syndrome”. It was hard to predict when this might start happening. Kessler worried that conditions could be ripe by as early as 2000. Thankfully, that estimate turned out to be premature. But wow, it looks like it might happen soon. What’s happened recently that makes the “Kessler Syndrome” more likely? A couple of things: Way more satellites are going up The pace at which satellites are going up in the sky is simply exploding. Back when Kessler wrote his paper in 1978, we humans were launching about 53 new satellites a year. Going to space was hard. But now launches are an order of magnitude more common, and they’re increasing in pace rapidly. SpaceX in particular is launching oodles of satellites as it builds its orbital Internet-access service Starlink. In the last two years, it has put 1,740 satellites in low-earth orbit, with plans to eventually shoot 30,000 up there. This is part of a larger trend, which is … The privatization of outer space The private sector is rapidly becoming the dominant actor in space. There’s a huge demand for satellite data — everyone wants better info about weather, crops, traffic patterns, tree coverage, emissions, you name it, on top of the explosive use of satellites for communication and Internet. SpaceX’s remarkable innovations in rocketry (the leading folks, though others are following in their footsteps) have made it cheaper than ever to get a satellite into orbit. It is unlocking a huge pent-up demand for near-earth-orbit tech. More launches mean not only more intentional objects in orbit but unintentional ones — bits of rocket parts and detritus from launches.

#### Privatization exponentially increases the curve but ending dangerous missions stops it.

Bernat 20 – Pawel, 2020, Military University of Aviation, [“ORBITAL SATELLITE CONSTELLATIONS AND THE GROWING THREAT OF KESSLER SYNDROME IN THE LOWER EARTH ORBIT,” SAFETY ENGINEERING OF ANTHROPOGENIC OBJECTS, Volume 4, PDF] Justin

5. Orbital satellite constellations and the growing threat of the Kessler syndrome Space 2.0 – the new era of space exploration that we witness now in the 21st century means, in words of Buzz Aldrin, “moving human enterprise into space” (Pyle, 2019, p. xiv). The process of commercialization of outer space has already begun and is not limited to private companies providing technologies and services for national or international space agencies, as it was in the past. On the contrary, private companies from the space sector have now matured to carry out their own independent projects. As for 2020, SpaceX is a company that serves as the best example – it launches satellites to the orbit, both for state and private contractors, it successfully realized two crew missions to the International Space Station, and is in the process of constructing Starlink satellite constellation that will provide high-speed internet access across the planet. Each satellite weighs around 260 kg, is equipped with an ion propulsion system, autonomous collision avoidance system, and orbits Earth at approximately 540-560 km altitude (Starlink, 2020). At the beginning of November 2020, more than 860 Starlink satellites were orbiting the Earth (Jewett, 2020). Immediate plans include launching 12,000 satellites, but they assume a potential later extension to 42,000 (Henry, 2019a). Of course, SpaceX has employed, at least declaratively, all necessary measures to keep the space clean – the satellites are equipped with the deorbiting system, and in the event of inoperability of the propulsion system (Starlink, 2020). The orbital collisions are, however, inevitable. As it was shown before, the possibility of collisions grows with the number of orbital objects. Bastida Virgili with the team compared (2016, p. 154-155) orbital debris environment development without and with a large hypothetical constellation consisting of merely 1080 satellites, distributed across 20 orbital planes at 1,100 km altitude (Fig. 5).

Chart, line chart

Description automatically generated

It has to be noted that although SpaceX’s Starlink is the only constellation that is being built in orbit, it is not the only one planned. There are at least a few initiatives aiming at the same goal – to construct internet infrastructure at the Earth’s orbit. The planned Kuiper Systems LLC, which is a subsidiary of Amazon and intends to place 3,236 broadband satellites in the LEO, is one of Starlink’s biggest competitors (Henry, 2019b). Now, there is even a rivalry between the two companies because Kuiper’s lowest orbital shell is planned to be 590 km, with a tolerance of 9 km either above or below (Cao, 2020), which is the altitude of Starlink satellites. Moreover, the race for space in orbit is now at the beginning. The outer space is vast. It increasingly becomes more cluttered with both operational satellites and space debris. The threat of collisions increases and no institution or body has enough power to license, coordinate and regulate what is sent to the orbit. The UNOOSA has not such power. National states decide what the companies from the space industry can launch to space. In the United States, which is most advanced in the area of private constellations, it is the Federal Aviation Administration (FAA) that issues the appropriate approvals. The race to put broadband internet satellites bears similarities to the gold rush – there are no rules, at the global level, apart from first-come, first-served.

#### Models are rigorous and robust – inserted below.

---To clarify this is the methodology for above chart.

Virgili et al. 16 – Bastida, J.C. Dolado, H.G. Lewis, J. Radtke, H. Krag, B. Revelin, C. Cazaux b , C. Colombo, R. Crowther, M. Metz, 4/26/16, [“Risk to space sustainability from large constellations of satellites,” Act Astranautica, <https://sci-hub.se/10.1016/j.actaastro.2016.03.034>.] Justin

1.3. Simulation approach and result analysis A Monte Carlo (MC) approach was used to simulate the evolution of the object population over a period of 200 years under different post-mission disposal requirements, with four different tools (MEDEE – Modelling the Evolution of Debris on Earth's Environment [9], LUCA – Long Term Utility for Collision Analysis [10], DAMAGE – Debris Analysis and Monitoring Architecture to the Geosynchronous Environment [11] and DELTA – Debris Environment Long Term Analysis [12]). For analysis purposes, the effective number of objects was used where the contribution to the population by each object was weighted by the proportion of the orbital period spent in LEO. In a first step, four different evolutionary models performed an analysis of two reference scenarios. One scenario considered only the evolution of the background population and non-constellation traffic. The second scenario augmented the first with the addition of the representative constellation, with the requirement that 90% of the constellation satellites achieved post-mission disposal to orbits with remaining lifetimes of 25 years. The manoeuvres performed at the mission end to meet the disposal requirement are assumed to be impulsive (i.e. instantaneous) and result in an eccentric orbit with the apogee near the original (constellation) altitude and the perigee at an altitude such that the effects of atmospheric drag would cause the orbit to decay within 25 years. Two of the models considered an apogee remaining at the operational constellation altitude, while the other two reduced the apogee by 50 km. The purpose of these scenarios is to provide a cross-comparison of the models in terms of their predictions of the total object population, which take into account the effects of the constellation. As the distribution of the MC results for the models is of the same nature and the results are independent, a bootstrapping [20] approach is used to derive the mean, the standard deviation and the confidence levels at 95% of the combined results of all the MC runs from the four models (cf. Fig. 1), although not all the models performed the same number of MC runs (see Table 1). The main source of variation inside a particular model's MC runs included the randomness in collision activity, while the different models used their own solar activity forecast.

#### Debris triggers miscalculated war.

Peter Dockrill 16. Award-winning science & technology journalist. “Space Junk Accidents Could Trigger Armed Conflict, Study Finds.” <https://www.sciencealert.com/space-junk-accidents-could-trigger-armed-conflict-expert-warns>.

The increasingly crowded space in Earth's low orbit could set the stage for an international armed conflict, says a new study. Researchers from the Russian Academy of Sciences warn that accidents stemming from the steady rise in space junk floating around the planet could incite political rows and even warfare, with nations potentially mistaking debris-caused incidents as the results of intentional aggressive acts by others. In a paper published in Acta Astronautica, the team suggests that space debris in the form of spent rocket parts and other fragments of hardware hurtling at high speed pose a "special political danger" that could dangerously escalate tensions between nations. According to the study, destructive impacts caused by random space junk cannot easily be told apart from military attacks. "The owner of the impacted and destroyed satellite can hardly quickly determine the real cause of the accident," the authors write. The risks of such an event occurring are compounded by the sheer volume of debris now orbiting Earth. Recent figures from NASA indicate that there are more than 500,000 pieces of space junk currently being tracked in orbit, travelling at speeds up to 28,160 km/h (17,500 mph). The majority of those objects are small – around the size of a marble – but some 20,000 of them are bigger than a softball. In addition to these 500,000 or so fragments – which are big enough for scientists to know about them – NASA estimates that there are millions of undetectable pieces of debris in orbit that are too small to be monitored. But even extremely small fragments such as these pose a threat – in fact, they're considered a greater risk than trackable debris, as their invisible status means spacecraft and satellites can't do anything to avoid them until it's too late. As NASA observed in 2013: "Even tiny paint flecks can damage a spacecraft when travelling at these velocities. In fact a number of space shuttle windows have been replaced because of damage caused by material that was analysed and shown to be paint flecks… With so much orbital debris, there have been surprisingly few disastrous collisions." While we may have been lucky in the past, we can't rely on that to continue. The study by the Russian team cites the repeated sudden failures of defence satellites in past decades that were never explained. The researchers attribute two possible causes: either unrecorded collisions with space junk, or aggressive actions from adversaries. "This is a politically dangerous dilemma," the authors write.

#### Goes nuclear.

Les Johnson 14. Baen science fiction author, popular science writer, and NASA technologist. “Living without satellites”. <https://www.baen.com/living_without_satellites>.

Satellite imagery is used by the military and our political leaders to maintain the peace. When your potential adversaries can’t hide what they’re doing, where their armies are moving and what they are doing with their civilian and military infrastructure, then the danger of surprise attack is diminished. In our nuclear age with instant death only minutes away by missile attack, the doctrine of Mutual Assured Destruction (MAD) only works if both sides know whether or not they are being attacked. The launch of missiles or a bomber fleet can easily be seen from space far in advance of either reaching their potential targets halfway around the globe. The danger of surprise attack is therefore small, making an accidental war far less likely. So what does all this mean? And what do we do about it? First of all, it means that the advocates of space development, exploration and commercialization have succeeded far beyond their initial expectations and dreams. The economies and security of countries in the developed world are now dependent on space satellites. We space advocates should celebrate our success and be terrified of it at the same time. Should we lose these fragile assets in space, our economy would experience a disruption like no other: ship, air and train travel would stop and only restart/operate in a much-reduced capacity for years (GPS loss). Many banking and retail transactions would cease (VSAT loss). Distribution of news and vital national information would be crippled (communications satellite loss). Lives would be put at risk and the productivity of our farming would dramatically decrease (weather satellite loss). The risk of war, including nuclear war, would increase (loss of spy satellites) and our military’s ability to react to crises would be significantly reduced (loss of military logistics and intelligence gathering satellites).

#### Any nuclear war causes extinction – ice age and famine.

Steven Starr 15 [Director of the University of Missouri’s Clinical Laboratory Science Program, as well as a senior scientist at the [Physicians for Social Responsibility](http://www.psr.org/). He has worked with the Swiss, Chilean, and Swedish governments in support of their efforts at the United Nations to eliminate thousands of high-alert, launch-ready U.S. and Russian nuclear weapons. “Nuclear War: An Unrecognized Mass Extinction Event Waiting To Happen.” Ratical. March 2015. <https://ratical.org/radiation/NuclearExtinction/StevenStarr022815.html>] TG

A war fought with 21st century strategic nuclear weapons would be more than just a great catastrophe in human history. If we allow it to happen, such a war would be a mass extinction event that [ends human history](https://ratical.org/radiation/NuclearExtinction/StarrNuclearWinterOct09.pdf). There is a profound difference between extinction and “an unprecedented disaster,” or even “the end of civilization,” because even after such an immense catastrophe, human life would go on. But extinction, by definition, is an event of utter finality, and a nuclear war that could cause human extinction should really be considered as the ultimate criminal act. It certainly would be the crime to end all crimes. The world’s leading climatologists now tell us that nuclear war threatens our continued existence as a species. Their studies predict that a large nuclear war, especially one fought with strategic nuclear weapons, would create [a post-war environment in which for many years it would be too cold and dark to even grow food](http://climate.envsci.rutgers.edu/pdf/RobockToonSAD.pdf). Their findings make it clear that not only humans, but most large animals and many other forms of complex life would likely vanish forever in a nuclear darkness of our own making. The environmental consequences of nuclear war would attack the ecological support systems of life at every level. Radioactive fallout, produced not only by nuclear bombs, but also by the destruction of nuclear power plants and their spent fuel pools, would poison the biosphere. Millions of tons of smoke would act to [destroy Earth’s protective ozone layer](https://www2.ucar.edu/atmosnews/just-published/3995/nuclear-war-and-ultraviolet-radiation) and block most sunlight from reaching Earth’s surface, creating Ice Age weather conditions that would last for decades. Yet the political and military leaders who control nuclear weapons strictly avoid any direct public discussion of the consequences of nuclear war. They do so by arguing that nuclear weapons are not intended to be used, but only to deter. Remarkably, the leaders of the Nuclear Weapon States have chosen to ignore the authoritative, long-standing scientific research done by the climatologists, research that predicts virtually any nuclear war, fought with even a fraction of the operational and deployed nuclear arsenals, will leave the Earth essentially uninhabitable.